About the Editor

Tener Goodwin Veenema, PhD, MPH, MS, CPNP, is an Associate Professor of Clinical Nursing, Assistant Professor of Emergency Medicine, and Program Director for Disaster Nursing and Strategic Initiatives at the Center for Disaster Medicine and Emergency Preparedness at the University of Rochester School of Nursing and School of Medicine and Dentistry. Dr. Veenema is also President and Chief Executive Officer of the TenER Consulting Group, LLC, which provides consultation and workforce development for emergency preparedness to federal, state agencies, and corporate organizations. She has received numerous awards and research grants for her work, and in June 2004, Dr. Veenema was elected into the National Academies of Practice and was selected as a 2004 Robert Wood Johnson Executive Nurse Fellow. In 2006, Dr. Veenema was the recipient of the Klainer Entrepreneurial Award in health care.

Dr. Tener Goodwin Veenema, in her role as Chief Executive Officer of the TenER Consulting Group, LLC, is the author and developer of “ReadyRN: A Comprehensive Curriculum for Disaster Nursing and Emergency Preparedness” and collaborated with the American Red Cross to customize the ReadyRN curriculum for use by the American Red Cross in educating and training American Red Cross health care professionals in providing health-related disaster and emergency response services.

Dr. Veenema’s ReadyRN Comprehensive Curriculum for Disaster Nursing and Emergency Preparedness was also published in 2007 as an innovative e-learning online course by Elsevier, and the companion ReadyRN Handbook for Disaster Nursing and Emergency Preparedness will be published in fall 2007.

While at the University of Rochester, Dr. Veenema developed the curriculum for a 30-credit Masters program entitled “Leadership in Health Care Systems: Disaster Response and Emergency Management,” the first program of its kind in the country to be offered at a school of nursing. The program offers course content on the Fundamentals of Disaster Management, Chemical, Biological and Radiological Terrorism, Global Public Health and Complex Human Emergencies, Leadership and Strategic Decision Making, and Communication in Disaster Response and Emergency Preparedness.


Dr. Veenema frequently serves as a subject-matter expert for the National American Red Cross, multiple state health departments and nurses associations, as well as the Registered Nurses Association of Ontario, Canada. She is a member of the World Association of Disaster Medicine (WADEM).
It is quite probable that at some time in the future, nurses may be called upon to respond to a mass casualty event or disaster outside of the hospital. Advance preparation of our national nursing workforce for such an event is predicted on the belief that mastery of the knowledge and skills needed to respond appropriately to such an event can improve patient outcomes.

I wrote these words in the spring of 2002 as I finished the summary section of chapter 9 (p. 199) in the first edition of this book—3 1/2 years before Hurricane Katrina would wreak its devastation on the communities of the Gulf Coast. When the first edition of the book was released, our country was still reeling from the 9/11 attacks and fearful of another outbreak of anthrax. These two events had resulted in an immediate awareness of our lack of national emergency preparedness and heightened vulnerability to disaster events. Health care providers were barraged by an onslaught of information from numerous sources (of varying quality) regarding topics such as disaster planning and response, biological agents, hazardous materials accidents, the dangers of radiation, therapeutics, and so forth. Resources on the Internet alone had increased exponentially. My own research on these topics had revealed that the existing disaster textbooks were written by and for physicians and public health officials. There was a major gap in the literature for nurses. Given the approximately 2.7 million nurses in this country, I found this to be not only unacceptable but a major threat to population health outcomes. Therefore, the genesis of the book was the desire to fill this gap in the literature and provide nurses with a comprehensive resource that was evidence based whenever possible, and broad in scope and deep in detail. We were very successful and the first edition was extremely well received, garnering an AJN Book of the Year award along with multiple additional accolades, and for that I am eternally grateful. The book is currently being used nationwide by universities and schools of nursing, hospitals, public health departments, and multiple other sites where nurses work.

The second edition of this textbook has an equally ambitious goal—to once again provide nurses and nurse practitioners with the most current, valid, and reliable information available for them to acquire the knowledge and skill set they will need to keep themselves, their patients, and families safe during any disaster event. Once again, we have held ourselves to the highest standards possible. Every chapter in the book has been researched, reviewed by experts, and matched to the highest standards for preparing health professions’ students for terrorism, disaster events, and public health emergencies.

The framework of the book is consistent with the United States National Response Plan, the National Incident Management System, and is based on the Centers for Disease Control Prevention’s (CDC) Competencies for public health preparedness and the CDC Guidelines for response to chemical, biological, and radiological events. This textbook will provide nurses with a heightened awareness for disasters and mass casualty incidents, a solid foundation of knowledge (educational competencies) and a tool box of skills (occupational competencies) to respond in a timely and appropriate manner.

Since September 11, 2001, our national concerns for the health and safety of our citizens has expanded to include additional hazards such as emerging infectious diseases (SARS, West Nile virus, avian influenza), the detonation of major explosive devices, and the use of nuclear weapons by countries unfriendly to the United States. We possess a heightened awareness of the forces of Mother Nature and the health impact on communities affected by natural disasters. We continue to face a growing national shortage of nurses and nurse educators, a health care system that is severely stressed financially, and emergency departments that are functioning in disaster mode on a daily basis. We have reason to believe that these challenges for the profession will only intensify in the coming years. Nurses are challenged to be prepared for all hazards—to plan for pandemic influenza, chemical, biological, radiological/nuclear, and explosive (CBRNE) events, mass casualty incidents involving major burns, and surge capacity to accommodate a sudden influx of hundreds, possibly thousands, of patients. In response to these concerns and the requests of nurses across the country, I have added several new chapters in the second edition that serve to strengthen the health systems focus of the book and to add a strong clinical presence.
Preface

Since 2003, the Department of Homeland Security, the Federal Emergency Management Administration (FEMA), the CDC, and other federal and nonfederal agencies have devoted significant resources to increasing our level of national emergency preparedness. We had made significant progress on certain fronts, but with regard to our level of workforce preparedness in the health professions, we have a long way to go. In the years since the first edition of this textbook was published, other nursing texts and educational resources have been developed and published, and this author applauds these initiatives. There is much work to be done, and it is personally rewarding to witness increased interest in disaster nursing as more nurses get involved.

As an emergency nurse and pediatric nurse practitioner, I have worked in the field of disaster nursing and emergency preparedness for many years, with a focus on promoting the health of the community and the health of the consumer by structuring, developing, and fostering an environment that is prepared for any disaster or major public health emergency. I have lobbied for the advancement of the profession of nursing in the disaster policy and education arena, and I remain personally committed to my work in preparing a national nursing workforce that is adequately prepared to respond to any disaster or public health emergency. This includes working to establish sustainable community partnerships that foster collaboration and mutual planning for the health of our community. It includes looking at innovative applications of technology to enhance sustainable learning and disaster nursing response. It means giving reflective consideration of the realities of the clinical demands placed on nurses during catastrophic events and the need for consideration of altered standards for clinical care during disasters and public health emergencies.

This textbook continues to be a reflection of my love for writing and research, as well as a deep desire to help nurses protect themselves, their families, and their communities. Disaster nursing is a patient safety issue. Nurses can only protect their patients if they themselves are safe first. The second edition represents a substantive attempt to collect, expand, update, and include the most valid and reliable information currently available about various disasters, public health emergencies, and acts of terrorism. The target audience for the book is every nurse in America—making every nurse a prepared nurse—staff nurses, nurse practitioners, educators, and administrators. The scope of the book is broad and the depth of detail intricate. My goal is to produce a second edition that represents a well-researched and well-organized scholarly work that will serve as a major reference for all our nation’s nurses on the topics of disaster nursing and emergency preparedness. It is my hope that nurse educators will be pleased to discover the expanded organization of the book and the inclusion of new chapters, case studies, and study questions. The insertion of Internet-based activities is designed to stimulate critical thinking in students and to provide them with the skill set to stay updated regarding these topics.

Ideally, this book represents the foundation for best practice in disaster nursing and emergency preparedness, and is a stepping stone for the discipline of disaster nursing research. Chapters in this book were based on empirical evidence whenever it was available. However, the amount of research in existence addressing disaster nursing and health outcomes is limited, and much work remains to be done. The editor welcomes constructive comments regarding the content of this text.

Tener Goodwin Veenema
Acknowledgments

As with the first edition of this book, I continue to profess that researching, revising, designing, and delivering this book was a true labor of love—I enjoyed every minute of it! And like any effective disaster response, this textbook was a coordinated team effort. The second edition is significantly larger than the first—several new chapters have been added, all of the content updated, and the clinical focus expanded. Additionally, the entire book has been mapped to the Centers for Disease Control and Prevention’s competencies for public health emergency preparedness—this represents nothing less than a Herculean effort. There are so many exceptional individuals, all over the country, who helped to make this book a reality.

My special thanks must first go to each of the wonderful chapter authors who researched, reviewed, and revised their manuscripts, assuring that the information contained within was valid, accurate, and reliable, and reflected the most current state of the science. This was a tremendous challenge given the highly transitional nature of many of the topic areas. The science was rapidly evolving (and continues to evolve) and as with the first edition, the structure of many disaster and emergency response systems was rapidly changing (and continues to change) during the year it was written.

I would like to first thank my fabulous colleagues who were chapter authors and/or contributors for the first edition and stayed committed to this project for the second edition. My very sincere thanks go to Kathleen Coyne Plum, PhD, RN, NPP (Monroe County Department of Human Services); Kristine Qureshi, RN, CEN, DNPc (University of Hawai‘i); Brigitte L. Nacos, PhD and Kristine M. Gebbie, DrPH, RN, FAAN (Columbia University); Lisa Marie Bernardo, RN, PhD, MPH (University of Pittsburgh); Erica Rihl Pryor, RN, PhD and Dave Piggott, MD, FACEP (University of Alabama); Linda Landesman, DrPH, MSW, ACSW, LCSW, BCD (NYC Health & Hospitals Consortium); Kathryn McCabe Votava, PhD, RN and Cathy Peters, MS, RN (University of Rochester); P. Andrew Karam, PhD, CHP (MJW Corporation); Joan Stanley, PhD, RN, CRNP (American Association of Colleges of Nursing); Lt. Col. Richard Ricciardi, RN, FNP and Patricia Hinton Walker, PhD, RN, FAAN (Uniformed Services University of the Health Services); Janice B. Griffin Agazio, PhD, CRNP, RN (The Catholic University of America); Eric Croddy, MA (Monterey Institute for International Studies); and Gary Ackerman, MA (Center for Terrorism and Intelligence Studies). Thank you so much for your wonderful contributions and for your ongoing support of this book.

Very special acknowledgments and many thanks go to my international colleagues at the University of Ulster—Pat Deeny, Kevin Davies, and Mark Gillespie, and welcome to Wendy Spencer. These wonderful individuals were committed to providing a broad and illustrative international perspective for the book. Their resultant chapter, Global Issues in Disaster Relief Nursing, is evidence of their expert knowledge, extensive experience in the field, and dedication to international collegiality. I will always remain grateful to each of them for their contributions to the field.

My thanks go once again to Jonathan Tucker, my special contributor, for allowing me to reprint a portion of his work from his wonderful book Scourge: The Once and Future Threat of Smallpox. It continues to be the perfect segue into the Chemical and Biological Terrorism section of the book.

I wish to thank each of the case study authors and welcome the following new authors to the second edition of the book. Thanks go to Ziad N. Kazzi, MD, FAAEM, along with his colleagues Dave Piggott, MD, FACEP and Erica Pryor, RN, PhD at the University of Alabama at Birmingham Center for Disaster Preparedness. The quality of their work is incredible, as is their generosity in sharing it.

Another very special welcome and thanks go to Roberta Lavin (Health and Human Services) and Lynn Slepski (Department of Homeland Security). Roberta and Lynn made sure that the descriptions of the National Response Plan and all components of the federal disaster program were as accurate as possible up to the time of publication. They are also two of the nicest and most generous individuals one would ever want to meet.

Welcome and thanks go to Christopher Lentz, MD, FACS, FCCM; Dixie Reid, PA; Brooke Rea, MS, RN; and Kerry Kehoe, MS (University of Rochester) for their chapter addressing the recognition and management of burns and guidelines for disaster planning for a surge of
Acknowledgments

burn patients. Dr. Lentz, as the Director of the regional Burn/Trauma Center at the University of Rochester Medical Center, along with his wife Diane Red, are burn experts and tireless advocates for clinical excellence in the care of the severely burned patient. Both Brooke Rea (Burn Program Manager) and Kerry Kehoe (former Administrator Division of Trauma & Burn) are graduates of the Leadership in Health Care Systems in Disaster Response and Emergency Health Care Systems, and so it is an even greater pleasure to be able to include them in this edition of the book. Brooke’s talents and leadership skills were clearly evident in her effort to produce this chapter, and I send her my special thanks.

A sincere welcome and thanks go out to two new authors and former students of mine, Tara Sacco, MS, BS, RN and Jennifer Byrnes, MLS, MPH (University of Rochester). Tara is a graduate of the Leadership in Health Care Systems program in Health Promotion and Health Education; Jennifer is a graduate of the Master’s in Public Health program. Both are talented researchers and writers, and it is my guess that you will be hearing more from them in the future. Their chapters on Traumatic Injuries Due to Explosions and Blast Effects, and Emerging Infectious Diseases (respectively) broadly expanded the clinical focus of the book and provided valuable new clinical resource information for nurses.

Welcome and thanks go to Amy T. Campbell, JD, MBE (University of Rochester, Division of Medical Humanities) for her detailed legal review and update of the chapter on Legal and Ethical Issues in Disaster Response and to Joy Spellman (Burlington County College, New Jersey) for her contributions on preparing and promoting the role of the public health nurses during disasters. Both of these authors were so gracious and generous with their expertise. Thank you.

A very special warm welcome and thanks go to Elizabeth A. Davis, JD, Ed.M and her colleagues Alan Clive, PhD, Jane A. Kushner, PhD, and Jennifer Mincin, MFA. Elizabeth is the Founder and President of Elizabeth Ann Davis Associates (http://www.eadassociates.com/) and is a nationally recognized expert/advocate for vulnerable populations. It was extremely important to me to add a substantive piece on planning for and responding to the needs of high-risk, high-vulnerability populations in this edition of the book, and Alan, Elizabeth, Jane, and Jennifer provided a superb chapter on this topic (and in a relatively short time frame). My sincere thanks and admiration go out to each of you for your work.

Welcome and gratitude go to Manish Shah, MD, MPH, FACEP, Jeremy Cushman, MD, MS, Charles Madew, MD, FACEP, and Jonnathan Busko, MD, MPH, EMT-P (University of Rochester, Department of Emergency Medicine), and to my colleague John Benitez, MD, MPH at the Center for Disaster Medicine and Emergency Preparedness (University of Rochester, Department of Emergency Medicine). Manish Shah, along with his colleagues Jeremy, Charles, and Jonnathan, contributed a comprehensive overview of Emergency Medical Services as it currently exists in this country. This well-designed and well-organized chapter was a wonderful new addition to the book. John Benitez is Director of the Western New York Regional Poison Control Center, who along with Sharon Benware, RN, contributed to the chapter addressing chemical agents of concern.

I want to express my continued appreciation and sincere gratitude to Lisa Bernardo, Erica Pryor, Kristine Qureshi, and Kathy Plum for their elegant contributions, for their ongoing support and encouragement, and for their willingness to make recommendations that strengthened the content of the book. I have the ultimate respect for each of you, and I am sincerely grateful for our ongoing relationships!

Special thanks go out to my wonderful friends and colleagues, Diane Yeater, Associate Director for Disaster Health Services and to Nancy McKelvey, Chief Nurse at the American Red Cross, National Headquarters in Washington, DC. Thank you for your contributions and your insight into national disaster preparedness and response initiatives.

I am so fortunate to call the University of Rochester School of Nursing my academic home. This phenomenal school is a leader in excellence in nursing education and in entrepreneurship for nurses, and I have learned something from every one of my talented colleagues. I wish to once again thank Dean Patricia Chiverton for creating an environment that supports new and visionary initiatives and for supporting and encouraging me to do the work that I want to do. I am eternally grateful to Pat and to each of my fellow faculty members in the Leadership in Health Care Systems Master’s Program.

As I finish the second edition of this book, I would also like to acknowledge 19 wonderfully talented individuals and very special, terrific friends—my colleagues in the 2004 Robert Wood Johnson Executive Nurse Fellowship. Carla Baumann, Suzanne Boyle, Kathleen Capitulo, Jane Chan, Theresa Daggi, Kathryn Flandt, Margaret Frankhauser, Mary Hooshmand, Paul Kuehnert, Mary Joan Ladden, Joan Marren, Maricia Maurer, Marcella McKay, Wanda Montalvo, Kathleen Murphy, Cheri Rinehart, Mary Lou de Leon Siantz, Kristen Swanson, and Bonnie Westra. We have shared an amazing experience in this wonderful program, and they have provided me with insight and guidance for my work, of which this book represents a portion of the overall project—ReadyRN: Making Every Nurse a Prepared Nurse. Their incredible work inspired me. But mostly I am grateful for the fun, friendship, and support they offered. They believed in my vision for disaster
nursing and for this book, and they are always there for me when I need them. Thank you.

Special thanks to Loretta Ford, former Dean and Professor Emeritus at the University of Rochester School of Nursing, and founder of the nurse practitioner role. I have had the amazing good fortune of having Lee as my mentor in the Robert Wood Johnson Executive Nurse Fellowship Program. There are no words to describe this feisty, energetic, phenomenally talented nurse and scholar. She is a role model to the entire profession of nursing, and my life is richer for having known her. Her wisdom and guidance have played a pivotal role in much of my work the past few years. Her kindness and support have sustained me. Thank you so much Lee.

I wish to thank all of my reviewers and those who provided valued commentary and recommendations. Special thanks to Lori Barrette (University of Rochester), Janice Springer (American Red Cross), and Lou Romig, MD, FAAP, FACEP. Just as there is no perfect research study, there is also not a perfect textbook or reference manual. This fact, however, did not dissuade us from seeking to make this book and every section in it the very best it could be. Many thanks to all who shared their wisdom and expertise during the preparation of the book.

I would like to acknowledge Sally Barhydt and her colleagues at Springer Publishing Company in New York City. I sincerely thank you, Sally, for all your hard work in assisting with the publication of the second edition, and for your ongoing commitment to me as an author.

I will be eternally grateful to my colleague and research assistant Adam B. Rains for his assistance with the preparation of this very large manuscript. Adam’s intelligence, humor and wit—and limitless talent—were a gift to this project.

Many thanks go to three very special women who are the best friends anyone could ask for—Katherine Lostumbo, Barbara Wale, and Maryanne Townsend. The warmth of your friendship continues to sustain me.

Finally, the people to whom I owe the most are my family. To my mother, thank you for all you have done for me and for thinking that I am much more capable than I really am. You often told me, “to thine own self be true,” when making my life’s decisions—great advice that I have often passed down to my children. Thanks to my dad—I love you lots.

To my four children, I sincerely thank you for the joy you have brought to my life. You are my greatest accomplishment. My sons Kyle, Blair, and Ryne—I love you so much. A huge and especially special thank you goes to my wonderful daughter Kendall, who has been a terrific help to me for many, many years. Her words of encouragement (and the sound of her laughter) have always kept me going! She is my very best friend and the most incredible person I know.

And to my husband and partner in all life’s adventures, my deepest thanks. I could not have done any of this without you. You have helped me in too many ways to mention, and I am so appreciative of each and every moment we have shared. Thank you.
Contributors

Gary Ackerman, MA
Director
Center for Terrorism and Intelligence Studies
A Division of the Akribis Group
San Jose, California

Janice B. Griffin Agazio, PhD, CRNP, RN
Assistant Professor
The Catholic University of America
School of Nursing
Washington, DC

Sherri-Lynne Almeida, DrPH, MSN, Med, RN, CEN
Chief Operating Officer—Team Health Southwest
Houston, Texas

Knox Andress, RN, FAEN
Designated Regional Coordinator
Louisiana Region 7 Hospital Preparedness
Director of Emergency Preparedness
Louisiana Poison Center
Shreveport, Louisiana

Randal D. Beaton, PhD, EMT
Research Professor
Department of Psychosocial and Community Health
School of Nursing
Adjunct Research Professor
Department of Health Services
School of Public Health and Community Medicine
University of Washington
Seattle, Washington

John G. Benitez, MD, MPH
Associate Professor of Emergency Medicine, Environmental Medicine and Pediatrics
University of Rochester School of Medicine and Dentistry
Director, Finger Lakes Regional Resource Center
Managing and Associate Medical Director
RA Lawrence Poison and Drug Information Center
Rochester, New York

Sharon Benware, RN, CSPI
RA Lawrence Poison and Drug Information Center
Rochester, New York

Lisa Marie Bernardo, RN, PhD, MPH
Associate Professor
University of Pittsburgh School of Nursing
Pittsburgh, Pennsylvania

Jonnathan Busko, MD, MPH, EMT-P
Emergency Physician / Medical Director, Operations
Eastern Maine Medical Center
Bangor, Maine
Regional Medical Director, Maine EMS
Region 4
Medical Director, Maine Medical Strike Team
New England MMRS
Medical Director, Northeastern Maine Regional Resource Center and Center for Emergency Preparedness
Eastern Maine Healthcare System

Jennifer A. Byrnes, MLS, MPH
University of Rochester School of Medicine and Dentistry
Rochester, New York

Amy T. Campbell, JD, MBE
Division of Medical Humanities
University of Rochester Medical Center
Rochester, New York

Alan Clive, PhD
Emergency Management Consultant
Silver Spring, Maryland

Eric Croddy, MA
Senior Research Associate
Monterey Institute of International Studies
Center for Nonproliferation Studies
Monterey, California
Contributors

Jeremy T. Cushman, MD, MS
Division of EMS and Office of Prehospital Care
Department of Emergency Medicine
University of Rochester School of Medicine and Dentistry
Rochester, New York

Kevin Davies, RRC, RN, MA, RNT, PGCE
Senior Lecturer in Nursing
School of Care Sciences
University of Glamorgan
Pontypridd, South Wales, United Kingdom

Elizabeth A. Davis, JD, Ed.M
Director
EAD & Associates, LLC
Emergency Management & Special Needs Consultants
New York, New York

Pat Deeny, RN, RNT, BSc (Hons) Nursing Ad Dip Ed.
Senior Lecturer in Nursing
University of Ulster, Magee Campus
Derry-Londonderry, Northern Ireland

Mary Kate Dilts Skaggs, RN, MSN
Director of Nursing Emergency Services
Southern Ohio Medical Center
Portsmouth, Ohio

Kristine M. Gebbie, DrPH, RN, FAAN
Elizabeth Standish Gill Associate Professor
Columbia University School of Nursing
Center for Health Policy
New York, New York

Mark Gillespie, RN, Msc
Advanced Nursing, Critical Nurse Specialist
Lecturer Trauma Nursing
University of Ulster, Magee
Derry-Londonberry, Northern Ireland

Kevin D. Hart, JD, PhD
Assistant Professor
Department of Community and Preventative Medicine
University of Rochester School of Medicine and Dentistry
Rochester, New York

Angela J. Hodge, RN, BSN, CEN
Clinical Coordinator for Emergency Services
Southern Ohio Medical Center
Portsmouth, Ohio

P. Andrew Karam, PhD, CHP
Senior Health Physicist
MJW Corporation
Rochester, New York

Ziad N. Kazzi, MD, FAAEM
Assistant Professor
Medical Toxicologist
Department of Emergency Medicine
University of Alabama
Birmingham, Alabama

Kerry Kohoe, MS
Administrator, Division of Trauma, Burn & Emergency Surgery
University of Rochester Medical Center
Rochester, New York

Paul Kuehnert, MS, RN
Deputy Director
Kane County Department of Health
Aurora, Illinois

Jane A. Kushma, PhD
Associate Professor
Institute for Emergency Preparedness
Jacksonville State University
Jacksonville, Alabama

Linda Young Landesman, DrPH, MSW, ACSW, LCSW, BCD
NYC Health and Hospitals Corporation
New York, New York

Roberta Proffitt Lavin, MSN, APRN, BC
CAPT, United States Public Health Service
Director, Office of Human Services Emergency Preparedness and Response
Administration for Children and Families
Department of Health and Human Services
Washington, DC

Christopher W. Lentz, MD, FACS, FCCM
Medical Director, Strong Regional Burn Center
Associate Professor of Surgery and Pediatrics
University of Rochester School of Medicine and Dentistry
Rochester, New York

Charles L. Maddow, MD, FACEP
Department of Emergency Medicine
University of Rochester School of Medicine and Dentistry
Rochester, New York
Nancy McKeelvey, MSN, RN
Chief Nurse/Healthcare Partnerships Lead
American Red Cross
Washington, DC

Jennifer Mincin, MPA
Senior Project Manager
EAD & Associates, LLC
Emergency Management & Special Needs Consultants
New York, New York

Brigitte L. Nacos, PhD
Department of Political Science
Columbia University
New York, New York

Karen Nason
Executive Director
Association of Rehabilitation Nurses
Rehabilitation Nursing Certification Board

Sally A. Norton, PhD, RN
Assistant Professor of Nursing
University of Rochester School of Nursing
Rochester, New York

Cathy Peters, MS, RN, APRN-BC
Assistant Clinical Professor
University of Rochester School of Nursing
Rochester, New York

David C. Pigott, MD, FACEP
Residency Program Director
Associate Professor and Vice Chair for Education
Department of Emergency Medicine
University of Alabama at Birmingham
Birmingham, Alabama

Kathleen Coyne Plum, PhD, RN, NPP
Director, Office of Mental Health,
Monroe County Department of Human Services
Rochester, New York
Adjunct Associate Professor, University of Rochester
School of Nursing
Rochester, New York

Erica Rihl Pryor, RN, MSN, PhD
Doctoral Program Coordinator and Assistant Professor
University of Alabama School of Nursing
University of Alabama at Birmingham
Birmingham, Alabama

Kristine Qureshi, RN, CEN, DNSc
Associate Professor
School of Nursing and Dental Hygiene
University of Hawaii at Manoa
Honolulu, Hawaii

Irwin Redlener, MD
Associate Dean & Director
The National Center for Disaster Preparedness
Columbia University Mailman School of Public Health
New York, New York

Dixie Reid, PA
Physician Assistant
Trauma/Burn/Emergency Surgery
University of Rochester School of Medicine and Dentistry
Rochester, New York

Brooke Rera, MS, RN
Burn Program Manager
University of Rochester/Strong Memorial Hospital
Rochester, New York

Lt. Col. Richard Ricciardi, RN, FNP
Uniformed Services University of the Health Sciences
Graduate School of Nursing
Bethesda, Maryland

Lou E. Romig, MD, FAAP, FACEP
Pediatric Emergency Medicine
Miami Children’s Hospital
Pediatric Medical Advisor, Miami-Dade Fire Rescue Department
South Florida Regional Disaster Medical Assistance Team (FL-5 DMAT)
Miami, Florida

Tara Sacco, MS, BS, RN
Burn Trauma Unit
University of Rochester Medical Center
Rochester, New York

Manish N. Shah, MD, MPH, FACEP
Director, EMS Research
Assistant Professor
Department of Emergency Medicine
Department of Community and Preventive Medicine
University of Rochester School of Medicine and Dentistry
Rochester, New York

Capt. Lynn A. Slepski, RN, MSN, PhD-C, CCNS
Senior Public Health Advisor
Department of Homeland Security
Washington, DC
Contributors

Joy Spellman, MS, RN
Director, Center for Public Health Preparedness
Burlington County College
Mt. Laurel, New Jersey

Wendy Spencer
University of Ulster

Janice Springer, RN, PHN, MA
Disaster Health Services
American Red Cross
Washington, DC

Joan M. Stanley, PhD, RN, CRNP
Director of Education Policy
American Association of Colleges of Nursing
Washington, DC

Jennifer Timony
President
National Student Nurses’ Association, Inc.

Kathryn McCabe Votava, PhD, RN
President
GoodCare.com
Washington, DC

Patricia Hinton Walker, PhD, RN, FAAN
Vice President for Nursing Policy and Professor
Uniformed Services University of the Health Sciences
Bethesda, Maryland

Dianne Yeater
Director for Disaster Health Services
American Red Cross
Washington, DC
Dedication

Our world is not safe. Fraught with peril, it continues to be a dangerous place in which to live. And yet we know that our children need safe homes, safe schools, and safe communities to live in if they are to grow to be healthy, happy, and secure adults. They are counting on us to be there for them—no matter what the circumstances. They are counting on us to provide love, protection, and a safe harbor in the storm. They are counting on us to be prepared. They are counting on us to rescue them when they need rescuing. This textbook is dedicated to our nation’s children—four in particular. To Kyle, Kendall, Blair, and Ryne—you are everything to me. Always know how much I love you and that home is a safe harbor. And know that I tried to make the world a safer place.
Most doctors, nurses, and other health workers look forward to a life pursuing their chosen career in relative order, peace, and tranquility. However, the unexpected, by its very nature, can strike anywhere, at any time, and involve anybody or everybody, including those who are unprepared. A disaster can happen in any community at any time. It is an inescapable fact brought into focus by the calamitous events we have seen befall our fellow citizens in just the past 5 years. From the four hurricanes that hit our coastal regions in just one 6-week period in 2004 to the twin shocks of the South Asia tsunami and Hurricane Katrina, earthquakes in Indonesia; floods; terrorist bombings in the London subway and Iraq (an everyday phenomenon in Baghdad); and a humanitarian crisis of unimaginable horror in Sudan, it is clear that no community is immune. Nurses have a primary role in preparing for and managing medical care during these episodic, but catastrophic, events. On a global scale, nurses are active participants in caring for victims of a wide variety of disasters that take place on an almost daily basis.

The second edition of Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards has been designed to provide emergency caregivers with a concise reference for managing specific disaster-preparedness and response issues while providing the requisite background necessary to begin an in-depth study of the health consequences of the most common types of disasters. The experience of the editor and many of the chapter authors is unique. The organizations for which they work cover the range of disasters that strike this world. We owe an enormous debt of gratitude to them all for their unstinting efforts to update this classic work.

Post-disaster evaluations conducted by nurses of the management of disasters by health professionals have provided critical data for mitigating the human impact of these events and enhancing future responses to disasters. This has been especially true regarding Hurricane Katrina. As a result, disaster management is well recognized as far more than just triage and mass casualty management. Since the first edition of this book was published, we have seen significant changes in the health management of disasters, whether natural or man-made. It is increasingly appreciated that the phenomenon goes far beyond the punctual provision of relief to the population affected and extends from advanced preparedness to the problems of long-term rehabilitation. While always emphasizing the use of proven management methods and practices, Dr. Veenema challenges nursing health professionals with questions that must still be answered in order for them to respond effectively in emergency situations. I know that decision makers at the highest echelons of government have increasingly relied on the nursing profession to address the myriad problems facing a disaster-affected community.

In the relatively short period of time that has elapsed since September 11, 2001, it is remarkable that a considerable body of new knowledge and experience related to the adverse health effects of disasters has already accumulated. In fact, disaster research has accelerated to such an extent that we probably need to update the results of this research at a minimum of every year so that we can apply the lessons learned during one disaster to the management of the next. Conveying so much information in so few pages, with the right mix of scientific data and human concern, in a practical and clear format, is no mean task. As the most comprehensive textbook on disaster nursing ever published (except for the groundbreaking first edition published in 2003), Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards does exactly that and more. With years of experience, Dr. Veenema and co-authors give the reader ample technical descriptions of each kind of disaster (particularly chemical, biological, radiological terrorism, and other hazards), an examination of the kinds of issues and problems that arise in planning hospital and emergency department disaster response, and an up-to-date review of the more common medical and management issues that might face a nurse involved in a local disaster. Unique chapters include those addressing the legal and ethical issues in disaster response, the role of the media, effective communication with the public (a major deficiency during Hurricane Katrina and the South Asia tsunami), the special needs of children during disasters and public health emergencies, and the evolving
priorities of the Departments of Health and Human Services and Homeland Security.

Like the first edition, the second edition includes well-designed case studies that provide realistic, hands-on experiences that challenge the reader to apply information provided in the chapters. Dr. Veenema’s inclusion of “Key Messages” and “Learning Objectives” that introduce each major section of the book, plus unique case studies addressing natural, industrial, and terrorism disasters, has resulted in the creation of a major resource that will serve as a timely, comprehensive, and structured text for the education of hospital, community, state, and national health and medical emergency managers, as well as nursing students who will assume major mass emergency preparedness responsibilities immediately after graduation.

It is incumbent that all health care workers, and nurses in particular, react professionally, efficiently, rationally, and effectively when disaster strikes. To do so, they need some fundamental principles and knowledge on which to base their activities. This highly topical book will serve as the most up-to-date course textbook and desk reference available not only for nursing professionals responsible for preparing their hospitals for responding to disasters and other public health emergencies but also for emergency managers and other decision makers charged with ensuring that disasters are well managed.

Eric K. Noji, MD, MPH, FACEP  
Program Director  
Pandemic Avian Influenza Preparedness Program  
Global Epidemic Intelligence Network  
Center for Disaster Medicine & Humanitarian Assistance  
Department of Military & Emergency Medicine  
Uniformed Services University of the Health Sciences  
Bethesda, Maryland
In the years since the first edition of this book was published, the complexity of terrorism has continued to increase. We now are very aware that terrorists exist, not only outside our country trying to get in, but also inside our country in small towns and large cities where some of our own citizens are plotting our downfall.

I have always said that nurses are the glue that holds our health care delivery system (as fragmented as it is) together. Once a nurse, always a nurse! Nurses in our communities are also expected to be able to respond to the natural and man-made disasters that we will surely encounter in the next few years. Our response must be evidence-based, as is so well exemplified by these chapters. This text gathers together the best thoughts about evidence-based response wherever possible and identifies where the evidence is spotty and slim.

As the founder of the International Nursing Coalition for Mass Casualty Education in March 2001 (now the Nursing Emergency Preparedness Education Coalition), which now represents over 80 nursing organizations, friends of nursing, and subject matter experts, I was not privy to any special vision. I knew that our public health infrastructure was rickety—at best—and that, in the event of any kind of mass casualty event, nurses would be expected to be in the forefront. I also knew that disaster nursing had virtually disappeared from our curricula, although we still incorporated basic population-based public health principles. If one good thing comes out of the tragedy of 9/11, it will be that monies granted from Congress to address terrorism will serve a dual role and also help strengthen our public health infrastructure.

The book you are about to read offers a comprehensive analysis of a broad range of disasters possible in today’s world—both those wreaked by humans as well as by nature. This text is the next generation of information needed by nurses to be informed about and responsive to the needs of our citizens in a disaster. Katrina was a wake-up event. The roles that nurses and nurse assistants played in that disaster were selfless and inspiring. Katrina only served to undergird our awareness that we must be vigilant and prepared!

Colleen Conway-Welch, PhD, RN, CNM, FAAN, FACNM
Nancy & Hilliard Travis Professor of Nursing
Dean
Vanderbilt University School of Nursing
As a Robert Wood Johnson Executive Nurse Fellow, Dr. Veenema, a disaster nursing expert, chose to pursue a lofty fellowship goal of “creating a national nursing workforce adequately prepared to respond to a disaster or any major public health emergency.” This monumental undertaking sounds and is formidable. Still, this second edition of her highly successful earlier publication, Disaster Nursing, convinces me she is well on the way toward that goal.

This expanded and updated edition is all encompassing and forms the basis for all her other efforts in developing printware and software and educational forums, coordinating and collaborating with volunteer and governmental agencies, and encouraging educational and professional organizations to help prepare nurses and other health professionals for natural and man-made disasters. The breadth and depth of this publication are phenomenally comprehensive and practical as well as theoretically and scientifically sound. Its expanded scope ranges from preparedness and management to specific types of disasters, ending with chapters on nursing education, research, and global connections.

I would find this edition particularly useful for its teaching/learning framework that focuses the learner on goals and expected outcomes. Case studies expedite discourse and critical thinking as do references and Internet sources.

In its expanded form and extensive content, this second edition is indeed required reading as a textbook, a reference, a compendium of comprehensive topics, and foundational to “making every nurse a prepared nurse.”

Loretta C. Ford, RN, PNP, EdD
Dean Emeritus
University of Rochester School of Nursing
Founder of the Nurse Practitioner Program
Contents

About the Editor ........................................................ ii
Preface ........................................................................ v
Acknowledgments ....................................................... vii
Contributors ............................................................. xi
Dedication .................................................................... xv
Foreword (Eric K. Noji) ................................................ xvi
Foreword (Colleen Conway-Welch) .............................. xvii
Special Foreword (Loretta C. Ford) .............................. xx

PART I

DISASTER PREPAREDNESS

Chapter 1 Essentials of Disaster Planning ........................................... 3
Tener Goodwin Veenema

Chapter 2 Leadership and Coordination in Disaster Health Care Systems:
The Federal Disaster Response Network .............................. 25
Roberta Lavin, Lynn Slepski, and Tener Goodwin Veenema

Chapter 3 Emergency Health Services ........................................... 51
Jeremy T. Cashman, Manish N. Shah, Charles L. Maddow, and Jonnathan Busko

Chapter 4 American Red Cross Disaster Health Services and Disaster Nursing ........................................... 67
Dianne Yeater and Nancy McKelvey

Chapter 5 Understanding the Psychosocial Impact of Disasters .......................... 81
Kathleen Coyne Plum

Chapter 6 Legal and Ethical Issues in Disaster Response ........................................... 101
Amy T. Campbell, Kevin D. Hart, and Sally A. Norton

Chapter 7 Crisis Communication: The Role of the Media ........................................... 119
Brigitte L. Nacos

xxi
PART II

DISASTER MANAGEMENT

Chapter 8  Disaster Management ...............................................137
Kristine Qureshi and Kristine M. Gebbie

Chapter 9  Disaster Triage .....................................................161
Kristine Qureshi and Tener Goodwin Veenema

Chapter 10  Restoring Public Health Under Disaster Conditions: Basic Sanitation, Water
and Food Supply, and Shelter ..........................................179
Tener Goodwin Veenema

Chapter 11  Managing Emergencies Outside of the Hospital: Special Events, Mass Gatherings,
and Mass Casualty Incidents ........................................... 205
Tener Goodwin Veenema

Chapter 12  Management of Burn Mass Casualty Incidents ........................................... 221
Christopher Lentz, Dixie Reid, Brooke Rena, and Kerry Kehoe

Chapter 13  Traumatic Injury Due to Explosives and Blast Effects .........................239
Tara Sacco

Chapter 14  Management of Psychosocial Effects ..................................... 255
Kathleen Coyne Plum and Tener Goodwin Veenema

Chapter 15  Unique Needs of Children During Disasters and Other Public Health Emergencies ....273
Lisa Marie Bernardo

Chapter 16  Identifying and Accommodating High-Risk and High-Vulnerability Populations ....309
Alan Clive, Elizabeth A. Davis, June A. Kushma, and Jennifer Mincin

PART III

NATURAL AND ENVIRONMENTAL DISASTERS

Chapter 17  Natural Disasters ...................................................327
Linda Young Landesman and Tener Goodwin Veenema

Chapter 18  Environmental Disasters and Emergencies ........................................... 351
Tener Goodwin Veenema
PART IV

DISASTERS CAUSED BY CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL AGENTS

Chapter 19 Biological and Chemical Terrorism: A Unique Threat
Eric Croddy and Gary Ackerman

Chapter 20 Surveillance Systems for Detection of Biological Events
Erica Rihl Pryor

Chapter 21 Biological Agents of Concern
David C. Pigott and Ziad N. Kazzi

Chapter 22 Early Recognition and Detection of Biological Events
Erica Rihl Pryor

Chapter 23 Emerging Infectious Disease
Jennifer A. Byrnes

Chapter 24 Design and Implementation of Mass Immunization and Prophylactic Treatment Clinics
Kathryn McCabe Votava

Chapter 25 Chemical Agents of Concern
Tener Goodwin Veenema, John Benitez, and Sharon Benware

Chapter 26 Mass Casualty Decontamination
Tener Goodwin Veenema

Chapter 27 Radiological Incidents and Emergencies
Andrew Karam

PART V

SPECIAL TOPICS

Chapter 28 Directions for Nursing Education
Joan M. Stanley and Tener Goodwin Veenema

Chapter 29 Directions for Nursing Research and Development
Richard Ricciardi, Janice B. Griffin Agazio, Roberta P. Lavin, and Patricia Hinton Walker
Chapter 30
Global Issues in Disaster Relief Nursing .................................................. 571
Pat Deeny, Kevin Davies, Mark Gillespie, and Wendy Spencer

Chapter 31
The Role and Preparation of the Public Health Nurse for Disaster Response ........ 589
Joy Spellman

Epilogue
Disaster Recovery: Creating Sustainable Disaster-Resistant Communities .......... 601
Tener Goodwin Veenema

Appendices
I Internet Resources on Disaster Preparedness, Emergency Care, and Bioterrorism ................................................................. 603
II Glossary of Terms Commonly Used in Disaster Preparedness and Response ................................................................. 607
III Bioterrorism and Emergency Readiness: Competencies for All Public Health Workers ................................................................. 615
IV Federal Emergency Management Agency: Emergency Response Action Steps ................................................................. 617
V Anthrax Summary ................................................................. 620
VI Botulism Summary ................................................................. 621
VII Plague Summary ................................................................. 622
VIII Smallpox Summary ................................................................. 623
IX Tularemia Summary ................................................................. 624
X Viral Hemorrhagic Fevers Summary ................................................................. 625
XI Biological Weapon (BW) Agent Lab Identification ................................................................. 626
XII Patient Isolation Precautions ................................................................. 630
XIII Creating a Personal Disaster Plan ................................................................. 632

INDEX ................................................................. 637
PART I

Disaster Preparedness
Key Messages

- The frequency of natural disasters, the individuals affected by them, and the economic costs associated with loss have been steadily increasing over recent years.
- While disasters are often unexpected, sound disaster planning can anticipate common problems and mitigate the consequences of the event.
- Different types of disasters are associated with distinct patterns of illness and injury, and early assessment of risks and vulnerability can reduce morbidity and mortality later on.
- Effective disaster plans are based on knowledge of how people behave. Key components and common tasks must be included in any disaster preparedness plan.
- The actual process of planning is more important than the resultant written plan because those who participate in planning are more likely to accept preparedness plans in general.
- Disaster planning must overcome apathy and complacency.
- Disasters are different from daily emergencies; most cannot be managed simply by mobilizing additional personnel and supplies. Certain commonly occurring problems can be anticipated and addressed during planning.
- A professional mandate exists that calls for nurses to participate in the development of and serve as an integral part of a community’s disaster preparedness plan.
- Nurses must participate as full partners with both the medical community and emergency management community in all aspects of disaster response and recovery.

Learning Objectives

When this chapter is completed, readers will be able to

1. Classify the major types of disasters based on their unique characteristics and describe their consequences.
2. Identify societal factors that have contributed to increased losses (human and property) as the result of disasters.
3. Describe two principles of disaster planning, including the agent-specific and the all-hazards approach, and the basic components of a disaster plan.
4. Discuss the five areas of focus in emergency and disaster planning: preparedness, mitigation, response, recovery, and evaluation.
5. Describe risk assessment, hazard identification, and vulnerability analysis.
6. Assess constraints on a community’s or organization’s ability to respond.
7. Describe the core preparedness actions.
8. Recognize situations suggestive of an increased need for additional comprehensive planning.
The principles of disaster planning, the common tasks consistent across all disaster responses, and the key components of a disaster preparedness plan are introduced in this chapter. Definitions of the different types of disasters are provided, along with a classification system for disasters based on their common and unique features: onset, duration, and effect (immediate aftermath); and reactive period. The concept of the disaster timeline as an organizational framework for strategic planning is introduced. The five areas of focus in emergency and disaster preparedness—preparedness, mitigation, response, recovery, and evaluation—are addressed. Risk assessment, hazard identification and mapping, and vulnerability analysis are presented as methods for decision making and planning. The concepts of disaster epidemiology and measurement of the magnitude of a disaster’s impact on population health are explored. Situations suggestive of an increased need for planning, such as bioterrorism and hazmat (hazardous material) events, are addressed.

INTRODUCTION

Disasters have been integral parts of the human experience since the beginning of time, causing premature death, impaired quality of life, and altered health status. The risk of a disaster is ubiquitous. On average, one disaster per week that requires international assistance occurs somewhere in the world. The recent dramatic increase in natural disasters, their intensity, the number of people affected by them, and the human and economic losses associated with these events have placed an imperative on disaster planning for emergency preparedness. Global warming, shifts in climates, sea-level rise, and societal factors may coalesce to create future calamities. Finally, war, acts of aggression, and the incidence of terrorist attacks are reminder of the potentially deadly consequences of man’s inhumanity toward man.

A review of recent disasters since 2000—political strife and conflicts in Angola, Afghanistan, Ethiopia, D.R. Congo, Sudan, Iraq, and Sierra Leone—indicates that few disasters are the result of a single cause and
effect. The disasters unfolding in this century are frequently complex human emergencies associated with global instability, economic decay, political upheaval and collapse of government structures, violence and civil conflicts, famine, and mass population displacement. The Sumatra tsunami and Hurricane Katrina, as well as the 2004 and 2006 hurricane seasons, point to more natural disasters and their growing complexity, which create considerable challenges to disaster planners.

In the United States, nurses constitute the largest sector of the health care workforce and will certainly be on the front lines of any emergency response. As part of the country’s overall plan for disaster preparedness, all nurses must have a basic understanding of disaster science and the key components of disaster preparedness, including the following:

1. The definition and classification system for disasters and major incidents based on common and unique features of disasters (onset, duration, effect, and re- active period).
2. Disaster epidemiology and measurement of the health consequences of a disaster.
3. The five areas of focus in emergency and disaster preparedness: preparedness, mitigation, response, recovery, and evaluation.
4. Methods such as risk assessment, hazard identification and mapping, and vulnerability analysis.
5. Awareness of the role of the nurse in a much larger response system.

This chapter introduces the reader to the principles of disaster planning, the common tasks consistent across all disaster responses, and the key components of a disaster preparedness plan.

**DEFINITION AND CLASSIFICATION OF DISASTERS**

Disasters have many definitions. Disaster may be defined as any destructive event that disrupts the normal functioning of a community. Disasters have been defined as ecologic disruptions, or emergencies, of a severity and magnitude that result in deaths, injuries, illness, and property damage that cannot be effectively managed using routine procedures or resources and that require outside assistance (Landesman et al., 2001). Health care providers characterize disasters by what they do to people—the consequences on health and health services. A medical disaster is a catastrophic event that results in casualties that overwhelm the health care resources in that community (Al-Madhari & Zeller, 1997). Noji (1997) describes disasters quite simply, as “events that require extraordinary efforts beyond those needed to respond to everyday emergencies.”

Disasters may be classified into two broad categories: natural (those caused by natural or environmental forces) or man-made (human generated). The World Health Organization defines natural disaster as the “result of an ecologic disruption or threat that exceeds the adjustment capacity of the affected community” (Lechat, 1979). Natural disasters include earthquakes, floods, tornadoes, hurricanes, volcanic eruptions, ice storms, tsunamis, and other geologic or meteorological phenomena. Man-made disasters are those in which the principal direct causes are identifiable human actions, deliberate or otherwise (Noji, 1996). Man-made disasters include biological and biochemical terrorism, chemical spills, radiological (nuclear) events, fire, explosions, transportation accidents, armed conflicts, and acts of war.

Human-generated disasters may be further divided into three broad categories: (a) complex emergencies, (b) technologic disasters, and (c) disasters that are not caused by natural hazards but occur in human settlements. Complex emergencies involve situations where populations suffer significant casualties as a result of war, civil strife, or other political conflict. Some disasters are the result of a combination of forces such as drought, famine, disease, and political unrest that displace millions of people from their homes. These humanitarian disasters can be epic in proportion, such as civilians fleeing the Iraq war or refugees displaced by the conflict in Darfur. With technologic disasters, large numbers of people, property, community infrastructure, and economic welfare are directly and adversely affected by major industrial accidents; unplanned release of nuclear energy; and fires or explosions from hazardous substances such as fuel, chemicals, or nuclear materials (Noji, 1996). The distinction between natural and human-generated disasters may be blurred; a natural disaster, or phenomenon, may trigger a secondary disaster, the result of weaknesses in the human environment. An example of this is a chemical plant explosion following an earthquake. Such combinations, or synergistic disasters, are commonly referred to as NA-TECHs (Natural and Technological Disasters) (Noji, 1996). A NA-TECH disaster occurred in the former Soviet Union, when windstorms spread radioactive materials across the country, increasing by almost 50% the land area contaminated in an earlier nuclear disaster. Disasters can and do occur simultaneously (e.g., a chemical attack along with a nuclear assault), potentiating the death and devastation created by each.

Disasters are frequently categorized based on their onset, impact, and duration. For example, earthquakes and tornadoes are rapid-onset events—short durations but with a sudden impact on communities. Hurricanes and volcanic eruptions have a sudden impact on a community; however, frequently advance warnings are issued enabling planners to implement evacuation and early response plans. A bioterrorism attack may be
sudden and unanticipated and have a sudden and prolonged impact on a community.

In contrast, droughts and famines have a more gradual onset or chronic genesis (the so-called creeping disasters) and generally have a prolonged impact. Factors that influence the impact of a disaster on a community include the nature of the event, time of day or year, health and age characteristics of the population affected, and the availability of resources (Gans, 2001). Further classification of terms in the field of disaster science distinguishes between hazards and disasters. Hazards present the possibility of the occurrence of a disaster caused by natural phenomena (e.g., hurricane, earthquake), failure of man-made sources of energy (e.g., nuclear power plant), or by human activity (e.g., war).

Defining an event as a disaster also depends on the location in which it occurs, particularly the population density of that location. For example, an earthquake occurring in a sparsely populated area would not be considered a disaster if no people were injured or affected by loss of housing or essential services. However, the occurrence of even a small earthquake could produce extensive loss of life and property in a densely populated region (such as Los Angeles) or a region with inadequate construction or limited medical resources. Similarly, numbers and types of casualties that might be handled routinely by a large university hospital or metropolitan medical center could overwhelm a small community hospital.

Hospitals and other health care facilities may further classify disasters as either “internal” or “external.” External disasters are those that do not affect the hospital infrastructure but do tax hospital resources due to numbers of patients or types of injuries (Gans, 2001). For example, a tornado that produced numerous injuries and deaths in a community would be considered an external disaster. Internal disasters cause disruption of normal hospital function due to injuries or deaths of hospital personnel or damage to the physical plant, as with a hospital fire, power failure, or chemical spill (Aghababian, Lewis, Gans, & Curley, 1994). Unfortunately, one type of hospital disaster does not necessarily preclude the other, and features of both internal and external disasters may be present if a natural phenomenon affects both the community and the hospital. This was the case with Hurricane Andrew (1992), which caused significant destruction in hospitals, in clinics, and in the surrounding community when it struck south Florida (Sabatino, 1992), and Hurricane Katrina (2005) when it impacted the Gulf Coast, rupturing the levee in New Orleans (Berggren, 2005).

DECLARATION OF A DISASTER

In the United States, the Robert T. Stafford Disaster Relief and Emergency Assistance Act, passed by Congress in 1988 and amended in 2000, provides for federal government assistance to state and local governments to help them manage major disasters and emergencies. Under the Stafford Act, the president may provide federal resources, medicine, food and other consumables, work assistance, and financial relief (Stafford Act). On average, 38 presidential disaster declarations are made per year; most are made immediately following impact, and review of recent years’ data suggests that the number of disasters is increasing (see Table 1.1; Federal Emergency Management Agency [FEMA], 2007).

1.1 Federally Declared Disasters 1976–2007

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TOTAL DISASTER DECLARATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>30</td>
</tr>
<tr>
<td>1977</td>
<td>22</td>
</tr>
<tr>
<td>1978</td>
<td>25</td>
</tr>
<tr>
<td>1979</td>
<td>42</td>
</tr>
<tr>
<td>1980</td>
<td>23</td>
</tr>
<tr>
<td>1981</td>
<td>15</td>
</tr>
<tr>
<td>1982</td>
<td>24</td>
</tr>
<tr>
<td>1983</td>
<td>21</td>
</tr>
<tr>
<td>1984</td>
<td>34</td>
</tr>
<tr>
<td>1985</td>
<td>27</td>
</tr>
<tr>
<td>1986</td>
<td>28</td>
</tr>
<tr>
<td>1987</td>
<td>23</td>
</tr>
<tr>
<td>1988</td>
<td>11</td>
</tr>
<tr>
<td>1989</td>
<td>31</td>
</tr>
<tr>
<td>1990</td>
<td>38</td>
</tr>
<tr>
<td>1991</td>
<td>43</td>
</tr>
<tr>
<td>1992</td>
<td>45</td>
</tr>
<tr>
<td>1993</td>
<td>32</td>
</tr>
<tr>
<td>1994</td>
<td>36</td>
</tr>
<tr>
<td>1995</td>
<td>32</td>
</tr>
<tr>
<td>1996</td>
<td>75</td>
</tr>
<tr>
<td>1997</td>
<td>44</td>
</tr>
<tr>
<td>1998</td>
<td>65</td>
</tr>
<tr>
<td>1999</td>
<td>59</td>
</tr>
<tr>
<td>2000</td>
<td>45</td>
</tr>
<tr>
<td>2001</td>
<td>45</td>
</tr>
<tr>
<td>2002</td>
<td>49</td>
</tr>
<tr>
<td>2003</td>
<td>56</td>
</tr>
<tr>
<td>2004</td>
<td>68</td>
</tr>
<tr>
<td>2005</td>
<td>48</td>
</tr>
<tr>
<td>2006</td>
<td>52</td>
</tr>
<tr>
<td>2007</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>1,169</td>
</tr>
<tr>
<td>Average</td>
<td>38</td>
</tr>
</tbody>
</table>

or avert the intensity of the threat, a state’s governor may request assistance even before the disaster has occurred. A library of all past and current federally declared disasters in the United States can be located at the FEMA Web site (http://www.fema.gov/library/dizandemer.shtm). A current list of international declared disasters and emergencies and links to disease outbreaks can be located on the World Health Organization’s Web site (http://www.who.int/health_topics/disasters/en/).

HEALTH EFFECTS OF DISASTERS

Disasters affect communities and their populations in different ways. Damaged and collapsed buildings are evidence of physical destruction. Roads, bridges, tunnels, rail lines, telephone and cable lines, and other transportation and communication links are often destroyed. Public utilities (e.g., water, gas, electricity, and sewage disposal) may be disrupted. A substantial percentage of the population may be rendered homeless and forced to relocate temporarily or permanently. Disasters damage and destroy businesses and industry, agriculture, and the economic foundation of the community. The impact of weather disasters alone has generated costs of over a billion dollars (see Figure 1.1). The federal government committed $85 billion to recovery efforts for Hurricane Katrina alone. The health effects of disasters may be extensive and broad in their distribution across populations (see chapter 8 for further discussion). In addition to causing illness and injury, disasters disrupt access to primary care and preventive services. Depending on the nature and location of the disaster, its effects on the short- and long-term health of a population may be difficult to measure.

Epidemiology, as classically defined, is the quantitative study of the distributions and determinants of health-related events in human populations (Gordis, 2004; see chapter 15 for further discussion). Disaster epidemiology is the measurement of the adverse health effects of natural and human-generated disasters and

Figure 1.1 Billion dollar U.S. weather disasters, 1980–2004—National Oceanic and Atmospheric Administration.

The life cycle of a disaster is generally referred to as the disaster continuum, or emergency management cycle. This life cycle is characterized by three major phases, **preimpact** (before), **impact** (during), and **postimpact** (after), and provide the foundation for the disaster time line (Figure 1.2). Specific actions taken during these three phases, along with the nature and scope of the planning, will affect the extent of the illness, injury, and death that occurs.

The five basic phases of a disaster management program include preparedness, mitigation, response, recovery, and evaluation (Kim & Proctor, 2002; Landesman, 2001). There is a degree of overlap across phases, but each phase has distinct activities associated with it. Preparedness refers to the proactive planning efforts designed to structure the disaster response prior to its occurrence. Disaster planning encompasses evaluating potential vulnerabilities (assessment of risk) and the propensity for a disaster to occur. Warning (also known as forecasting) refers to monitoring events to look for indicators that predict the location, timing, and magnitude of future disasters.

**Mitigation** includes measures taken to reduce the harmful effects of a disaster by attempting to limit its impact on human health, community function, and economic infrastructure. These are all steps that are taken to lessen the impact of a disaster should one occur and can be considered as prevention measures. Prevention refers to a broad range of activities, such as attempts to prevent a disaster from occurring, and any actions taken to prevent further disease, disability, or loss of life. Mitigation usually requires a significant amount of forethought, planning, and implementation of measures before the incident occurs.

The response phase is the actual implementation of the disaster plan. Disaster strategy, or emergency management, is the organization of activities used to address the event. Traditionally, the emergency management field has organized its activities in sectors, such as fire, police, hazardous materials management (hazmat), and emergency medical services. The response phase focuses primarily on emergency relief: saving lives, providing first aid, minimizing and restoring damaged systems such as communications and transportation, and providing care and basic life requirements to victims (food, water, and shelter). Disaster response plans are most successful if they are clear and specific, simple to understand, use an incident command system, are routinely practiced, and updated as needed. Response activities need to be continually evaluated and adjusted to the changing situation.

**Recovery** actions focus on stabilizing and returning the community (or an organization) to normal (its preimpact status). This can range from rebuilding damaged buildings and repairing infrastructure, to relocating populations and instituting mental health interventions. Rehabilitation and reconstruction involve numerous activities to counter the long-term effects of the disaster on the community and future development.

**Evaluation** is the phase of disaster planning and response that often receives the least attention. After a disaster, it is essential that evaluations be conducted to determine what worked, what did not work, and what specific problems, issues, and challenges were identified. Future disaster planning needs to be based on empirical evidence derived from previous disasters.

**DISASTER PLANNING**

Effective disaster planning addresses the problems posed by various potential events, ranging in scale from mass casualty incidents, such as motor vehicle collisions with multiple victims, to extensive flooding or earthquake damage, to armed conflicts and acts of terrorism.
The disaster planning continuum is broad in scope and must address collaboration across agencies and organizations, advance preparations, as well as needs assessments, event management, and recovery efforts. Although public attention frequently focuses on medical casualties, it is imperative to consider numerous other factors when disaster plans and responses are being designed and developed. Participation by nurses in all phases of disaster planning is critical to ensure that nurses are aware of and prepared to deal with whatever these numerous other factors may turn out to be. Individuals and organizations responsible for disaster plans should consider all possible eventualities—from the sanitation needs of crowds at mass gatherings, to the psychosocial needs of vulnerable populations, to evacuation procedures for buildings and geographic areas—when designing a detailed response (Leonard, 1991; Parillo, 1995). Completion of the disaster planning process should result in the production of a comprehensive disaster or “emergency operations plan.”

**TYPES OF DISASTER PLANNING**

The two major types of disaster plans are those that take the agent-specific approach and those that use the
all-hazards approach. Communities that embrace the agent-specific approach focus their preparedness activities on the most likely threats to occur based on their geographic location (e.g., hurricanes in Florida). The all-hazards approach is a conceptual model for disaster preparedness that incorporates disaster management components that are consistent across all major types of disaster events to maximize resources, expenditures, and planning efforts. It has been observed that despite their differences many disasters share similarities because certain challenges and similar tasks occur repeatedly and predictably. The Department of Homeland Security’s National Response Plan encourages all communities to prepare for disasters using the all-hazards approach instead of stand-alone plans, and the agency published its guidelines for all-hazards preparedness titled Guide for All-Hazards Emergency Operations Planning (1996). These guidelines are helpful in developing community emergency operations plans.

Problems, issues, and challenges are commonly encountered across several types of disasters (Auf der Heide, 1996, 2002; Landesman, 2001). Frequently, these issues and challenges can be effectively addressed in core preparedness activities and include the following:

1. Communication problems.
2. Triage, transportation, and evacuation problems.
3. Leadership issues.
4. The management, security of, and distribution of resources at the disaster site.
5. Advance warning systems and the effectiveness of warning messages.
6. Coordination of search and rescue efforts.
7. Media issues.
8. Effective triage of patients (prioritization for care and transport of patients).
9. Distribution of patients to hospitals in an equitable fashion.
11. Damage or destruction of the health care infrastructure.
12. Management of volunteers, donations, and other large numbers of resources.
13. Organized improvisational response to the disruption of major systems.
14. Finally, encountering overall resistance (apathy) to planning efforts. Auf der Heide states, “Interest in disaster preparedness is proportional to the recency and magnitude of the last disaster” (1989).

**CHALLENGES TO DISASTER PLANNING**

Adequate planning can address many of these issues in advance and even eliminate some as problems in the event of future disaster situations. Challenges to address proactively are discussed next.

**Communication**, sharing information among organizations and across many people, is a major priority in any disaster planning initiative. Failure of the communication system may occur in the event of a disaster, as a result of damage to the infrastructure caused by the disaster, as well as lack of operator familiarity, excessive demands, inadequate supplies, and lack of integration with other communications providers and technologies. Backup communications systems, such as wireless, hardwire, and cellular telephones, may reduce the impact of disrupted standard communications, but, frequently, even advanced technology has been ineffectual during disasters (Garshnek & Burkle, 1999). Alternative ways for the public, as well as health providers, to get accurate information is critically important. The 9/11 World Trade Center disaster demonstrated the need for reliable communication systems such as two-way radios and assured backup systems (see Figure 1.3).

A detailed process for the efficient and effective distribution of all types of resources, including supplemental personnel, equipment, and supplies among multiple organizations and the establishment of a security perimeter around a disaster site should also be included in the plan. Leadership responsibilities and coordination of all rescue efforts (across territories and jurisdictions) should be worked out in advance of any event.

**Advance warning systems and the use of evacuation** from areas of danger save lives and should be included in community disaster response plans whenever appropriate. Warnings can now be made months in advance, in the case of El Niño, to seconds in advance of the arrival of earthquake waves at some distance from the earthquake. Computers are being programmed to respond to warnings automatically, shutting down
or appropriately modifying transportation systems, lifelines, and manufacturing processes. Warnings are becoming much more useful to society as lead time and reliability are improved and as society devises ways to respond effectively. Effective dissemination of warnings provides a way to reduce disaster losses that have been increasing in the United States as people move into at-risk areas (FEMA, 2000).

A plan for the use of the mass media for the purpose of disseminating public health messages in the postimpact phase in order to avoid health problems (e.g., water safety, food contamination) should be developed in advance. Nurses and other disaster responders may need training in how to interact effectively with the media. (See chapter 5 for further discussion.)

A comprehensive disaster plan will account for the effective triage of patients (prioritization for care and transport of patients) and distribution of patients to hospitals (a coordinated, even distribution of patients to several hospitals as opposed to delivering most of the patients to the closest hospital). Review of previous disaster response efforts reveals that patients are frequently transferred without adequate triage and that patient distribution to existing health care facilities is often grossly unequal and uncoordinated (Auf der Heide, 1996, 2002).

Disaster planning must include a community mutual aid plan in the event that the hospital(s), nursing home(s), or other residential health care facility needs to be evacuated. Plans for evacuation of health care facilities must be realistic and achievable, and contain sufficient specific detail as to where patients will be relocated to and who will be there to care for them. Patient evacuation was a major challenge to disaster response efforts following Hurricane Katrina, and was hampered by the destruction of all major transportation routes in and out of the city. Pre-planning for the possibility of the need to evacuate entire health care facilities must address alternative modes of transportation and include adequate security measures (see Figure 1.4).

For large-scale disasters involving a broad geographic region, disaster-medical aid-centers may need to be established and evenly spaced throughout a community. These disaster-medical aid-centers are provided...
in addition to existing emergency medical services and should be set up no more than an hour’s walk from any location involved in the disaster to ensure maximum accessibility (Schultz, Koenig, & Noji, 1996). Casualty collection points for both patients and health care providers may also need to be established in large-scale events (see Figure 1.5). Potential collection points may include golf courses and shopping malls, or any large expanse of open land capable of accommodating both ground and air transport to serve as a staging area (Schulz et al., 1996).

Information systems need to be identified or developed that will track patients across multiple (and perhaps temporary) settings. Patient tracking during disasters is a major challenge because of lack of registration at shelters, and hospital communication systems that do not interface with other hospitals or county health departments. Family reunification was a major issue following hurricanes Katrina and Rita, and has persisted as a major challenge to meaningful recovery initiatives.

Historic, Hazard Identification, Vulnerability Analysis, and Risk Assessment

Chapter 1

Hazards are situations or items that create danger and the potential for the disaster to occur. Hazard identification and analysis is the method by which planners identify which events are most likely to affect a community and serves as the foundation for decision making for prevention, mitigation, and response. Hazards may include items such as chemicals used by local industry, transportation elements such as subways, airports, and railroad stations; or collections of large groups of people in areas with limited access, such as skyscrapers, nursing homes, or sports stadiums (see Table 1.3). Environmental and meteorological hazards must also be considered, such as the presence of fault lines and seismic zones and the seasonal risks posed by blizzards, ice storms, tornadoes, hurricanes, wildfires, and heat waves. The National Fire Protection Association’s Technical Committee on Disaster Management issued international codes and standards that require a community’s hazard identification to include all natural, technological, and human hazards (NFPA, 2004).

Vulnerability is the “state of being vulnerable—open to attack, hurt, or injury” (Merriam Webster’s Collegiate Dictionary, 2002). The disaster planning team must identify vulnerable groups of people—those at particular risk of injury, death, or loss of property from each hazard. Vulnerability analysis can provide predictions of what individuals or groups of individuals are most likely to be affected, what property is most likely to sustain damage or be destroyed, and what resources will be available to mitigate the effects of the disaster. Vulnerability analysis should be conducted for each hazard that is identified and must be regularly updated to accommodate population shifts and changes in the environment (Landesman, 2001).

Risk assessment is an essential feature of disaster planning and is in essence a calculation or model of risk, in which a comprehensive inventory is created including all existing and potential dangers, the population most likely to be affected by each danger, and a prediction of the health consequences. Risk analysis uses the elements of hazard analysis and vulnerability
1.2 Methods for Data Collection for Disaster Planning

HAZARD IDENTIFICATION AND MAPPING
Hazard identification is used to determine which events are most likely to affect a community and to make decisions about who or what to protect as the basis of establishing measures for prevention, mitigation, and response. Historical data and data from other sources are collected to identify previous and potential hazards. Data are then mapped using aerial photography, satellite imagery, remote sensing, and geographic information systems.

VULNERABILITY ANALYSIS
Vulnerability analysis is used to determine who is most likely to be affected, the property most likely to be damaged or destroyed, and the capacity of the community to deal with the effects of the disaster. Data are collected regarding the susceptibility of individuals, property, and the environment to potential hazards in order to develop prevention strategies. A separate vulnerability analysis should be conducted for each identified hazard.

RISK ASSESSMENT
Risk assessment uses the results of the hazard identification and vulnerability analysis to determine the probability of a specified outcome from a given hazard that affects a community with known vulnerabilities and coping mechanisms (risk equals hazard times vulnerability). The probability may be presented as a numerical range (i.e., 30% to 40% probability) or in relative terms (i.e., low, moderate, or high risk). Major objectives of risk assessment include:

- Determining a community’s risk of adverse health effects due to a specified disaster (i.e., traumatic deaths and injuries following an earthquake)
- Identifying the major hazards facing the community and their sources (i.e., earthquakes, floods, industrial accidents)
- Identifying those sections of the community most likely to be affected by a particular hazard (i.e., individuals living in or near flood plains)
- Determining existing measures and resources that reduce the impact of a given hazard (i.e., building codes and regulations for earthquake mitigation)
- Determining areas that require strengthening to prevent or mitigate the effects of the hazard

1.3 Hazard Analysis

Natural Events
- Drought
- Wildfire (e.g., forest, range)
- Avalanche
- Winter storms/blizzard: Snow, ice, hail
- Tsunami
- Windstorm/hurricane/cyclone
- Biological event
- Heat wave
- Flood or wind-driven water
- Earthquake
- Volcanic eruption
- Tornado
- Landslide or mudslide
- Dust or sand storm
- Lightning storm
- Technological events
- Hazardous material release
- Explosion or fire
- Transportation accident (rail, subway, bridge, airplane)
- Building or structure collapse
- Power or utility failure
- Extreme air pollution
- Radiological accident (industry, medical, nuclear power plant)
- Dam or levee failure
- Fuel or resource shortage
- Industrial collapse
- Communication disruption

Human events
- Economic failures
- General strikes
- Terrorism (e.g., ecological, cyber, nuclear, biological, chemical)
- Sabotage, bombs
- Hostage situation
- Civil unrest
- Enemy attack
- Arson
- Mass hysteria/panic
- Special events (mass gatherings, concerts, sporting events, political gatherings)

analysis to identify groups of people at particular risk of injury or death from each individual hazard. The calculation of estimated risk (probability estimate) may be constant over time, or it may vary by time of day, season, or location relative to the community (Gans, 2001). Risk assessment necessitates the cooperation of corporate, governmental, and community groups to produce a comprehensive listing of all potential hazards (Leonard, 1991; Waeckerle, 1991).

The following disaster prevention measures can be implemented following the analysis of hazards, vulnerability, and risk:

- Prevention or removal of hazard (e.g., closing down an aging industrial facility that cannot implement safety regulations).
- Removal of at-risk populations from the hazard (e.g., evacuating populations prior to the impact of a hurricane; resettling communities away from flood-prone areas).
- Provision of public information and education (e.g., providing information concerning measures that the public can take to protect themselves during a tornado).
- Establishment of early warning systems (e.g., using satellite data about an approaching hurricane for public service announcements).
- Mitigation of vulnerabilities (e.g., sensors for ventilation systems capable of detecting deviations from normal conditions; sensors to check food, water, currency, and mail for contamination).
- Reduction of risk posed by some hazards (e.g., relocating a chemical depot farther away from a school to reduce the risk that children would be exposed to hazardous materials; enforcing strict building regulations in an earthquake-prone zone).
- Enhancement of a local community’s capacity to respond (e.g., health care coordination across the entire health community, including health departments, hospitals, clinics, and home care agencies).

Regardless of the type of approach used by planners (agent-specific or all-hazard), all hazards and potential dangers should be identified before an effective disaster response can be planned.

CAPACITY TO RESPOND

Resource identification is an essential feature of disaster planning. A community’s capacity to withstand a disaster is directly related to the type and scope of resources available, the presence of adequate communication systems, the structural integrity of its buildings and utilities (e.g., water, electricity), and the size and sophistication of its health care system (Cuny, 1998; Gans, 2001). Resources include both human and physical elements, such as organizations with specialized personnel and equipment. Disaster preparedness should include assembling lists of health care facilities; medical, nursing, and emergency responder groups; public works and other civic departments; and volunteer agencies, along with phone numbers and key contact personnel for each. Hospitals, clinics, physician offices, mental health facilities, nursing homes, and home care agencies must all have the capacity to ensure continuity of patient care despite damage to utilities, communication systems, or their physical plant. Communication systems must be put in place so that hospitals, health departments, and other agencies both locally and regionally, can effectively communicate with each other and share information about patients in the event of a disaster. Within hospitals, departments should have readily available a complete record of all personnel, including home addresses and home, pager, and cellular phone numbers to ensure access 24 hours a day. Resource availability will vary with factors such as time of day, season, and reductions in the workforce. Creativity may be needed in identifying and mobilizing human resources to ensure an adequate workforce (see Case Study 1.1). Disaster plans must also include alternative treatment sites in the event of damage to existing health care facilities or in order to expand the surge capacity of the present health care system.

Coordination between agencies is also necessary to avoid chaos if multiple volunteers respond to the disaster and are not directed and adequately supervised. As with the 9/11 disaster, many national health care workers and emergency medical services responders who came to New York to help returned because the numbers of volunteer responders overwhelmed the local response effort.

CORE PREPAREDNESS ACTIVITIES

1) Theoretical foundation for disaster planning. Disaster plans are “constructed” in much the same way as one builds a house. Conceptually, they must have a firm foundation grounded in an understanding of human behavior. Effective disaster plans are based on empirical knowledge of how people normally behave in disasters (Landesman, 2001). Any disaster plan must focus first on the local response and best estimates of what people are likely to do as opposed to what planners “want people to do.” Realistic predictions of population behaviors accompanied by disaster plans that are flexible in design, and easy to change, will be of greater value to all personnel involved in a disaster response.

2) Disaster planning is only as effective as the assumptions upon which it is based. The effectiveness of planning is enhanced when it is based on information
that has been empirically verified by systematic field disaster research studies (Auf der Heide, 2002). Sound disaster preparedness includes a comprehensive review of the existing disaster literature.  

3) Core preparedness activities must go beyond the routine. Most disasters cannot be managed merely by mobilizing more equipment, personnel, and supplies. Disasters differ from routine daily emergencies, and they pose significant problems that have no counterpart in routine emergency responses. Many disaster-related issues and challenges have been identified in the disaster literature, and they can be anticipated and planned for (Auf der Heide, 2002).

4) Community needs assessment. A community needs assessment must be conducted to identify the preexisting prevalence of disease and to identify those high-risk, high-need patients that may need to be transported in the event of an evacuation or whose needs may necessitate the provision of care in nontraditional sites. This needs assessment provides a foundation for planning along with baseline data for establishing the extent of the impact of the disaster.

5) Identify leadership and command post. The process of planning is often more important than the final written plan because those individuals who participate in the planning process will be more likely to accept and abide by the final product. The issue of “who’s in charge” is critical to all components of the disaster response and must be determined before the event occurs. The process of disaster planning is important to establishing relationships, identifying leaders, and laying the groundwork for smooth responses. Identification of the command post must also be decided in advance and communicated to all members of the organization or community (see chapter 6 for further discussion).

6) The first 24–48 hours: design of the local response. A plan for the mobilization of local authorities, personnel, facilities, equipment, and supplies for the initial postimpact 48-hour period is composed of the next level of the foundation of the disaster response. Most disaster casualties will arrive at the hospital within 1 hour of impact, and very few trapped casualties are rescued alive after the first day (Noji, 1996b). Thus, the effectiveness of the local response is a key determinant in preventing death and disability (Auf der Heide, 2002). Communities must be prepared to handle the immediate postimpact phase in the event that they are also isolated from outside resources or supplies (as happened in the immediate aftermath of 9/11 when all planes were grounded for the first time in U.S. aviation history). This stage of the disaster planning will involve many organizations and disciplines, from local institutions to municipal, state, and federal governments, including private, volunteer, and international agencies. First, local organizational leaders and executives from each agency must come together and work as a planning group to conduct the initial assessments (risk, hazard, and vulnerability), establish a coordinated process for response, design effective and complementary communication systems, and create standard criteria for the assessment of the scope of damage to the community.

7) Identification and accommodation of vulnerable populations. A community disaster plan must accommodate the needs of all people, including patients residing in hospitals and long-term care facilities such as nursing homes, assisted living, psychiatric care facilities, and rehabilitation centers. Children in residential living centers, individuals detained in the criminal justice system, and prison populations must all be accommodated within the plan. Poison control and suicide hotlines need to be maintained, and the continuity of home health care services must be safeguarded as well (see Case Study 1.2). School districts, day care centers, and employers must be kept aware and up to date regarding the community’s disaster plan.

8) State and federal assistance. Finally, state and federal assistance programs are added to the plan, and consideration of the need for mutual aid agreements (between communities or regions) is begun. Groups and organizations are most helpful when they understand their own capabilities and limitations, as well as those of the organizations with which interactions are anticipated or intended. Disaster plans should be designed to be both structured and flexible, with provisions made for plan activation and decision making by first-line emergency responders or field-level personnel, if necessary.

9) Identification of training and educational needs, resources, and personal protective equipment (PPE). A comprehensive discussion of PPE is found in chapter 26.

10) Plan for the early conduct of damage assessment. In emergency medical care, response time is critical (Schultz et al., 1996). A critical component to any disaster response is the early conduct of a proper damage assessment to identify urgent needs and to determine relief priorities for an affected population (Lilburne, Noji, & Burkle, 1992). Disaster assessment provides managers with objective information about the effects of the disaster on a community and can be used to match available resources to the population’s needs. The early completion of this task and the subsequent mobilization of resources to areas of greatest need can significantly reduce the adverse effects of a disaster. Identification of who will be responsible for this rapid assessment and what variables the assessment will contain needs to be identified in advance as part of the disaster planning process. Guha-Sapir (1991) developed a template, or tool, from disaster epidemiology that includes useful indicators for a rapid needs assessment.
assessment after earthquakes and which can be used to estimate the following factors:

- Overall magnitude of the effect of the disaster (geographical extent, number of individuals affected, estimated duration).
- Effect on measurable health outcomes (deaths, illnesses, injuries).
- Integrity of the health care delivery system.
- Specific health care needs of survivors.
- Disruption of services vital to the public’s health (water, power, sanitation).
- Extent of response to the disaster by local authorities.

EVALUATION OF A DISASTER PLAN

An essential step in disaster planning and preparedness is the evaluation of the disaster response plan for its effectiveness and completeness by key personnel involved in the response. The comprehension of people expected to execute the plan and their ability to perform duties must be assessed. The availability and functioning of any equipment called for by the disaster plan need to be evaluated and reviewed on a systematic basis. Several methods may be used to exercise the disaster plan, the most comprehensive of which would be its full implementation in an actual disaster. Disaster drills may also provide an excellent means of testing plans for their completeness and effectiveness. Drills can be staged as large, full-scale exercises, using moulaged victims and requiring vast resources of supplies and personnel, or they may be limited to a small segment of the disaster response, such as drills that assess the effectiveness of communications protocols or notification procedures. The disaster plan also may be assessed by using “table-top” academic exercises, mock patients, computer simulations, or seminar sessions focusing on key personnel and limited aspects of the disaster response.

Improved performance during the drill, with enhanced understanding of disaster planning and response, is more likely when personnel are notified in advance that a drill is scheduled. The specific goal of any drill should be clearly communicated. If drills are to be used as training sessions as well as evaluations of preparations and response plans, personnel are more likely to make the correct or most appropriate response choices during the drill if they are prepared. Frequent drills will assure that knowledge and skills are current. Consequently, they will be more likely to take appropriate actions when faced with an unexpected disaster situation in the future. The more realistic the exercise, the more likely it is that useful information about the strengths and weaknesses of both the disaster plan and the responders will be acquired. A shortage of available resources is a common factor in many disasters; without experiencing at least some of the stress that accompanies that situation, it is unlikely that the disaster plan and response will be taxed at a level that realistically simulates the circumstances of an actual disaster.

Essential features of all effective disaster drills are the inclusion of all individuals and agencies likely to be involved in the disaster response and a critique, with debriefing, of all participants following the exercise. This should include representation from all sectors of the emergency management field, all health care disciplines, government officials, school officials, and the media. The news media has a vital role in disasters, and failure to include the media in planning activities can lead to a dysfunctional response (Auf der Heide, 2002). Regardless of the format used, the critique should consider comments from everyone involved in the drill. Disaster planners should review all observations and comments and respond with modifications of the disaster plan, if necessary. Any modifications made to disaster plans or response procedures must be communicated to all groups involved or affected. Periodic evaluations of disaster plans are essential to ensure that personnel are adequately familiar with their roles in disaster situations, as well as to accommodate changes in population demographics, regional emergency response operations, hospital renovations and closings, and other variables. At a minimum, disaster drills should take place once every 12 months in the community, and more frequently in hospitals and other long-term care facilities.

SITUATIONS SUGGESTIVE OF AN INCREASED NEED FOR PLANNING

Disasters Within Hospitals

Most hospital plans concern themselves with “external” events, dealing specifically with the management of large volumes of patients arriving from an emergency that has occurred somewhere other than in the hospital (Aghababian et al., 1994). “Internal” disasters refer to incidents that disrupt the everyday, routine services of the medical facility and may or may not occur simultaneously with an external event. Although these concurrent events are rare, experiences such as the Northridge earthquake, Hurricane Andrew, and Hurricanes Katrina and Rita are evidence that they can happen (Aghababian et al., 1994; Quarantelli, 1983; Wolfson & Walker, 1993) with devastating consequences. Before Hurricane Katrina’s impact, there were 22 hospitals in New Orleans. Following the rupture of the levy, all 22 hospitals had to be evacuated. Health care facilities need to define what constitutes an internal disaster. In general, an internal
event can be defined as any event that threatens the smooth functioning of the hospital, medical center or health care facility, or that presents a potential danger to patients or hospital personnel (Aghababian et al., 1994).

In the United States, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) requires that all hospitals have comprehensive plans for both internal and external disasters. A copy of the current JCAHO standards for hospital disaster preparedness and a detailed discussion of these guidelines can be found in Appendix XIV. Internal disasters or system support failures can result in a myriad of responses, such as evacuation of patients and staff, decreased levels of service provision; diversion of ambulances, helicopter transport, and other patients; and relocation of patient care areas.

Sources of internal events include power failures, flood, water loss, chemical accidents and fumes, radiation accidents, fire, explosion, violence, bomb threats, loss of telecommunications (inability to communicate with staff), and elevator emergencies. The hospital setting is full of flammable and toxic materials. The use of lasers near flammable gases, multiple sources of radiation, storage of toxic chemicals, and potentially explosive materials in hospitals and medical centers, magnifies the potential for a catastrophic event. Internal disaster plans are based on a “Hospital Incident Management System” and address the institution’s response to any potential incident that would disrupt hospital functioning. Similar to the disaster continuum, the phases of a hospital’s internal disaster response plan generally include the identification of a command post and the following three phases:

1) Alert phase, during which staff remain at their regular positions, service provision is uninterrupted, and faculty and staff await further instructions from their supervisors.
2) Response phase, during which designated staff report to supervisors or the command post for instructions, the response plan is activated, and nonessential services are suspended.
3) Expanded response phase, when additional personnel are required, off-duty staff are called in, and existing staff may be reassigned based on patient needs (see chapter 6).

Internal disaster plans must address all potential scenarios, including:

- Loss of power, including auxiliary power;
- Loss of medical gases;
- Loss of water and/or water pressure;
- Loss of compressed air and vacuum (suction);
- Loss of telecommunications systems;
- Loss of information technology systems;
- Threats to the safety of patients and staff (violence, terrorism, and bombs);
- Toxic exposures involving fumes, chemicals, or radiation;
- Immediate evacuation of all patients and personnel.

Internal disaster plans should be integrated with the hospital’s overall disaster preparedness protocol. Training should be mandatory for all personnel. As with other disaster plans, drills should be designed and routinely performed to ensure that all staff are adequately prepared (see chapter 6 for a detailed discussion of the management of internal disasters).

**Bioterrorism/Communicable Disease**

Infectious disease outbreaks create unique challenges to planners. At what point does outbreak management become disaster management? The investigation and management of any communicable disease outbreak requires three steps: (a) recognition that a potential outbreak is occurring; (b) investigation of the source, mode of transmission, and risk factors for infection; and (c) implementation of appropriate control measures. If outbreak management exceeds or threatens to exceed the capability and resources of the institution, then a disaster management model may be useful (Moralejo, Russell, & Porat, 1997).

Institutional outbreaks of communicable disease are common. Most institutional outbreaks involve relatively few cases with minimum effect on the hospital and external community. However, large outbreaks, outbreaks of rare diseases, smaller outbreaks in institutions lacking infection control departments, or outbreaks in those with inadequate infection control personnel may exceed an institution’s or a community’s coping capacities (Moralejo et al., 1997). The need for widespread quarantine for the purposes of disease control (e.g., smallpox epidemic) would rapidly overwhelm the existing health care system and create significant staffing issues. Staff may refuse to come to work, fearing exposure to themselves and their families. Health care facilities may experience a vital role in the detection and response to biological emergencies, including new emerging infections, influenza outbreaks, and terrorist use of biological weapons. Assessment of the preparedness and capacity of each hospital to respond to and treat victims of an infectious disease outbreak or biological incident must be conducted as part of disaster planning. The Agency for Healthcare Research and Quality (AHRQ, 2002) released a survey tool that was widely used by hospitals and health care facilities to assess their capacity to handle potential victims of bioterrorist attacks. In 2006, the Agency for Healthcare Research and Quality issued a report entitled “Altered Standards of Care in Mass Casualty Events” with respect to bioterrorism and other public health emergencies (AHRQ, 2005).
Hazardous Materials Disaster Planning

Every industrialized nation is heavily reliant on chemicals. The United States is no exception; it produces, stores, and transports large quantities of toxic industrial agents. In fact, hazardous materials are present in every sector of American society and represent a unique and significant threat to civilians, the military, and health care workers both in the field and in the hospital emergency department. Situations involving hazardous materials suggest a need for additional planning efforts (Levitin & Siegelson, 1996, 2002). The chemical industry and the U.S. government have been making substantial efforts since 9/11 to increase security preparedness. Industry is carrying out joint assessments with the Federal Bureau of Investigation; the Environmental Protection Agency; Coast Guard; FEMA; the Bureau of Alcohol, Tobacco and Firearms; and the Office of Homeland Security (Institute of Medicine, 2002). In the United States, the Superfund Amendment and Reauthorization Act requires that all hazardous materials manufactured, stored, or transported by local industry that could affect the surrounding community be identified and reported to health officials. Gasoline and liquid petroleum gas are the most common hazardous materials, but other potential hazards include chlorine, ammonia, and explosives. Situations involving relocation of nuclear waste materials also pose a considerable risk to the communities involved. Material safety data sheets standardize the method of communicating relevant information about each material—including its toxicity, flammability, and known acute and chronic health effects—and can be used as part of the hazard identification process.

Clinically, the removal of solid or liquid chemicals from exposed individuals is the first step in preventing serious injury or death. Civilian hazmat teams generally have basic decontamination plans in place, though proficiency may vary widely (Institute of Medicine, 1999). Few teams are staffed, trained, and equipped for mass decontamination. Hospitals need to be prepared to decontaminate patients, despite plans that call for field decontamination of patients prior to transport. Currently, few hospitals in the United States are prepared to manage this type of disaster. During a hazmat accident, the victims often ignore the rules of the disaster plan by seeking out the nearest hospital for medical care, regardless of that institution's capabilities. If health care providers rush to the aid of contaminated individuals without taking proper precautions (e.g., donning PPE), they may become contaminated—the newest victims (Levitin & Siegelson, 1996). Because mishandling of a hazmat incident can turn a contained accident into a disaster involving the entire community, disaster planning initiatives must incorporate victim decontamination and PPE into the planning process (Levitin & Siegelson, 1996, 2002). A detailed discussion of hazmat and patient decontamination is found in chapter 26.

PROFESSIONAL NURSING MANDATE

Caring for patients and the opportunity to save lives is what professional nursing is all about, and disaster events provide nurses with an opportunity to do both. According to the American Nurses Association (ANA), “the aim of nursing actions is to assist patients, families and communities to improve, correct or adjust to physical, emotional, psychosocial, spiritual, cultural, and environmental conditions for which they seek help” and definitions of nursing have evolved to acknowledge six essential features of professional nursing (ANA, 2003, pp. 1–5):

- Provision of a caring relationship that facilitates health and healing.
- Attention to the range of human experiences and responses to health and illness within the physical and social environments.
- Integration of objective data with knowledge gained from an appreciation of the patient or group’s subjective experience.
- Application of scientific knowledge to the processes of diagnosis and treatment through the use of judgment and critical thinking.
- Advancement of professional nursing knowledge through scholarly inquiry.
- Influence on social and public policy to promote social justice.

All nurses should have an awareness of the basic life cycle of disasters, the health consequences associated with the major events, and a framework to support the necessary assessment and response efforts. Several nursing organizations have focused on the need for improved disaster nursing preparation. The ANA, the Emergency Nurses Association (see Case Study 11.1), and the Association for Professionals in Infection Control and Epidemiology have each issued position statements regarding the need for nurses to advance their disaster knowledge and preparedness skills. In addition, the National Student Nurses Association also recognized the need to prepare itself for practice in disaster settings (see Case Study 1.2). Although not all nurses will want to become “disaster” nurses, it is imperative that each nurse acquire a knowledge base and minimum set of skills to enable them to plan for and respond to a disaster in a timely and appropriate manner.
SUMMARY

Disasters are highly complex events that bring significant destruction and devastation to the communities they strike. A disaster’s immediate effects may be seen in injuries and deaths, disruption of the existing health care system and public health infrastructure, and social chaos. Effective planning for disaster preparedness should be based on the fundamentals of disaster knowledge and an understanding of how people behave during a disaster situation. Disasters often share a common set of problems and challenges that can be addressed during the planning process.

STUDY QUESTIONS

1) Differentiate between “disaster,” “hazard,” and “complex emergency.” What are the criteria used to classify the different types of disasters into categories? Explain how these unique features provide a structure for strategic planning.
2) What is the disaster continuum, and what are the five foci of disaster management?
3) Compare and contrast risk assessment, hazard identification, and vulnerability analysis.
4) The Southport County Health Department is holding a planning meeting with key public health officials and health care clinicians to address disaster preparedness. Southport is a town of 28,000 in northwest Montana and has experienced five blizzards and one flood in the past 3 years. Using the five focus areas of disaster planning, construct a disaster response plan for this community.
5) Why is the disaster planning process so important?
6) What are some of the common problems, issues, and challenges associated with disaster response? How can these problems and issues be addressed during the preparedness phase?
7) What types of activities should a community prepare for during the first 24 hours following impact of a disaster?
8) Following Hurricane Andrew in south Florida, more than 1,000 physicians’ offices were destroyed or significantly damaged. What impact did this have on the burden of the health care system, and what kind of planning could have mitigated this effect?
9) Following Hurricane Katrina all of the hospitals located in New Orleans had to be evacuated. You are a nurse working on Louisiana’s Gulf Coast and are concerned that another hurricane may hit. What are you doing to prepare? Where would you find resources to help develop a plan for another major event?
10) Describe the impact nursing involvement can have in each of the five focus areas of disaster planning and response.

INTERNET ACTIVITIES

1) Go to the National Traffic and Road Closure Information Web site at http://www.fhwa.dot.gov/trafficinfo/index.htm. In the event of a natural disaster involving severe weather conditions, locate updated information on the status of roads in your state and locality. What other Web sites could you go to for current weather-related road conditions during a disaster? What aspects of a disaster plan would this information change?
2) Go to the FEMA Web site at http://www.fema.gov/pdf/library/fema_strat_plan_fy03-08(no_append).pdf. Review FEMA’s Strategic Plan for fiscal years 2003–2008 entitled “A Nation Prepared.” Describe the agency’s goals and objectives. What is the all-hazard management system and who is involved? How would you integrate this federal plan into a local or regional disaster plan?
3) FEMA is organized around four functional divisions that correspond to the phases of a disaster. Those are Mitigation Division, Preparedness Division, Recovery Division, and Response Division. Why isn’t there an Evaluation Division? Do you think that FEMA should establish an Evaluation Division? How quickly could FEMA accomplish this?
4) Also located within the FEMA Web site is information regarding essentials of disaster planning for vulnerable populations. Find “Disaster preparedness for people with disabilities” (http://www.fema.gov/library/disprep/shtm. Describe the care of the vulnerable following Hurricanes Katrina and Rita. Draft a proposal for disaster preparedness that includes identification of high-risk, high-vulnerability individuals in your community, mapping of their location, and detailed plans for meeting their needs during a disaster.
5) Visit the U.S. Department of Health and Human Services, Office of Public Health Emergency Preparedness at http://www.hhs.gov/ophep/. What is the purpose of this agency? Find the National Disaster Medical System (http://www.ndms.dhhs.gov/index.html). Why was this system developed, and what are the responsibilities of the teams? How do you join a team? How are teams notified of current national conditions?
REFERENCES


American Nurses Association (ANA). (2003). Nursing’s social policy statement (2nd ed.).


ADDITIONAL READINGS


Response and Recovery

First response to a disaster is the job of local government’s emergency services with help from nearby municipalities, the state, and volunteer agencies. In a catastrophic disaster, at the request of the governor, federal resources can be mobilized through the U.S. Department of Homeland Security’s Federal Emergency Management Agency for search and rescue, electrical power, food, water, shelter, and other basic human needs. It is the long-term recovery phase of disaster that places the most severe financial strain on a local or state government.

A major disaster could result from a hurricane, earthquake, flood, tornado, or major fire that the president determines warrants supplemental federal aid. The event must be clearly more than state or local governments can handle alone. If declared, funding comes from the president’s Disaster Relief Fund, which is managed by FEMA, and disaster aid programs of other participating federal agencies.

A presidential major disaster declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities. An emergency declaration is more limited in scope and without the long-term federal recovery programs of a major disaster declaration. In general, federal assistance and funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring.

The Major Disaster Process

A major disaster declaration usually follows these steps:

- Local government responds, supplemented by neighboring communities and volunteer agencies. If overwhelmed, turn to the state for assistance.
- The state responds with state resources, such as the National Guard and state agencies.
- Damage assessment by local, state, federal, and volunteer organizations determines losses and recovery needs.
- A major disaster declaration is requested by the governor, based on the damage assessment, and an agreement to commit state funds and resources to the long-term recovery.
- FEMA evaluates the request and recommends action to the White House based on the disaster, the local community, and the state’s ability to recover.
- The president approves the request or FEMA informs the governor it has been denied. This decision process could take a few hours or several weeks, depending on the nature of the disaster.

Disaster Aid Programs

There are three major categories of disaster aid:

- **Individual Assistance.** Immediately after the declaration, disaster workers arrive and set up a central field office to coordinate the recovery effort. A toll-free telephone number is published for use by affected residents and business owners in registering for assistance. Disaster Recovery Centers also are opened where disaster victims can meet with program representatives and obtain information about available aid and the recovery process.

- Disaster aid to individuals generally falls into the following categories:
  - **Disaster housing** may be available for up to 18 months, using local resources, for displaced persons whose residences were heavily damaged or destroyed. Funding also can be provided for housing repairs and replacement of damaged items to make homes habitable.
  - **Disaster grants** are available to help meet other serious disaster-related needs and necessary expenses not covered by insurance and other aid programs. These may include replacement of personal property, transportation, and medical, dental, and funeral expenses.
  - **Low-interest disaster loans** are available after a disaster for homeowners and renters from the U.S. Small Business Administration (SBA) to cover uninsured property losses. Loans may be for repair or replacement of homes, automobiles, clothing, or other damaged personal property. Loans are also available to businesses for property loss and economic injury.
Other disaster aid programs include crisis counseling, disaster-related unemployment assistance, legal aid, and assistance with income tax, Social Security, and Veteran’s benefits. Other state or local help may also be available.

After the application is taken, the damaged property is inspected to verify the loss. If approved, an applicant will soon receive a check for rental assistance or a grant. Loan applications require more information and approval may take several weeks after application. The deadline for most individual assistance programs is 60 days following the president’s major disaster declaration.

Audits are done later to ensure that aid went to only those who were eligible and that disaster aid funds were used only for their intended purposes. These federal program funds cannot duplicate assistance provided by other sources such as insurance.

After a major disaster, FEMA tries to notify all disaster victims about the available aid programs and urge them to apply. The news media are encouraged to visit a Disaster Recovery Center, meet with disaster officials, and help publicize the disaster aid programs and the toll-free teleregistration number.

Public Assistance. Public assistance is aid to state or local governments to pay part of the costs of rebuilding a community’s damaged infrastructure. In general, public assistance programs pay for 75% of the approved project costs. Public assistance may include debris removal, emergency protective measures and public services, repair of damaged public property, loans needed by communities for essential government functions and grants for public schools. Learn more about public assistance at http://www.fema.gov/government/grant/pa/index.shtm.

Hazard Mitigation. Disaster victims and public entities are encouraged to avoid the life and property risks of future disasters. Examples include the elevation or relocation of chronically flood-damaged homes away from flood hazard areas, retrofitting buildings to make them resistant to earthquakes or strong winds, and adoption and enforcement of adequate codes and standards by local, state, and federal government. FEMA helps fund damage mitigation measures when repairing disaster-damaged structures and through the hazard mitigation.

Contact Information for FEMA:

General Questions
FEMA-Correspondence-Unit@dhs.gov
Telephone: 1 (800) 621-FEMA (332)
TDD: TTY users can dial 1 (800) 462-7585 to use the Federal Relay Service.
Fax: 1 (800) 827-8112

Technical Assistance (Online Registration)
Telephone: 1 (800) 745-0243
Fax: 1 (800) 827-8112
Federal Emergency Management Agency
P.O. Box 10055
Hyattsville, MD 20782-7055


CASE STUDY

1.2 National Student Nurses Association 2006 Resolution for Student Nurses Disaster and Emergency Preparedness

Jennifer Timony

During the 2005–2006 academic year, I had the opportunity to serve as the Resolutions Chairperson for the National Student Nurses’ Association (NSNA). The NSNA is an organization of over 45,000 nursing students from the United States and its commonwealths and territories who are enrolled in associate, baccalaureate, diploma, and generic graduate nursing programs. With its nationwide membership, the NSNA mentors the professional development of future nurses and facilitates their entrance into the profession by providing educational resources, leadership opportunities, and career...
guidance. As the chairperson of the Resolutions Committee I guided the legislative process of writing and adopting resolutions that would guide the future actions of the NSNA. At the midyear convention of the NSNA in Kentucky, I conducted a workshop on the process of writing a resolution and sought out fellow students to become the authors of quality materials for potential resolutions. Students were encouraged to return to their home states and begin research on significant topics for nursing students at the national level.

Groups of students in Florida and Texas began writing about issues related to emergency and disaster preparedness as a response to the great devastation caused by hurricanes and flooding in their areas. They wanted to help after the hurricanes but were often met with obstacles. The frustration created by these obstacles led them to want to do more to make changes. They authored resolutions aimed at addressing potential solutions for emergency and disaster preparedness for nursing students. The next step was to combine these resolutions into one comprehensive resolution to be presented at the NSNA annual convention, which took place in Baltimore, Maryland, in April 2006. The Resolutions Committee facilitated combining the material so it could be presented before the House of Delegates, the voting body of the NSNA. The following is the resolution as it was presented.

**TOPIC:** IN SUPPORT OF THE ESTABLISHMENT OF PROTOCOLS FOR DISASTER RELIEF GUIDING THE SCOPE OF PRACTICE FOR STUDENT NURSES AND THE COLLECTION AND DISTRIBUTION OF DONATIONS

**SUBMITTED BY:** Texas Student Nurses Association and Valencia Community College Nursing Student Association

**AUTHORS:** Blair Baker, Jessica Jones, Millicent Jones, Jessica Macleary, Brieann Mellar, Starlit Monzingo, and Daniel Thurow

WHEREAS, student nurses have contributed to disaster relief from the time of The Jacksonville yellow fever epidemic of 1888; and

WHEREAS, the American Red Cross recognizes the contributions of student nurses in “delivering critical community services for more than half a century”; and

WHEREAS, the United States has experienced many crisis events, both natural and man-made, within the past four years; and

WHEREAS, professional nurses are often restricted to acute care settings in times of disaster and crisis; and

WHEREAS, student nurses are an available and competent resource to assist in disaster relief efforts; and

WHEREAS, no literature has identified the appropriate scope of practice to support student nurse utilization in the area of disaster relief; and

WHEREAS, the lack of a defined scope of practice for student nurses during disaster relief operations is a repeated problem needing attention and is likely to reoccur; and

the National Student Nurses’ Association (NSNA) has for the past 53 years been the connecting link and collective body of the state student nurses associations promoting “civic responsibility”; therefore be it

RESOLVED, that the National Student Nurses’ Association (NSNA) support education and awareness of the need for the establishment of protocols guiding the scope of practice for student nurses in the area of disaster relief and the collection and distribution of donations for disaster areas; and be it further

RESOLVED, that the NSNA encourage its constituents to work collaboratively with their local and state disaster response and health-care agencies to develop a taskforce that will define the scope of practice for student nurses in disaster settings and develop a protocol for coordinating the collection and distribution of donations to be sent to disaster areas; and be it further

RESOLVED, that the NSNA promote student involvement in community disaster response planning, implementation, and evaluation, and the collection and distribution of donations; and be it further

RESOLVED, that the NSNA send a copy of this resolution to the President of the United States, the American Nurses Association, the American Red Cross, the Federal Emergency Management Agency, the American Association of Colleges of Nursing, the National League for Nursing, the National Organization for Associate Degree Nursing, state departments of health, the National Council of State Boards of Nursing, and all others deemed appropriate by the NSNA Board of Directors.
Discussion at the Resolutions Hearings at the annual meeting of the NSNA centered on inspiring fellow students to be visionaries and agents of change. We were reminded to continue to advocate for our patients by furthering our education, becoming involved in our communities, and influencing future changes in nursing. Fellow students encouraged the NSNA members to endorse programs that are already in place that provide disaster relief, training, education, and certification. Taking these steps in times of calm will allow us to meet needs when there are emergencies or disasters. Leadership by nurses in various community groups will positively influence the changing image of nursing. Liability concerns were raised regarding nurses and students who are serving with the best of intentions. National consistency for scope of practice and licensure was discussed. This resolution was one of 15 adopted out of a total of 19 presented before the House of Delegates.

The task set before the newly elected board members of the NSNA is to begin to creatively implement the 2006 resolutions. The constituent chapters will be guided in constructing programs to implement the resolved statements and to empower the membership to take personal action as well. We are all part of support communities, and we need to find creative ways to give back.

Key Messages

- The National Disaster Response Framework includes emergency management authorities, policies, procedures, and resources of local, state, and federal governments, as well as voluntary disaster relief agencies, the private sector, and international resources to provide assistance following a disaster.
- The Department of Homeland Security coordinates the National Response Plan (NRP) to provide supplemental assistance when the consequences of a disaster overwhelm local and state capabilities.
- The NRP coordinates with other federal emergency plans as necessary to meet the needs of unique situations.
- The NRP works hand-in-hand with the National Incident Management System and incorporates the tenets of the Incident Command System.
- Nurses need to be aware of Emergency Support Function (ESF 8), Health and Medical Services, and its core provisions.
- Nursing leadership during a disaster or mass casualty event demands a broad knowledge base and a unique skill set.
- Changes in government structure in disaster response and in the public health system may create opportunities for nurses to act in new, yet-to-be defined roles.
- Nurses must actively seek out positions of leadership in health policy and disaster management.
- Nurses must remain vigilant as this information is constantly changing as health policy and federal restructuring continues.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the medical services system.
2. Describe the National Response Plan and the National Incident Management System.
3. List the 15 emergency support functions included in the plan, particularly the emergency support function (ESF 8).
4. Discuss the purpose and scope of ESF 8.
5. List the federal definitions of a disaster condition.
6. Describe federal resources where nurses might volunteer, including the National Disaster Medical System, Medical Reserve Corps, and U.S. Public Health Service and its Federal Medical Shelters.
7. Identify challenges to health systems leadership and coordination.
8. Communicate the issues surrounding disaster nursing leadership.
Leadership and Coordination in Disaster Health Care Systems: The Federal Disaster Response Network

Roberta Lavin, Lynn Slepski, and Tener Goodwin Veenema

In the early stages of a large-scale incident, the question usually becomes “so when will the cavalry arrive?”

This chapter explores health care systems frameworks for disaster response. Included is a brief review of the key components of the Emergency Medical Services System (EMS); a detailed overview of the National Response Plan (NRP), the National Incident Management System (NIMS), and Federal Medical Shelters (FMS); and a description of the National Disaster Medical System (NDMS). Discussion addresses the NRP’s purpose, scope, and 15 emergency support functions (ESFs), highlighting the importance of ESF 8 Public Health and Medical Services in providing supplemental assistance to state and local governments in identifying and meeting the public health and medical needs of victims and communities. The chapter reviews the medical response actions particular to the plan and names the responsible agency. The chapter provides federal definitions of disaster conditions, the basic underlying assumptions of the NRP, and provides links to the most current information.

Disaster response, including national plans, must be routinely updated to incorporate new presidential directives and legislative changes and to reflect ongoing plan improvements and enhanced response capabilities, especially as a result of “lessons learned.” Because of the ever-changing nature of disaster response, published documents soon become outdated. Nurses need to know where they can obtain the most up-to-date information. Guidance to online resources on disaster response and emergency preparedness are provided.

This chapter explores the issues and challenges related to defining the role of nurses in a disaster situation. Disaster nursing leadership mandates that nurses have a sound knowledge base in critical management areas, as well as in health policy and public health. The chapter presents suggestions for educational needs, research initiatives to further the science of disaster nursing, and political advocacy issues. Nurses must capitalize on
opportunities for leadership during disasters and other periods of crisis. The reader should note that writing a chapter on federal health and medical response at this point in history is difficult because of the current transitional nature of these systems, as evidenced by the following factors:

1. Lessons learned from Hurricanes Katrina and Rita.
2. Continuing realignment of resources to better meet the needs of the nation.
3. Current modifications to the NRP that include the refinement of NIMS.
4. Continuing work to clarify and to preplan the national response to such issues as the 15 threat scenarios, which are expected to encompass the most likely responses, as well as pandemic influenza.

INTRODUCTION

In order to actively participate in the country’s plan for emergency preparedness for disasters and other mass casualty incidents (MCIs), nurses must be aware of the existing framework for disaster response. The role of nurses may include identifying the event; functioning as a first responder to the scene; working with a rapid needs assessment team; providing direct care by working in a local hospital, FMS, public health department, or field medical team; managing communications and the media; or assuming a leadership position in the coordination of all of these types of activities. Each of these roles might include planning, policy writing, or research. Knowledge of the disaster life cycle and knowledge of the organization of local, state, and federal response plans is critical for nurses to function successfully during these types of events. Leadership roles for nurses in disaster management require a unique knowledge base and skills set. Finally, because of the anticipated restructuring of NIMS and factors such as alterations in the federal systems for public health and medical response and accommodations for additional national security concerns, nurses need to view some of the information in this chapter as “a moving target” subject to change with a high degree of certainty. To understand how these changes will alter the leadership structure and coordination of efforts of the major disaster health systems, nurses are advised to seek updated information on the Internet Web sites listed at the end of the chapter.

Organization of the NRP

- Base Plan
- Glossary, Acronyms, Authorities, and Compendium of National Interagency Plans
- Appendices
- Describe the structures and responsibilities for coordinating incident resource support
- Emergency Support Functions Annexes
- Provide guidance for the functional processes and administrative requirements
- Support Annexes
- Address contingency or hazard situations requiring specialized application of the NRP
- Incident Annexes
- Figure 2.1 National Response Plan structure.

Chapter 2  Leadership and Coordination in Disaster Health Care Systems

EMERGENCY MEDICAL SERVICES RESPONSE

The Emergency Medical Services (EMS) system is a highly organized sector of the health care system that has a significant impact on the health of the public both through routine crisis management functions and their contribution during disasters. EMS systems are frequently responsible for coordinating the provision of medical care at a mass gathering (Leonard & Moreland, 2001). The EMS system, in general, consists of (a) pre-hospital systems (fire and rescue services, dispatch/911, EMTs and paramedics, and ambulance services) and (b) in-hospital systems (emergency departments, poison control, etc.). See chapter 3 “Emergency Medical Services” for further discussion.

NATIONAL RESPONSE PLAN

Local and state responders handle most disasters and emergencies. Occasionally, the actual or potential impact of an event can overwhelm resources available at the local level. When the scope of a disaster exceeds local and state capability to respond, they can call on the federal government to provide supplemental assistance. The U.S. government has a fundamental obligation to provide for the security of the nation and to protect its people, principles, and social, economic, and political structures (Pinkson, 2002). If needed, the federal government can mobilize an array of resources to support state and local efforts. Various emergency teams, support personnel, specialized equipment, operating facilities, assistance programs, and levels of access to private-sector resources constitute the overall federal response system. The NRP describes the major components of the system, as well as the structure for coordinating federal response and recovery actions necessary to address state-identified requirements and priorities.

National Response Plan Implementation

Established by Homeland Security Presidential Directive-5 (HSPD-5), the NRP provides a single, comprehensive, all-hazards approach to the structure and mechanisms of national level policy and operational coordination for domestic incident management. It incorporates prevention, preparedness, response, and recovery (White House, 2003). Proper implementation of the plan results in a coordinated and effective response, regardless of the cause, size, or nature of the event (DHS, 2004b). The plan provides the structure and mechanisms to ensure that all levels of government work together. The base plan includes planning assumptions, roles and responsibilities, concept of operations, and incident management actions.

Under the NRP, the Secretary of the Department of Homeland Security (DHS) serves as the Principal Federal Official for domestic incident management and manages the federal government’s response. The Secretary of Homeland Security declares Incidents of National Significance (in consultation with other departments and agencies as appropriate) and provides coordination for federal operations and resources, establishes reporting requirements, and conducts ongoing communications with federal, state, local, tribal, private-sector, and nongovernmental organizations to maintain situational awareness, analyze threats, assess the national implications of threats, maintain operational response activities, and coordinate threat or incident response activities.

As “all hazards” implies, potential events covered by the NRP include man-made and natural disasters, disruptions to the nation’s energy and information technology infrastructure, and terrorist attacks, among others. The NRP is always in effect, however, the implementation of NRP coordination mechanisms is flexible and scalable and is based on the needs of the area where the event is occurring. The plan can be implemented in response to a threat, in anticipation of a significant event, or in response to an event such as an Incident of National Significance. An Incident of National Significance is defined as an actual or potential high-impact event that requires robust coordination of the federal response, including federal, state, local, tribal, private-sector, and nongovernmental partners, in order to save lives, minimize damage, and provide the basis for long-term community and economic recovery. Actions range in scope from ongoing monitoring, analysis, and reporting of the event, known as maintaining situational awareness, through the implementation of NRP incident annexes and other supplemental federal continuity plans, to full implementation of all relevant NRP coordination mechanisms.

Although there are no automatic triggers for an Incident of National Significance, the Secretary of Homeland Security considers the four HSPD-5 criteria but also evaluates other factors in determining whether to declare an Incident of National Significance (DHS, 2006a). The four criteria are as follows:

1. A federal department or agency acting under its own authority has requested the assistance of the Secretary of Homeland Security.
2. The resources of state and local authorities are overwhelmed and federal assistance has been requested by the appropriate state and local authorities. Examples include:
   - Major disasters or emergencies as defined under the Stafford Act.
   - Catastrophic incidents.
(3) More than one federal department or agency has become substantially involved in responding to an incident. Examples include:
  - Credible threats, indications, or warnings of imminent terrorist attack or acts of terrorism directed domestically against the people, property, environment, or political or legal institutions of the United States or its territories or possessions.
  - Threats or incidents related to high-profile, large-scale events that present high-probability targets such as National Special Security Events (NSSEs) and other special events as determined by the Secretary of Homeland Security, in coordination with other federal departments and agencies.

(4) The Secretary of Homeland Security has been directed to assume responsibility for managing the domestic incident by the President.

The NRP forms the basis of how the federal government coordinates with state, local, and tribal governments and the private sector during incidents. Through standardized protocols, the plan helps to protect the nation from natural and man-made hazards and terrorist attacks, thereby saving lives; protecting public, health, safety, and property; protecting the environment; and reducing negative psychological consequences and disruptions to the American way of life.

The NRP (DHS, 2004b, p. 3) establishes mechanisms to

(1) Maximize the integration of incident-related prevention, preparedness, response, and recovery activities.
(2) Improve coordination and integration of federal, state, local, tribal, regional, private-sector, and non-governmental organization partners.
(3) Maximize efficient utilization of resources needed for effective incident management and critical infrastructure/key resources protection and restoration.
(4) Improve incident management communications and increase situational awareness across jurisdictions and between the public and private sectors.
(5) Facilitate emergency mutual aid and federal emergency support to state, local, and tribal governments.
(6) Facilitate federal-to-federal interaction and emergency support.
(7) Provide a proactive and integrated federal response to catastrophic events.
(8) Address linkages to other federal incident management and emergency response plans developed for specific types of incidents or hazards.

The NRP lays out the process for a federal response and designates the Secretary of the Department of Homeland Security to coordinate the response efforts and to provide support for the incident command structure. In some cases, federal agencies manage localized incidents with plans under their own authority and not part of the NRP.

Within the NRP, there are 15 emergency support functions (ESF) (Table 2.1). Each ESF is coordinated by a federal agency, except ESF 6, which DHS coordinates with the American Red Cross. The ESFs provide coordination for interagency support from the federal government.

ESF 8 is the public health and medical portion of the NRP and is coordinated by the Department of Health and Human Services (HHS). As required by the NRP, HHS is responsible for the following (DHS, 2004b, p. ESF-iii):

(1) Preincident planning and coordination.
(2) Maintaining ongoing contact with ESF primary and support agencies.
(3) Conducting periodic ESF meetings and conference calls.
(4) Coordinating efforts with corresponding private-sector organizations.
(5) Coordinating ESF activities relating to catastrophic incident planning and critical infrastructure preparedness as appropriate.

In addition, the primary agency serves as the executive agent under the federal coordinating officer. The primary agency is responsible for the following (DHS, 2004b):

(1) Orchestrating federal support within their functional area for an affected state.
(2) Providing staff for the operations functions at fixed and field facilities.
(3) Notifying and requesting assistance for support agencies.
(4) Managing mission assignments and coordinating with support agencies, as well as appropriate state agencies.
(5) Working with appropriate private-sector organizations to maximize use of all available resources.
(6) Supporting and keeping other ESFs and organizational elements informed of ESF operational priorities and activities.
(7) Executing contracts and procuring goods and services as needed.
(8) Ensuring financial property accountability for ESF activities.
(9) Planning for short-term and long-term incident management and recovery operations.
(10) Maintaining trained personnel to support interagency emergency response and support teams.
### 2.1 National Response Plan Emergency Response Functions Descriptions

<table>
<thead>
<tr>
<th>ESF</th>
<th>ESF Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1—Transportation</td>
<td>U.S. Department of Transportation</td>
</tr>
<tr>
<td>■ Federal and civil transportation support</td>
<td></td>
</tr>
<tr>
<td>■ Transportation safety</td>
<td></td>
</tr>
<tr>
<td>■ Restoration/recovery of transportation infrastructure</td>
<td></td>
</tr>
<tr>
<td>■ Movement restrictions</td>
<td></td>
</tr>
<tr>
<td>■ Damage and impact assessment</td>
<td></td>
</tr>
<tr>
<td>2—Communications</td>
<td>U.S. Department of Homeland Security / National Communications System</td>
</tr>
<tr>
<td>■ Coordination with telecommunications industry</td>
<td></td>
</tr>
<tr>
<td>■ Restoration/repair and temporary provisioning of communications infrastructure</td>
<td></td>
</tr>
<tr>
<td>■ Protection, restoration, and sustainment of national cyber and information technology resources</td>
<td></td>
</tr>
<tr>
<td>3—Public Works and Engineering</td>
<td>U.S. Department of Defense / U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td>■ Infrastructure protection and emergency repair</td>
<td></td>
</tr>
<tr>
<td>■ Infrastructure restoration</td>
<td></td>
</tr>
<tr>
<td>■ Engineering services, construction management</td>
<td></td>
</tr>
<tr>
<td>■ Critical infrastructure liaison</td>
<td></td>
</tr>
<tr>
<td>4—Firefighting</td>
<td>U.S. Department of Agriculture</td>
</tr>
<tr>
<td>■ Firefighting activities on federal lands</td>
<td></td>
</tr>
<tr>
<td>■ Resource support to rural and urban firefighting operations</td>
<td></td>
</tr>
<tr>
<td>■ Coordination of incident management efforts</td>
<td></td>
</tr>
<tr>
<td>■ Issuance of mission assignments</td>
<td></td>
</tr>
<tr>
<td>■ Resource and human capital</td>
<td></td>
</tr>
<tr>
<td>■ Incident action planning</td>
<td></td>
</tr>
<tr>
<td>■ Financial management</td>
<td></td>
</tr>
<tr>
<td>■ Mass care</td>
<td></td>
</tr>
<tr>
<td>■ Disaster housing</td>
<td></td>
</tr>
<tr>
<td>■ Human services</td>
<td></td>
</tr>
<tr>
<td>7—Resource Support</td>
<td>U.S. General Services Administration</td>
</tr>
<tr>
<td>■ Resource support (facility space, office equipment &amp; supplies, contracting services, etc.)</td>
<td></td>
</tr>
<tr>
<td>8—Public Health and Medical Services</td>
<td>U.S. Department of Health and Human Services</td>
</tr>
<tr>
<td>■ Public health</td>
<td></td>
</tr>
<tr>
<td>■ Medical</td>
<td></td>
</tr>
<tr>
<td>■ Mental health services</td>
<td></td>
</tr>
<tr>
<td>■ Mortuary services</td>
<td></td>
</tr>
<tr>
<td>■ Life-saving assistance</td>
<td></td>
</tr>
<tr>
<td>■ Urban search and rescue</td>
<td></td>
</tr>
</tbody>
</table>
The National Response Plan as It Relates to the National Incident Management System

The NRP and National Incident Management System (NIMS) work together to improve the nation’s incident management capabilities and overall efficiency by ensuring that responders from different jurisdictions and disciplines can work together to respond to natural disasters and emergencies, including acts of terrorism, by following standardized practices and using common terminology (DHS, 2004a).

The NIMS provides a template for incident management regardless of size, scope, or cause. The template includes a core set of concepts, doctrine, principles, procedures, organizational processes, and terminology. It sets standards where possible. Use of the NIMS template enables federal, state, local, and tribal governments, as well as the private sector and nongovernmental organizations to work together effectively and efficiently to prevent, prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity.

NIMS is meant to be used at all levels of a response (Figure 2.2). NIMS standard incident command structures are based on the following three key organizational systems:
Chapter 2
Leadership and Coordination in Disaster Health Care Systems

31

Figure 2.2 NIMS incident command organization: Command staff and general staff.

(a) Incident Command System (ICS)
NIMS establishes ICS as a standard incident management organization with five functional areas—command, operations, planning, logistics, and finance/administration—for management of all major incidents. To ensure further coordination, and during incidents involving multiple jurisdictions or agencies, the principle of unified command has been universally incorporated into NIMS. This unified command not only coordinates the efforts of many jurisdictions but provides for and assures joint decisions on objectives, strategies, plans, priorities, and public communications.

(b) Multiagency Coordination Systems
These define the operating characteristics, interactive management components, and organizational structure of supporting incident management entities engaged at the federal, state, local, tribal, and regional levels through mutual-aid agreements and other assistance arrangements.

(c) Public Information Systems
These refer to processes, procedures, and systems for communicating timely and accurate information to the public during crisis or emergency situations.

By prescribing standard roles, functions, and language, responders know what to expect and how to communicate their needs. Together, the NRP and the NIMS integrate the capabilities and resources of various governmental jurisdictions, incident management and emergency response disciplines, nongovernmental organizations, and the private sector into a cohesive, coordinated, and seamless national framework for domestic incident management. NIMS benefits include a unified approach to incident management, standard command and management structures, and emphasis on preparedness, mutual aid, and resource management. NIMS activities address each phase of the disaster life cycle (see Figure 2.3).

The National Response Plan and a Local Event

Sometimes, when trying to understand a large “system of systems,” the best approach is to examine the issue from a specific frame of reference. Listed below is an example of how the NRP might be used in a pandemic.

One Example: Use of the NRP With Pandemic Influenza

A pandemic is a global disease outbreak. A flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity and for which there is no vaccine. The disease spreads easily from person to person, causes serious illness, and can sweep across the country and around the world in a very short time. In the United States, pandemic planning assumes that nearly all areas of the country will be affected simultaneously by multiple waves of disease lasting 6–8 weeks. Plans estimate that 40% of the workforce could be out ill, taking care of ill family members, or unwilling to come to work for fear of contracting the disease. Emergency planners recognize that pandemic influenza has the risk of disrupting society and its function, so using a pandemic as an exemplar can help illustrate how the NRP works. The plan addresses federal responses to actual or potential health emergencies or biological incidents, to specifically include pandemic influenza.
For purposes of a national health emergency, such as pandemic influenza, the NRP outlines the broad objectives of the federal government as:

- Detecting the event through disease surveillance and environmental monitoring.
- Identifying and protecting the population(s) at risk.
- Determining the source of the outbreak.
- Quickly framing the public health and law enforcement implications.
- Controlling and containing any possible epidemic (including providing guidance to state and local public health authorities).
- Augmenting and surgically public health and medical services.
- Tracking and defeating any potential resurgence or additional outbreaks.
- Assessing the extent of residual biological contamination and decontaminating as necessary.

**Activation of the National Response Plan**

Consistent with NIMS, elements of the NRP can be partially or fully implemented, depending on the specifics and the magnitude of a threat or an event. The following structures and annexes are the primary, but not exclusive, mechanisms that may be implemented during a pandemic.

- **Domestic Readiness Group (DRG):** The Domestic Readiness Group comprises senior leaders from all cabinet-level departments and agencies. The White House will convene the DRG on a regular basis to develop and coordinate implementation of preparedness and response policy and in anticipation of, or during crises, such as pandemic influenza to address issues that cannot be resolved at lower levels and provide strategic policy direction for the federal response.

- **Incident Advisory Council (IAC):** A tailored group of senior federal interagency representatives, the IAC resolves resource support conflicts required for a federal response and provides strategic advice to the Secretary of Homeland Security during an actual potential incident. During a pandemic, the IAC might advise providing critical infrastructure assistance, such as movement of food supplies, or critical components, such as chlorine for a water treatment plant.

- **Joint Field Office (JFO):** A temporary federal facility established locally to provide a central point for federal, state, local, and tribal executives with responsibility for incident oversight, direction, and assistance to coordinate protection, prevention, preparedness, response, and recovery actions. For a pandemic, a national JFO may be established, or, if the pandemic outbreak is isolated to various areas, multiple JFOS may be established locally.

**Emergency Support Functions (ESFs):** A functional approach that groups the capabilities of federal departments and agencies and the American Red Cross into ESFs to provide the planning, resources, and program implementation that are most likely needed during incidents of National Significance. Although there are 15 ESFs that can be activated independently or concurrently, key ESFs applicable to a pandemic are as follows:

- **ESF 5—Emergency Management:** Provides the core management and administrative functions in support of NRP operations. This includes, but is not limited to activating ESFs; alerting, notifying, and deploying DHS emergency response teams; information management; and facilitating requests for federal assistance. FEMA is the ESF 5 coordinator.

- **ESF 8—Public Health and Medical Services:** Provides the mechanism for coordinated federal assistance in response to public health and medical care needs for potential or actual Incidents of National Significance or during a developing potential health and medical situation. HHS is the ESF 8 coordinator.

- **ESF 11—Agriculture and Natural Resources:** Supports efforts to control and eradicate an outbreak of a highly contagious animal disease and assures food safety and security. The U.S. Department of Agriculture is the ESF 11 coordinator.

- **ESF 13—Public Safety and Security:** Presents a mechanism for coordinating and providing federal noninvestigative/noncriminal law-enforcement, public-safety, and security capabilities and resources during potential or actual Incidents of National Significance. DHS and the Department of Justice are joint ESF 13 Coordinators.

- **ESF 15—External Affairs:** Ensures that sufficient federal assets are deployed to provide accurate, coordinated, and timely messages to affected audiences, including governments, the media, the private sector, and the affected populace.

- **Incident Annexes:** Address contingency or hazard situations requiring specialized application of the NRP. Incident annexes can be implemented concurrently or independently. Examples of incident annexes with applicability to a pandemic are:

  - **Biological Incident Annex:** Describes incident management activities related to a biological terrorism event, pandemic, emerging infectious disease, or novel pathogen outbreak. HHS is the coordinating agency for this annex. The response by HHS and other federal agencies is flexible and adapts as the outbreak evolves.

  - **Catastrophic Incident Annex:** Establishes the context and overarching strategy for implementing and coordinating an accelerated, proactive, national
response to a catastrophic incident with little or no advance warning, where the need for federal assistance is obvious and immediate. This annex may be activated during a pandemic to push preidentified assets/resources for mass care, public health and medical support, and victim transportation to areas expected to be severely impacted. DHS is the coordinating agency for this annex.

- **Support Annexes:** Describe the framework through which common functional processes and administrative requirements necessary to ensure efficient and effective incident management are executed. The actions described in the support annexes are overarching and applicable to nearly every type of incident. Examples of key support annexes that would support a pandemic are:
  - **Private Sector Coordination Annex:** Addresses specific federal actions that are required to effectively and efficiently integrate incident management operations with the private sector. This includes, but is not limited to, determining the impact of an incident on a sector and forecasting cascading effects of interdependencies, assisting federal decision makers in determining appropriate recovery measures, and establishing procedures for communications between public and private sectors. DHS is the coordinating agency for this annex.
  - **International Coordination Annex:** Describes activities taken in coordination with international partners for public health messaging, monitoring, and responding to an Incident of National Significance that may transcend U.S. borders. The U.S. Department of State is the coordinating agency for this annex.

### ROLES AND RESPONSIBILITIES

Although many agencies and nongovernmental organizations will have responsibilities for assisting in the federal response to a pandemic outbreak, the following entities have primary roles:

**Department of Homeland Security**

- Retains responsibility for overall domestic incident management.
- Possesses the authority, through the Secretary, to declare an Incident of National Significance and activate the Biological Incident Annex to the NRP.
- Coordinates nonmedical federal response actions for an Incident of National Significance.
- Coordinates with other federal agencies to develop a public communications plan through ESF 15—external affairs and the public affairs annex to the NRP.

**Department of Health and Human Services (HHS)**

- Provides logistics support, as appropriate.
- Identifies transportation needs and arranges for use of U.S. Coast Guard aircraft and other assets in providing urgent airlift and other transportation support through ESF 1.
- Works with HHS to identify and to isolate people and cargo entering in the United States that may be contaminated.
- Develops plans and facilitates coordinated incident response planning with the private sector at the strategic, operational, and tactical levels.

**Department of Health and Human Services (HHS)**

- Supports the DHS incident management mission by providing the leadership, expertise, and authority to implement critical and specific aspects of the response under the NRP.
- Has primary responsibility for public health and medical emergency planning, preparations and response to a naturally occurring outbreak from an emerging infectious disease and its own authority to declare a public health emergency.
- Coordinates for both ESF 8 and the NRP biological incident annex.
  - Convenes meeting of ESF 8 organizations and provides ESF 8 representatives to appropriate multiagency coordinating structures and teams.
  - Assists with epidemic surveillance and coordination.
  - Notifies and coordinates with international health organizations (e.g., World Health Organization) in coordination with the Department of State.
  - Coordinates requests for medical transportation.
  - Coordinates assembly and delivery of medical equipment and supplies.
  - Requests/informs support agencies of required assistance for vaccine/pharmaceutical allocation and distribution.
  - Evaluates event and makes recommendations for quarantine, shelter-in-place, and so on.
  - Oversees deployment of the Strategic National Stockpile.
  - Activates NDMS, PHS, and other medical response capabilities.

**U.S. Department of Agriculture (USDA)**

- Supports the DHS incident management mission by leading the effort to control and eradicate an outbreak of a highly contagious or an economically devastating animal disease.
- Coordinates surveillance activities along with ESF 8 in zoonotic diseases.
- Assures food safety and security in coordination with other responsible federal agencies (including...
coordinating recall and tracing of adulterated products and disposal of contaminated food products.

■ Provides appropriate personnel, equipment, and supplies, coordinated through the Animal and Plant Health Inspection Service Emergency Management Operations Center primarily for coordination of animal issues such as disposal of animal carcasses, protection of livestock health, and zoonotic diseases associated with livestock.

Department of State

■ Has sole responsibility for bilateral and multilateral actions on foreign affairs issues related to a federal event or Incident of National Significance.

■ Notifies and coordinates with appropriate international health agencies, in conjunction with HHS, and coordinates with DHS and other nations regarding any transportation or border restrictions.

■ Acts as the formal diplomatic mechanism for U.S. government requests to other nations for assistance or other nations’ requests to the United States.

Department of Defense (DOD): Provides defense support of civil authorities to all ESF and support and incident annexes when requested and approved by the Secretary of Defense. Examples of DOD support include, but are not limited to:

■ Providing support for the evacuation of seriously ill or injured patients to locations where hospital care or outpatient services are available.

■ Providing available logistical support to health/medical response operations.

■ Providing available military medical personnel to assist HHS in the protection of public health.

■ Activating and deploying (or preparing to deploy) agency- or ESF-managed teams, equipment caches, and other resources in accordance with the NRP-Catastrophic Incident Supplement.

Other Departments and Agencies: Support public health emergencies according to their outlined roles and responsibilities in ESF and support, and incident annexes.

ESF 8: Public Health and Medical Services

Most important to nurses is ESF 8, or public health and medical services, which provides coordinated federal assistance to communities following a major disaster or emergency or during a developing potential medical situation. HHS is the primary agency for ESF 8. The purpose of ESF 8 is to “provide supplemental assistance to State, local, and tribal governments in identifying and meeting the public health and medical needs of victims of an Incident of National Significance” following a significant natural disaster, man-made event, or Incident of National Significance (DHS, 2004b). The core functions of ESF 8 include:

■ Assessment of public health/medical needs (including behavioral health).

■ Public health surveillance.

■ Medical care personnel.

■ Medical equipment and supplies.

Resources will be furnished when state and local resources are overwhelmed and public health or medical assistance is requested from the federal government. ESF 8 involves supplemental assistance to state and local governments in identifying and meeting the public health and medical needs of victims in the following functional areas:

■ Assessment of public health/medical needs includes:
  □ Health surveillance
  □ Medical care personnel
  □ Health/medical equipment and supplies
  □ Patient evacuation
  □ Patient care
  □ Safety and security of human drugs, biologics, medical devices, and veterinary drugs
  □ Blood and blood products
  □ Food safety and security
  □ Agriculture safety and security
  □ Worker health/safety
  □ All-hazard public health and medical consultation, technical assistance, and support
  □ Behavioral health care
  □ Public health and medical information
  □ Vector control
  □ Potable water/wastewater and solid-waste disposal
  □ Victim identification/mortuary services
  □ Protection of animal health

A basic concept of the NRP is that responding federal resources will operate in coordination with state, local, and tribal entities. To learn more about roles and responsibilities in ESF 8, refer to http://www.dhs.gov/interweb/assetlibrary/NRP_FullText.pdf for the full reference and a full copy of the NRP (Appendix A).

FEDERAL DEFINITION OF A DISASTER CONDITION

For the purposes of activating the National Response Plan, the federal government defines a disaster condition as follows:
Chapter 2
Leadership and Coordination in Disaster Health Care Systems

1. A significant natural disaster or man-made event that overwhelms the affected state that would necessitate both federal public health and medical care assistance. Hospitals, nursing homes, ambulatory care centers, pharmacies, and other facilities for medical/health care and special needs populations may be severely structurally damaged or destroyed. Facilities that survive with little or no structural damage may be rendered unusable or only partially usable because of a lack of utilities (power, water, sewer) or because staff are unable to report for duty as a result of personal injuries or damage/disruption of communications and transportation systems. Medical and health care facilities that remain in operation and have the necessary utilities and staff will probably be overwhelmed by the “walking wounded” and seriously injured victims who are transported there in the immediate aftermath of the occurrence. In the face of massive increases in demand and the damage sustained, medical supplies (including pharmaceuticals) and equipment will probably be in short supply. (Most health care facilities usually maintain only a small inventory stock to meet their short-term, normal patient-load needs). Disruptions in local communications and transportation systems could also prevent timely resupply.

2. Uninjured persons who require daily or frequent medications such as insulin, antihypertensive drugs, digitalis, and dialysis may have difficulty in obtaining these medications and treatments because of damage/destruction of normal supply locations and general shortages within the disaster area.

3. In certain other disasters, there could be a noticeable emphasis on relocation; shelters; vector control; and returning water, wastewater, and solid-waste facilities to operation.

4. A major medical and environmental emergency resulting from chemical, biological, or nuclear weapons of mass destruction could produce a large concentration of specialized injuries and problems that could overwhelm the state and local public health and medical care system.

Assumptions of the Plan

For a disaster plan to work, it must be based on a set of valid assumptions. The primary assumptions of the NRP include:

1) Resources within the affected disaster area will be inadequate to clear casualties from the scene or treat them in local hospitals. Additional mobilized federal capabilities will be urgently needed to assist state and local governments to triage and treat casualties in the disaster area and then transport them to the closest appropriate hospital or other health care facility. Additionally, medical resupply will be needed throughout the disaster area. In a major disaster, operational necessity may require the further transportation by air of patients to the nearest metropolitan areas with sufficient concentrations of available hospital beds, where patient needs can be matched with the necessary definitive medical care.

2) A terrorist release of weapons of mass destruction; damage to chemical and industrial plants, sewer lines, and water distribution systems; and secondary hazards such as fires will result in toxic environmental and public health hazards to the surviving population and response personnel, including exposure to hazardous chemicals, biological substances, radiological substances, and contaminated water supplies, crops, livestock, and food products.

3) The damage and destruction of a major disaster, which may result in multiple deaths and injuries, will overwhelm the state and local mental health system, producing an urgent need for mental health crisis counseling for disaster victims and response personnel.

4) Assistance in maintaining the continuity of health and medical services will be required.

5) Disruption of sanitation services and facilities, loss of power, and massing of people in shelters may increase the potential for disease and injury.

6) Primary medical treatment facilities may be damaged or inoperable; thus, assessment and emergency restoration to necessary operational levels is a basic requirement to stabilize the medical support system.

Federal Medical Response Resources

A variety of response resources exist across the federal government. Each provides options where nurses can volunteer and make a difference. The following sections briefly discuss some of the major response resources.

National Disaster Medical System

The foundation of ESF 8 is the multiagency National Disaster Medical System (NDMS). Directed by the Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, the NDMS has the following three primary functional elements: medical response, patient evacuation, and hospitalization.

Medical response. NDMS responds to a disaster area with disaster medical assistance teams (DMATs),
specialty teams, management support teams, medical supplies, and equipment.

**Patient evacuation.** Arrangements are coordinated for patients who cannot be cared for locally to be evacuated to designated locations throughout the United States.

**Hospitalization.** NDMS has created a network of hospitals spanning the major metropolitan areas of the country. All hospitals in this network have agreed to accept patients in the event of a national emergency.

The NDMS is designed to care for victims of any incident that exceeds the capability of the state, regional or federal health care system. Some of the events that may require its activation are earthquakes, floods, hurricanes, industrial disasters, a refugee influx, and military casualties from overseas. Activation of NDMS may be accomplished by a presidential declaration. This authority is granted by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, also referred to as the Stafford Act. When a presidential declaration has not occurred, HHS, under the Public Health Service Act as amended, may request activation of the NDMS. In addition, through the mechanism provided by Emergency Management Assistance Compacts states may request health and medical teams from another state when either their own resources are overwhelmed or they do not have the particular type of resource available in a nearby jurisdiction (Wallace, 2002) (see Figures 2.4 and 2.5).
Disaster Medical Assistance Team

A DMAT is a volunteer group of professional and para-professional medical personnel (supported by a cadre of logistical and administrative staff) designed to provide medical care during a disaster or other event. Members are usually from the same state or region of a state. Each team has a sponsoring organization, such as a major medical center; public health or safety agency; or non-profit, public, or private organization that signs a memorandum of agreement with the HHS. The DMAT sponsor organizes the team and recruits members, arranges training, and coordinates the dispatch of the team. The team composition includes physicians, nurses, nurse practitioners, physician’s assistants, pharmacists, pharmacy technicians, nurse’s aides, mental health specialists, dentists, environmental and laboratory specialists, and emergency medical technicians. Technical or non-medical members may consist of engineers; radio operators; administrators; and logistic, security, mechanics, and computer specialists. The nonmedical, technical,
and logistical support group is as important as the medical group. Without these support personnel, the team cannot function (Wallace, 2002).

Team size will vary according to the mission assignment. Strike teams, a concept developed during the Atlanta 1996 Summer Olympic Games, are five- to six-member squads, usually made up of medical personnel that have the capability to move quickly into an affected area to provide limited medical treatment and assessment. A full team deployment is expected to be 33 to 35 personnel and is made up of medical, technical, and support personnel. The full team is usually the configuration that is used for a large event such as a hurricane or an earthquake (Wallace, 2002; see Figure 2.6).

Highly specialized DMATs that deal with specific medical conditions such as crush injury, burn, and mental health emergencies supplement the standard DMATs. Other teams within the NDMS section include Disaster Mortuary Operational Response Teams (DMORTs) that provide mortuary services, Veterinary Medical Assistance Teams that provide veterinary services, and National Nursing Response Teams (NNRTs) that will be available for situations specifically requiring nurses and not full DMATs. Such a scenario might include assisting with mass chemoprophylaxis (a mass vaccination program) or a scenario that overwhelms the region's supply of nurses in responding to a weapon of mass destruction event. Others teams are the National Pharmacy Response Teams that will be used in situations such as those described for the NNRTs but where pharmacists, not nurses or DMATs, are needed, and the National Medical Response Teams (NMRTs) that are equipped and trained to provide medical care for potentially contaminated victims of weapons of mass destruction.

DMATs deploy to disaster sites with sufficient supplies and equipment to sustain themselves for a period of 72 hours while providing medical care at a fixed or temporary medical care site. In mass casualty incidents, their responsibilities may include triaging patients, providing high-quality medical care despite the adverse and austere environment often found at a disaster site, and preparing patients for evacuation. In other types of situations, DMATs may provide primary medical care and may serve to augment overloaded local health care staffs. Under the rare circumstance that disaster victims are evacuated to a different locale to receive definitive medical care, DMATs may be activated to support patient reception and disposition of patients to hospitals. DMATs are designed to be a rapid-response element to supplement local medical care until other federal or contract resources can be mobilized or the situation is resolved. DMAT members are required to maintain appropriate certifications and licensure within their discipline. When members are activated as federal employees, licensure and certification is recognized by all states. In addition, DMAT members are paid while serving as part-time federal employees and have the protection of the Federal Tort Claims Act in which the federal government becomes the defendant in the event of a malpractice claim. DMATs are principally a community resource available to support local, regional, and state requirements. However, as a national resource they can be federalized.

Training plays one of the most important roles in DMAT development. The primary source of training is distance learning through the World Wide Web. NDMS, at its annual conferences, offers workshops and training courses for members. More information about the NDMS and its training and education programs can be accessed at http://ndms.dhhs.gov/. Individual teams have different amounts of training. Some approaches to field exercises have the teams identify a mass gathering event, such as an air show or an outside concert. Although medical care is the primary focus of training, the logistic and administrative support functions must participate equally to develop their skills.

Medical Reserve Corps

The Medical Reserve Corps (MRC) was launched in July 2002 to organize medical, public health, and other volunteers in support of existing local programs and resources to improve the health and safety of communities and the nation. Ultimately, the goal is to have a nationwide network of community-based units of volunteers that focus on strengthening public health. The MRC focuses on addressing the issues of preidentification, credential verification, training, legal protection, and activation of volunteers at the local level.
The MRC is a specialized component of Citizen Corps, hometown volunteers dedicated to improving and ensuring security where they live. These community-based units locally organize and use volunteers who want to donate their time and expertise to promote healthy living throughout the year and to prepare for and respond to emergencies. Since its inception, the MRC program has blossomed to include over 390 units across the nation and more than 70,000 volunteers. MRC units are not stand-alone entities. Instead, they provide supplemental personnel to support the existing emergency and public health capabilities in the community. MRC volunteers are a community resource during times of need and also for ongoing public health activities. Many MRC units have undertaken activities that support the public health priorities of the U.S. Surgeon General and the objectives of the Healthy People 2010 initiative, such as diabetes detection, hypertension monitoring, cancer screening, influenza vaccination, and other similar programs.

MRC volunteers include medical and public health professionals such as physicians, nurses, pharmacists, dentists, veterinarians, and epidemiologists. Other community members, such as interpreters, chaplains, office workers, and legal advisors, can fill other vital support functions in the units. MRC volunteers supplement existing local emergency and public health resources.

The MRC response to the 2005 hurricanes highlights the broad range of services that MRCs can provide in emergencies. An estimated 6,000 MRC volunteers supported the response and recovery efforts in their local communities in the hardest-hit areas. As the storm forced hundreds of thousands of Americans to flee the affected areas, MRC volunteers were ready and able to help when needed and were there to assist as evacuees were welcomed into their communities. These volunteers spent countless hours helping people whose lives had been upended by these disastrous events by:

- Establishing medical needs shelters to serve medically fragile and other displaced people.
- Staffing and providing medical support in evacuee shelters and clinics.
- Filling in locally at hospitals, clinics, and health departments for others who were deployed to the disaster-affected regions.
- Immunizing responders prior to their deployment to the disaster-affected regions.
- Staffing a variety of response hotlines created after the hurricanes hit.
- Teaching emergency preparedness to community members.
- Recruiting more public health and medical professionals who can be credentialed, trained, and prepared for future disasters that may affect their hometowns or other communities.

In addition to this local MRC activity, over 1,500 MRC members expressed a willingness to deploy outside their local jurisdiction on optional missions to the disaster-affected areas with their state agencies, the American Red Cross, and HHS. Of these, almost 200 volunteers from 25 MRC units were activated by HHS and more than 400 volunteers from over 80 local MRC units were deployed to support American Red Cross disaster operations in areas along the Gulf Coast.

The United States Public Health Service (USPHS)

Led by the U.S. Surgeon General, the mission of the “U.S. Public Health Service (Corps) is protecting, promoting, and advancing the health and safety of the Nation. The Commissioned Corps achieves its mission through rapid and effective response to public health needs, leadership and excellence in public health practices, and the advancement of public health science. As one of the seven Uniformed Services of the United States, the corps is a specialized career system designed to attract, develop, and retain health professionals who may be assigned to Federal, State, or local agencies or international organizations” (USPHS, 2006). To accomplish this mission, the agencies and programs are designed to:

- Help provide health care and related services to medically underserved populations—Americans, American Indians, Alaska Natives, and other population groups with special needs.
- Prevent and control disease, identify health hazards in the environment and help correct them, and promote healthy lifestyles for the nation’s citizens.
- Improve the nation’s mental health.
- Ensure that drugs and medical devices are safe and effective, food is safe and wholesome, cosmetics are harmless, and that electronic products do not expose users to dangerous amounts of radiation.
- Conduct and support biomedical, behavioral, and health sciences research and communicate research results to health professionals and the public.
- Work with other nations and international agencies on global health problems and their solutions.

Federal Medical Shelters

First used in the aftermath of Hurricanes Katrina and Rita, Federal Medical Shelters (FMS) are 250-bed capacity shelters equipped with equipment supplied, in part, from the Strategic National Stockpile (SNS). Staffed by 150 USPHS, DOD, the Department of Veterans’ Affairs, and the National Disaster Medical
System (NDMS) health care and support personnel, these shelters are self-contained facilities designed to quickly augment both inpatient and outpatient treatment facilities. A total of 40 medical shelters will be created, for a total capacity of 10,000 beds. Fixed facilities, such as the National Institutes of Health, supplement existing FMS capabilities by providing a telemedicine consultation and triage facility to serve as a medical specialty service, allowing providers on the ground to tap into the expertise of NIH experts in collaboration with 125 medical centers throughout the country.

Medical Response Actions

Federal health and medical assistance is generally categorized into the major functions of prevention, medical services, mental health services, and environmental health. Each of the 15 specific functional areas is contained in one of these categories. When the lead of the national ESF 8 (the Assistant Secretary for Preparedness and Response) is notified of the occurrence of a potential major disaster or emergency, the Assistant Secretary will request HHS and support agencies to initiate action immediately to identify and report the potential need for federal health and medical support to the affected disaster area in the following functional areas.

Assessment of Health/Medical Needs. Lead HHS Agency: Office of the Assistant Secretary for Preparedness and Response (ASPR)
Action: Mobilize and deploy an assessment team to the disaster area to assist in determining specific health/medical needs and priorities. This function includes the assessment of the health system/facility infrastructure.

Health Surveillance. Lead HHS Agency: Centers for Disease Control and Prevention
Action: Assist in establishing surveillance systems to monitor the general population and special high-risk population segments; carry out field studies and investigations; monitor injury and disease patterns and potential disease outbreaks; and provide technical assistance and consultations on disease and injury prevention and precautions.

Medical Care Personnel. Lead HHS Agency: ASPR
Action: Provide federal medical response assets and individual public health and medical personnel to assist in providing care for ill or injured victims at the location of a disaster or emergency. DMATs and Federal Medical Shelters can provide triage, medical or surgical stabilization, and continued monitoring and care of patients until they can be evacuated to locations where they will receive definitive medical care. Specialty DMATs can also be deployed to address mass burn injuries, pediatric care requirements, chemical injury, or contamination. In addition to DMATs, active duty, reserve, and National Guard units for casualty clearing/staging and other missions will be deployed as needed. Individual clinical health and medical care specialists may be provided to assist state and local personnel. The VA is one of the primary sources of these specialists.

Patient Evacuation. Lead HHS Agency: ASPR in coordination with DHS/National Response Coordination Center
Action: Provide for movement of seriously ill or injured patients from the area affected by a major disaster or emergency to locations where definitive medical care is available. NDMS patient movement will primarily be accomplished using fixed-wing aeromedical evacuation resources of DOD; however, other transportation modes may be used as circumstances warrant.

In-Hospital Care. Lead HHS Agency: ASPR
Action: Provide definitive medical care to victims who become seriously ill or injured as a result of a major disaster or emergency. For this purpose, NDMS has established and maintains a nationwide network of voluntarily precommitted, nonfederal, acute care hospital beds in the largest U.S. metropolitan areas.

Food/Drug/Medical Device Safety. Lead HHS Agency: Food and Drug Administration
Action: Ensure the safety and efficacy of regulated foods, drugs, biologic products, and medical devices following a major disaster or emergency. Arrange for seizure, removal, and destruction of contaminated or unsafe products.

Worker Health/Safety. Lead HHS Agency: Centers for Disease Control and Prevention
Action: Assist in monitoring health and well-being of emergency workers, perform field investigations and studies addressing worker health and safety issues, and provide technical assistance and consultation on worker health and safety measures and precautions.
Radiological/Chemical/Biological Hazards Consultation. Lead HHS Agency: Centers for Disease Control and Prevention
Action: Assist in assessing health and medical effects of radiological, chemical, and biological exposures on the general population and on high-risk population groups; conduct field investigations, including collection and analysis of relevant samples; advise on protective actions related to direct human and animal exposure, and on indirect exposure through radiologically, chemically, or biologically contaminated food, drugs, water supply, and other media; and provide technical assistance and consultation on medical treatment and decontamination of radiologically, chemically, or biologically injured/contaminated victims.

Mental Health Care. Lead HHS Agency: Substance Abuse and Mental Health Services Administration
Action: Assist in assessing mental health needs; provide disaster mental health training materials for disaster workers; and provide liaison with assessment, training, and program development activities undertaken by federal, state, and local mental health officials.

Public Health Information. Lead HHS Agency: Centers for Disease Control and Prevention
Action: Assist by providing public health and disease and injury prevention information that can be transmitted to members of the general public who are located in or near areas affected by a major disaster or emergency.

Vector Control. Lead HHS Agency: Centers for Disease Control and Prevention
Action: Assist in assessing the threat of vector-borne diseases following a major disaster or emergency; conduct field investigations, including the collection and laboratory analysis of relevant samples; provide vector control equipment and supplies; provide technical assistance and consultation on protective actions regarding vector-borne diseases; and provide technical assistance and consultation on medical treatment of victims of vector-borne diseases.

Potable Water/Waste Water and Solid Waste Disposal. Lead HHS Agency: Indian Health Service
Action: Assist in assessing potable water and wastewater/solid-waste disposal issues; conduct field investigations, including collection and laboratory analysis of relevant samples; provide water purification and wastewater/solid-waste disposal equipment and supplies; and provide technical assistance and consultation on potable water and wastewater/solid-waste disposal issues.

Victim Identification/Mortuary Services. Lead HHS Agency: ASPR in coordination with DHS/FEMA
Action: Assist in providing victim identification and mortuary services, including DMORTs; temporary morgue facilities; victim identification by fingerprint, forensic dental, and/or forensic pathology/anthropology methods; and processing, preparation, and disposal of remains. Another important function of DMORTs is the provision of family support centers.

Veterinary Services. Lead HHS Agency: ASPR in coordination with DHS/FEMA/NDMS
Action: Assist in delivering health care to injured or abandoned animals and performing veterinary preventive medicine activities following a major disaster or emergency, including conducting field investigations and providing technical assistance and consultation as required.

CHALLENGES TO HEALTH SYSTEMS’ LEADERSHIP AND COORDINATION

Increased Risk. America’s metropolitan areas continue to grow in size and density, with many of the largest cities situated in coastal regions, along earthquake faults, or in other high-risk areas. Meanwhile, commercial and residential development has progressed at a rapid pace across the nation, expanding into previously unsettled or sparsely settled areas exposing these growing communities to wildfire, flooding, and erosion. The ubiquitous risks associated with acts of terrorism and the dramatic increase in recent natural disasters will continue to pose significant challenges to all those involved with health systems coordination and management as well.

Limited Resources. The downturn in the economy coupled with years of reduced funding for public health infrastructure has imposed severe constraints on many federal agencies and organizations. Working with limited resources means that each organization must make the most of the resources it already has. Many states are experiencing cuts in federal funding for public health programs.

Workforce Management. All federal, state, and local governments and organizations are facing serious challenges in maintaining and growing their workforce. In no place is this more serious than in the disaster management and nursing professions. Programs and curricula must be developed and implemented with the focus on growing disaster and emergency management leaders of the future.
OPPORTUNITIES AND CHALLENGES FOR NURSES IN DISASTER MANAGEMENT

Nursing as a profession has a long history of being creative and visionary in its continuous efforts to meet the needs of patients and their families. Nursing leadership in tumultuous times, such as during the disaster continuum or at a mass casualty incident, will also require significant amounts of the same creativity and vision. When the opportunities and challenges of disaster management in the future are considered, the following questions arise.

Leadership

Who will become the leaders? A leader is anyone who uses interpersonal skills to influence others to accomplish a specific goal (Sullivan & Decker, 2001). Leadership is important in forging links and creating connections among organizations and their members to promote high levels of performance, quality outcomes, and the accomplishment of goals. Nurses need to get into leadership positions in all types of health care and public health organizations to assist with the design of disaster response plans and the development of future change in these organizations. In this capacity, nurses can serve as advocates for communities, and in particular for vulnerable populations such as infants and children, the elderly, the disabled, the mentally ill, and for the safety of other nurses in disaster response. Previous literature describes models for disaster nursing leadership (Demi & Miles, 1984). These models will need to be updated and expanded to meet the challenges of the future. Nurses also need to move into leadership positions in politics, public policy, civic administration, education administration, and emergency management systems. Nurses will have the competencies to be in these positions if they prepare themselves for them. Clearly, nursing knowledge of the health care process, diagnosis, planning, treatment, and evaluation is an asset. Additional preparation in all phases of disaster planning and management, health promotion, risk reduction, disease prevention and illness and disease management, information and health care technologies, and human resource management will prepare nurses for positions of leadership. Effective leadership in disaster management requires personal integrity, strength, flexibility, creativity, and use of collaborative approaches.

Roles and Functions

What will be the roles and functions of nurses in disaster response? Nurses need to define what their roles will be across the disaster continuum and across many diverse types of organizations. Clinician, planner, director, coordinator of care, scientist, educator, and colleague to public health, these roles must be defined by nursing. Supportive work environments must be created. As has been evident in the past decade, nursing has undergone major changes in its roles and functions. Reduced staffing levels required that nurses develop new strategies and interventions to ensure that patients receive the care they need, including support and patient education. Disaster nursing in particular will also require new strategies and interventions in order for nurses to render care in nontraditional care settings, to potentially large numbers of patients, while under great stress and with limited resources. The field of disaster management has historically been viewed as the domain of the emergency management field, police, fire department, EMS, and hazardous material management teams. Although nurses have been successful in developing new and advanced roles in acute care, home care, and ambulatory care, nursing must now clearly articulate what its role will be in disaster management and work to get involved. Advanced practice nurses will play greater roles in these areas, too.

Policy Development

Why will health care policy development be important? Health care policy provides direction and standards with regard to health care delivery, reimbursement, evaluation, and education of health care professionals. Changes in disaster health care policy will target new emphasis on the nation’s public health infrastructure, information technology and communications systems, immunization and antibiotic therapy guidelines, educational preparation, and numerous other aspects of daily health care practice. Nurses need to understand and participate in the health care policy development process in respect to disaster preparedness and response as planners, policy makers, educators, individuals, members of a community, and members of professional organizations. This requires knowledge of the process at the levels in which it occurs: local, state, national, and political representation at the individual as well as the organizational level. Globalization is frequently discussed in all areas of health care today, including disaster relief. Nurses have been involved in international policy development through the International Council of Nurses and the World Health Organization. This will become more important as boundaries that separate one country from another become less rigid, accessibility is improved, and the number and scope of disasters continue to increase.
Government Organization

How will changes in the structure and functioning of the federal government impact the health care system and the National Response Plan?

Public Health

How will changes in the structure and governance of the U.S. public health system impact nursing? The neglect of the public health infrastructure for the past 20 years had a major impact on population-based health care and nursing and on the nation’s entire emergency preparedness capabilities. The sizable funding stream provided to states through the Health Resources and Services Administration and the Centers for Disease Control and Prevention cooperative agreements should help to reverse the problem, but it will not be a cure. Years of chronic underfunding and lack of planning will not be corrected overnight. The creation of additional programs and positions involving public health nurses in health promotion disease surveillance and disease management will depend on the fiscal priorities of each state and local health department.

Surveillance

Disease surveillance and containment are interventions designed to prevent or mitigate the consequences of disease. Disaster nursing will demand close collaboration with public health colleagues in areas where health promotion and disease prevention strategies will play a critical role in achieving health outcomes for populations affected by disasters. Nursing needs educational programs that are visionary and unique—providing knowledge and skills regarding health promotion and technology and leadership in complex health care systems.

Quality Care

What is quality care in disaster nursing, and can we find a way to provide quality care in the case of a mass casualty event? Quality in health care has always been difficult to define. The definition is highly dependent on who is defining it (e.g., provider, insurer, consumer). Disaster response is no different. Staffing is a major predictor of quality of care, and the issue of adequate nurses during a disaster response must be addressed. Although most state and county health departments have spent considerable time ensuring that systems are developed and put in place to handle a disaster or mass casualty incident, their initiatives have focused almost universally on responding to a sudden demand for increased inpatient hospital-bed capacity. These plans have proposed strategies to increase the overall number of community beds; however, little attention has been paid to address the issue of nurse staffing for these additional patients. In the event of a major disaster, where will the nurses come from to care for these patients, and will these nurses be adequately prepared? What if a disaster occurs and there are 500 casualties, 5,000 casualties, or 200,000 casualties? Simultaneously, we are experiencing a nursing shortage that, if unaddressed, will be more severe and longer in duration than those previously experienced. If a major terrorist attack or disaster were to occur amid the current nursing shortage, these forces would combine to create the “perfect storm” for the health care system, with devastating consequences to patient safety across all health care settings and to overall public health outcomes.

Efforts have been made to address this situation. For example, the American Nurses Association announced in June 2002 that they would work with the Department of Health and Human Services, ASPR, and the Public Health Service to establish a National Nurses Response Team (NNRT). The NNRTs are dedicated to responding to a presidentially declared disaster to provide mass immunization or chemoprophylaxis to a population at risk. This initiative represents an excellent beginning to address nurse staffing during disasters. Much more, however, remains to be done. Now and in the future, decisions regarding funding of disaster response initiatives will be subject to funding constraints due to the unpredictable nature of the events. There must be balance between quality and cost containment because both are important. Disaster nursing research can provide empirical evidence on which to base quality decisions. Nurses must play a role in this process in order to contribute to the process of quality care. There are currently ten NNRTs across the United States.

Evidence-Based Practice

Where do we go in disaster nursing, and who will be the disaster nurse researchers? The evaluation of health care outcomes has been important for a long time; yet, the empirical evidence supporting disaster nursing is minimal. Much of the lack of evidence is due to the challenging nature of research conducted under disaster conditions. Evaluation of every phase of the disaster continuum and all nursing interventions is paramount for advancing the field of disaster nursing.

Education

What are the educational needs of nurses? This is a critical question. Nursing education must adjust rapidly to
the changing health care environment and must provide content that prepares graduates to work in an environment where the potential for a disaster or mass casualty incident is real. Relevant clinical content is important. In addition, students need to have content on the following: all-hazards disaster planning, disaster management and response, the National Response Plan, collaboration across agencies and health care delivery systems, disaster nursing leadership and management, delegation, decision making, short-term and strategic planning, communication systems, legal and ethical issues, disaster health care policy development, and a multitude of other topics related to nuclear, biologic, chemical, and radiological events. This content should be provided to all students majoring in nursing. All nurses who practice in all types of settings must obtain certain disaster nursing core competencies. In addition, nurses who are already in practice cannot be ignored. They need updates on disaster content through continuing education. Nurses must be prepared to assume leadership roles in national emergency preparedness, and this cannot be done without knowledge and skills.

Critical Thinking Skills
Why is critical thinking important to disaster nursing? The inherent nature of the disaster condition mandates that providers are critical thinkers who can remain calm, rapidly assess situations, consider options, and enact the emergency response plan. New problems will need to be addressed. Time will be of the essence. Flexibility, a preparedness to assume responsibility and risk, and strength of character are just a few characteristics of the disaster nurse leader. An ability to triage situations as well as patients and prioritize and delegate limited resources are also key components of the role. Critical thinking requires risk taking, not formulaic response.

Collaboration
What will be gained from collaboration? The complexity of the health care delivery system in response to disasters requires many skills, and no one health care profession has all of the necessary skills to provide all the care to large masses of patients. Interdisciplinary teams and cross-agency collaboration are critical. The future will bring other new organizations and their members. Nurses need to develop the necessary skills to participate and to lead effectively on the team (e.g., communication, delegation, coordination, negotiation). An important issue will be the need for more interdisciplinary disaster preparedness educational experiences—students from the various health care professions learning together in field exercises and participating in clinical and administrative conferences together. Learning separately makes it very difficult to expect spontaneous collaboration under the pressure of real-life disasters. Interdisciplinary learning environments enhance interdisciplinary functioning in practice.

Opportunities
Why are opportunities for nurses important? Stepping out and taking on leadership positions in disaster and emergency preparedness by defining needs and creating innovative strategies to resolve problems are critical. To see into the future and its possible opportunities means that nursing must rethink current educational strategies in order to prepare new nurses with the skills that will be needed for new roles and functions.

SUMMARY
As disasters continue to grow in their magnitude and frequency, disaster response plans will be developed, implemented, evaluated, and modified for use during the next event. While the nuances of a disaster response plan will probably stay consistent, the structure of the federal and state agencies responsible for coordinating the response may change. Nurses must remain current about the status of the National Response Plan and the organizational responsibilities of collaborating agencies. In the meantime, the national nursing workforce must face its own issues regarding professional emergency preparedness. Nursing must become part of the solution before a disaster occurs. Attention to professional issues like leadership, educational preparation, nursing science, and establishing or enhancing collaborative relationships with other disaster providers is paramount if we are to be ready when disaster strikes.

EDITOR’S NOTE
The information presented in this chapter has been verified up to the date of submission for publication; however, references and resources frequently change. Readers are encouraged to visit the FEMA Web site at http://www.fema.gov and the Department of Homeland Security Web site at http://www.whitehouse.gov/deptofhomeland/ for the most current available information. No-cost training (DHS, 2006c) information is available at: http://www.training.fema.gov/EMIWeb/IS/IS%20Brochure.doc (Table 2.2).
### 2.2 Links to Learn More

<table>
<thead>
<tr>
<th>SPONSOR</th>
<th>TITLE/DESCRIPTION</th>
<th>WEB ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Emergency Management Institute, Department of Homeland Security</td>
<td>IS-100: Introduction to Incident Command System, I-100 As an introduction to the Incident Command System (ICS), this course provides the foundation for higher-level ICS training. This course describes the history, features and principles, and organizational structure of the Incident Command System. It also explains the relationship between ICS and the National Incident Management System (NIMS).</td>
<td><a href="http://training.fema.gov/EMIWeb/IS/is100.asp">http://training.fema.gov/EMIWeb/IS/is100.asp</a></td>
</tr>
<tr>
<td>Federal Emergency Management Institute, Department of Homeland Security</td>
<td>IS-200: ICS for Single Resource and Initial Action Incidents ICS-200 is designed to enable personnel to operate efficiently during an incident or event within the Incident Command System (ICS). ICS-200 provides training on and resources for personnel who are likely to assume a supervisory position within the ICS. (0.3 CEUs)</td>
<td><a href="http://training.fema.gov/EMIWeb/IS/is200.asp">http://training.fema.gov/EMIWeb/IS/is200.asp</a></td>
</tr>
<tr>
<td>Federal Emergency Management Institute, Department of Homeland Security</td>
<td>IS-700: National Incident Management System (NIMS), and Introduction On February 28, 2003, President Bush issued Homeland Security Presidential Directive-5 (HSPD-5). This directive instructed the Secretary of Homeland Security to develop and administer a National Incident Management System (NIMS). The NIMS provides a consistent nationwide template to enable all government, private-sector, and nongovernmental organizations to act in concert during domestic incidents. This course explains the purpose, principles, key components, and benefits of NIMS. It also contains “Planning Activity” screens giving you an opportunity to practice some planning tasks. (0.3 CEUs)</td>
<td><a href="http://training.fema.gov/EMIWeb/IS/is700.asp">http://training.fema.gov/EMIWeb/IS/is700.asp</a></td>
</tr>
<tr>
<td>Federal Emergency Management Institute, Department of Homeland Security</td>
<td>IS-800: National Response Plan (NRP), an Introduction The National Response Plan, or NRP, specifies how resources of the federal government will work in concert with state, local, and tribal governments, as well as the private sector to respond to Incidents of National Significance. The NRP is predicated on the National Incident Management System (NIMS). Together, NRP and NIMS provide a nationwide template for working together to prevent or respond to threats and incidents regardless of cause, size, or complexity. The IS-800 course is designed primarily for Department of Homeland Security (DHS) and other federal department/agency personnel responsible for implementing the National Response Plan. State, local and private sector emergency management professionals will also find great benefit by taking this distance learning course. (0.3 CEUs)</td>
<td><a href="http://www.training.fema.gov/emiweb/IS/is800.asp">http://www.training.fema.gov/emiweb/IS/is800.asp</a></td>
</tr>
<tr>
<td>Office of the U.S. Surgeon General, Department of Health and Human Services</td>
<td>Medical Reserve Corps</td>
<td><a href="http://www.medicalreservecorps.gov/homePage">http://www.medicalreservecorps.gov/homePage</a></td>
</tr>
</tbody>
</table>

Office of the Surgeon General, Department of Health and Human Services
National Disaster Medical System
Medical Reserve Corps

**Office of the Surgeon General, Department of Health and Human Services**

- **National Disaster Medical System**
- **Medical Reserve Corps**
REFERENCES


CASE STUDY

2.1 HIPAA and Disaster Nursing Research

Roberta Lavin and Michael Dreyfuss

In the Emergency Department, the walls seemed to breathe with the patients. Hot and humid in the August dawn, the air tasted thick, stale, used, like there wasn’t enough to go around. The patients, pressed shoulder to shoulder, sitting in softly creaking plastic chairs or slouching against the stained beige walls, silently fought for air, each breath long, shallow, and urgent. Besides their lungs, only their eyes moved, watching the doctors and nurses move from patient to patient behind the cotton curtains that years of use had worn soft like gossamer. The curtains clung to the staff’s every hair and bead of sweat like spider’s silk, softly grasping them like the ephemeral fingers of their patients’ hands.

Stress and humidity settled on everyone, and sank in. Liquid anxiety permeated sheets and clothes and nurses until the latter felt drenched to drowning. Yet diligently they moved, swiftly, and with icy calm the nurses breezed from one person to the next, hurriedly aiding their patient and moving on. “How can they function at all?” you wondered. “The sheer number of patients seems like it would just be too much to bear.”

Sometime later, you decided to investigate that question further. Does stress during a disaster affect the level of care given by a provider? You set out immediately to plan your study and decided that the best method would be a medical chart review, focusing on instances where the patients did not require disaster-specific interventions but instead needed what was essentially primary care, only during a disaster situation. The medical records of these patients would be assessed to determine the quality of care that they received. Some specific questions that you intended to look at include:

- Were all of the appropriate procedures performed?
- What was the rate of complications involved?
- How many preventable adverse drug interactions or drug allergies occurred?
- How many malpractice claims were filed?

You decide to compare the records in all of these categories during several periods of disaster, with the records of the same hospital just before the disaster in a stratified random sample of hospitals from regions in which major disasters occurred in the last decade. Before too long, you run into a major roadblock, the Health Insurance Portability and Accountability Act (HIPAA).

HIPAA, and more specifically the Privacy Rule, came into full effect April 14, 2004. All parties were required to comply with it or a more stringent state law on the same issue. The Privacy Rule was designed by the Department of Health and Human Services (HHS) to keep the private Protected Health Information (PHI) of American citizens confidential when they sought medical attention.¹ In so doing, it was hoped that citizens would be less likely to experience discrimination, either in health insurance or in the corporate world, as a result of the contents of their medical records. To safeguard PHI, the Privacy Rule stipulates that in almost all cases, if a party wishes to obtain or use a patient’s medical records in any way he must first obtain the patient’s consent for disclosure of this information. In general, the penalty for a violation of HIPAA is up to $100 per violation, with one person not being able to accumulate more than $25,000 in a year if the disclosure is accidental. Persons who willfully violate the law face a fine of not more than $50,000, prison time of not more than one year, or both; if there is fraud but no money involved (i.e., false pretenses), the penalty is not more than $100,000, five years in prison, or both; and if the defendant disclosed the information with the intention of returning a profit on it, or of harming someone, then the penalty is a fine of no more than $250,000, ten years of prison, or both.²

Unfortunately, as with all things, HIPAA came with a few unintended consequences. HIPAA’s intention was to prevent citizens from losing their insurance coverage as a result of new medical information discovered in the course of regular doctor’s appointments or research. However, the impact of the Privacy Rule on researchers is to make it much more difficult to do fieldwork or even to mine existing data sets. Any data set that includes one of the 18 PHI markers mentioned in the Privacy Rule must follow HIPAA guidelines to progress. The 18

identifiers of the individual, the individual’s relatives, employers, or household members are:

1. Names
2. All geographic subdivisions smaller than a state except for the first three digits of a zip code if and only if that geographic area encompasses more than 20,000 people; otherwise, the initial three digits must be changed to 000.
3. All dates, except year, that are directly related to an individual (birth date, admission/discharge date, death date) for patients 89 and under. For patients 90 and over, years also cannot be included. The only grouping permissible for this category is that of an aggregate of “age 90 or older.”
4. Telephone numbers
5. Fax numbers
6. Electronic mail addresses
7. Social security numbers
8. Medical record numbers
9. Health plan beneficiary numbers
10. Account numbers
11. Certificate/license numbers
12. Vehicle identifiers and serial numbers (license plate, VIN)
13. Device identifiers and serial numbers
14. Web Universal Resource Locators (URLs)
15. Internet Protocol (IP) addresses
16. Biometric identifiers including finger and voice prints (It remains to be seen whether genetic information will be considered biometric.)
17. Full face photographs or comparable images
18. Any other unique characteristic, code, or number that could be used to identify the patient. However, a covered entity can assign a new code to a patient once that patient has been de-identified that would allow for subsequent re-identification provided that code is not derived from any related identifying code (e.g., social security number) and that the covered entity does not disclose the method by which the de-identified person can be re-identified.

If a researcher who is in any way affiliated with a covered entity, or will be receiving his data from a covered entity, wishes to use information from a patient or set of patients that includes information that falls under any of the above 18 categories, then they must obtain either signed consent from the patient or a waiver from an Internal Review Board. These steps are required for each patient and for each study, regardless of whether the patient is living or dead.

8 Ibid. §164.314. Other requirements relating to uses and disclosures of protected health information.

Attempting to obtain consent or a waiver for every patient in a study would quickly lead to a veritable mountain of paperwork. As a result, the process of conducting scientific research, even through database mining or chart reviews, has become prohibitively expensive and time consuming in many cases. Perhaps the only way around this is to have all patients sign a waiver as they enter. However, because HIPAA requires some specificity in its forms, a blanket waiver does not work as well as one would hope. An additional drawback is that each form would only cover information and results up to that visit. Each subsequent event would require another waiver. The waiver also only allows the researcher to disclose personal information to those persons actually named on the waiver; future researchers would still need to reestablish contact with the patient and ask them to sign an additional waiver. Refusal to sign these waivers cannot be used by the hospital as a basis for denying care to patients. Furthermore, even if the patient does sign a consent form, they can call in at any point and rescind their permission.

One positive aspect is that the HIPAA Privacy Rule only applies to covered entities. Covered entities include health plans, health care clearingshouses (i.e., those companies that deal with the administrative and financial aspects of health care), and health care providers whose electronic transactions contain health information. Additionally, the Privacy Rule is somewhat less strict for public health authorities (PHAs). If the intended recipient of the PHI is a PHA and if that PHA is authorized by law to collect PHI in order to prevent disease, injury, or disability, then a disclosure can be made, provided the disclosure contains the minimum necessary information that the PHA requires to carry out its job effectively. Disclosures can also be made if the PHI recipient is a health care provider and the information is needed to perform adequate treatment. If the disclosure is to be used for anything besides treatment, research, for example, the disclosure cannot be made unless the patient gives the covered entity a signed authorization.

The other way to get around requesting written authorization for disclosure from each individual patient is to disclose a limited data set. If you can eliminate all of the 18 PHI points from the document and you have a data use agreement with the recipient of the information, then you can disclose the limited data set.
to the recipient, provided you disclose the minimum necessary.\(^8\) With this last option, however, there can still be some significant, negative impact on the study.\(^9\) The data sets that do not contain any patient-identifying information are, by definition, limited. These kinds of limited data sets can cause people to be split into artificial and nondescript groups, removing the specificity that allows clear, identifiable, nonspurious patterns to become visible in data.

\(^8\) Ibid.

The effect on your study of the effect of stress on quality of care is a huge increase in cost and time attributed to the consent process. Each hospital that you selected to include in your survey had to certify independently that they are disclosing the bare minimum of only that information which is absolutely vital to your study in an Internal Review Board. After jumping through all the hoops, your study reaches significant conclusions and you learned a valuable lesson. You must plan your research in advance, have prepared consent forms, have an IRB waiver or know how to rapidly access the IRB, and be ready to start your study immediately. Most important, by following the HIPAA requirements you kept the private information of patients private and your perseverance advanced the field of study.
Key Messages

- The emergency health services system is a complex network of various providers and facilities that provide evacuation, stabilization, and redistribution.
- The multiple components of the emergency health services system and the complex processes of entry and exit create many potential problems and inefficiencies, particularly when stressed by a disaster.
- Paralytic disasters or catastrophic events will severely limit the emergency health services systems’ ability to respond.

Learning Objectives

When this chapter is completed, readers will be able to

1. Review common characteristics of the current emergency health services system.
2. Discuss the emergency health services planning necessary for disaster preparedness.
3. Discuss the major emergency health services challenges that must be addressed.
Emergency Health Services
Jeremy T. Cushman, Manish N. Shah, Charles L. Maddow, and Jonnathan Busko

CHAPTER OVERVIEW
Emergency health services (EHS) constitutes a critical element of the medical response to disasters and their planning is a key component of community disaster preparedness. This chapter reviews the characteristics of the EHS system, the challenges and barriers facing the system, and how these challenges may affect disaster response. Potential solutions are identified, and the EHS planning necessary for disaster preparedness is outlined.

THE EMERGENCY HEALTH SERVICES SYSTEM
EHS Components
The EHS system is a complex combination of various providers and facilities that provide three basic medical functions: evacuation, stabilization, and redistribution. Although organizational structures and resources vary worldwide, the fundamental components of any EHS system are essentially the same. Those components are the emergency medical services (EMS) system, emergency departments (ED), and alternate sources of emergency care.

The EMS system traditionally includes all services from the receipt of emergency requests for assistance to the transport of patients to EDs. In most circumstances, EMS dispatchers receive the call for assistance and, in response, send appropriate resources to the patient. Some communities provide maximal EMS response to all patients regardless of their complaint. In most areas, however, dispatchers have special training and follow protocols to triage patients’ acuity and provide the appropriate resources given the complaint. The Medical Priority Dispatch System (MPDS) is an example of a commonly used triage system specifically designed to abstract caller information through a question-driven protocol and direct appropriate resources based on that information. Despite the widespread use of MPDS, only limited evaluation has been published on its accuracy and effect on patient outcome (Shah, Bishop, Czapranski, & Davis, 2003; Shah, Bishop, Lerner, Fairbanks, & Davis, 2005).
Through the protocol-driven triage process, dispatchers determine the level and rapidity of response required. EMS providers range from first responder to emergency medical technician-paramedic and provide care that can be divided roughly into two levels—basic life support (BLS) and advanced life support (ALS). BLS providers can provide extrication, immobilization, and bleeding control, while assisting a patient in taking their own medication (nitroglycerin, for example) or administering oxygen. ALS providers can perform a number of skills, including intubation, needle thoracostomy, defibrillation, and cardiac pacing, while administering a wide variety of pharmacotherapy, including advanced cardiac life support medications. Of course, regional variations in the scope of practice afforded to both BLS and ALS providers exist, requiring planners to be familiar with local community standards and practices. More advanced certifications have been developed for EMT-paramedics and reflect additional training such as in hazardous materials management (HAZMAT), critical care, tactical medicine, and aeromedical operations.

A second component of the EHS system is the hospital ED. Fundamentally, EDs receive undifferentiated, unscheduled patients and can evaluate and provide initial management of disease. Beyond this, EDs have differing capabilities in terms of diagnostic tools and treatment capabilities. Many EDs in the United States are staffed continuously and exclusively by emergency medicine trained physicians, while other EDs have no physicians present, relying on an on-call physician or mid-level practitioners (nurse practitioners or physician’s assistants). Although essential to ED functions, certain types of consult services and support staff may be irregularly or entirely unavailable. For example, a small community hospital may not have such specialized care as neurosurgeons, cardiac catheterization facilities, pediatrics, obstetrics, or infectious disease experts, potentially limiting the level of care that the ED and hospital can provide. Accordingly, the hospital’s ED and impatient capabilities may range from providing basic care to administering specialized, advanced interventions such as trauma, stroke, and cardiac care. Based on the various resources available at the hospital, the EMS system may have protocols in place to ensure that patients with certain conditions (trauma, burn, or pediatric care, for example) are referred to the most appropriate facility.

Alternate sources of emergency care can come in two general forms. Many communities have urgent care centers established to provide care for minor illnesses and injuries. Some are equipped to perform laboratory testing and radiographs, infuse intravenous medications, or provide more advanced therapies. Physician offices are also an alternate source of emergency care. Some integrated physician practices already evaluate and care for acutely ill patients on-site. These practices can provide services such as laboratory, radiographic, or even cardiac stress testing. These sites can and should be considered part of the EHS system because they possess tremendous resources that may be accessed in times of increased patient demand.

Although they are not part of the traditional EHS system, satellite EDs are preexisting health care facilities that can be activated in the event of a disaster to provide emergency care. These sites could include schools, arenas, stadiums, jails, or fairgrounds. Depending on the resources invested, satellite EDs can provide a level of service ranging from simple first aid to advanced life support care, including radiographic and surgical capabilities. These facilities have the potential to provide the required level of care for many patients if their capabilities are investigated and integrated into the region’s disaster plan (Henderson et al., 1994). Taking the concept of satellite ED to another level is the self-supporting mobile emergency care unit such as the Carolinas Healthcare System’s MED-1 project. This entirely self-contained emergency department has critical care and operating room capabilities and an expandable, climate-controlled tent system that can accommodate over 100 treatment beds, all of which is contained on two tractor-trailers with its own water, electrical, and fuel supplies (Carolina’s MED-1 Mobile Emergency Department Project, 2006).

**Standard Operation of EHS**

Under ordinary circumstances, entry to EHS in the United States occurs most often when individual patients request assistance through the 911 system or by presenting directly to EDs or urgent care centers. Once in the care of EMS, patients are transported to EDs for further evaluation and treatment. Initial care may be provided on-site or en route to the ED, where patients are screened, evaluated, and treated for unstable, or potentially dangerous conditions. Patients presenting to EDs with limited capabilities or urgent care centers may also be transported to other sites for additional or specialized care. For instance, a patient suffering a blast injury may initially receive temporizing care in a smaller local or rural ED without trauma services and then be transported to a regional trauma center for admission and more definitive therapy. Patients exit the EHS system by being discharged to home, admitted to inpatient units (including observation units), or admitted to skilled nursing facilities. Patients discharged to home require transportation, which can be a limiting factor during a disaster. For patients admitted to inpatient units or nursing homes, a common limitation is the availability of bed space (Derlet & Richards, 2000; Schneider, Gallery, Scharfemeyer, & Zwemer, 2003) and, if needed, isolation rooms and equipment. If patients are unable to exit the EHS system, problems can develop as bed space and resources required for new, acutely ill patients are diverted to caring
for stabilized and admitted patients. This “exit block” can then cause an “entry block,” limiting the ability of EHS to respond to the disaster.

The multiple components of the EHS system and the complex processes of entry and exit create many potential points for problems and inefficiencies, particularly when the EHS system is stressed by a disaster. Cooperation and integration among the groups interacting within the EHS system, such as fire and police departments, are critical to preventing or overcoming problems and inefficiencies within the system. Cooperation within organizations, such as between housekeeping and nursing or between different nursing units, is both practical and critical. Turf battles must be eliminated, otherwise the ability to respond to disasters will be limited and communities and patients will suffer (Chavez & Binder, 1996).

Current State of EHS

Today, many would consider that the EHS system operates in disaster mode on a daily basis. In many parts of the United States, the system is stretched such that it lacks the flexibility to handle a sudden increase in patient volume (American College of Emergency Physicians, 2006; Schneider et al., 2003). EDs throughout the United States are routinely overwhelmed with “boarders”—patients who cannot leave the ED because of a lack of inpatient beds (exit block). The etiology and impact of this boarding situation may be understood by applying the input-throughput-output conceptual model of EHS system crowding (Asplin et al., 2003). In this model, output limitations, or exit blocks, cause “entry blocks,” which progressively limit the EHS’s ability to function and to respond to the demands placed on it (Derlet & Richards, 2000; Schneider et al., 2003). Patients exiting the system require an appropriate destination and a means of getting there. If that destination is lacking (for instance, a patient needs nursing home placement but there are no openings), patients are unable to exit the EHS system. As a result, the inpatient bed space and resources required for new, acutely ill patients are diverted to caring for stabilized and admitted patients. Those new, acutely ill patients are effectively blocked from exiting the ED and remain there as boarded patients, continuing to draw resources and staff energies from the ED. Thus, as ED output is blocked, the ED becomes overwhelmed in its capacity to care for current patients. The simple lack of available ED care space and provider availability leads to delays in caring for new patients (input block). Because the ED’s input includes EMS output, when the ED’s input gets blocked, the EMS output gets blocked, preventing EMS from caring for new patients. A traditional response to overcrowding has been the practice of ambulance diversion, whereby patients with less acute conditions are diverted away to decrease the amount of ED input. This creates a revolving “shell-game,” which relies on any one hospital resolving its overcrowding problem before other hospitals become equally crowded and shift the input back to it. This systemic inability to manage throughput and output, and hospitals’ inability to recruit capacity due to system pressures, is a dangerous condition at any time. It is particularly problematic when responding to a disaster, when input increases dramatically and output is more limited by transportation and resource limitations.

The difficult circumstance under which the EHS system operates is compounded by staff shortages. The national nursing shortage is well described and unlikely to resolve soon (Buerhaus, Staiger, & Auerbach, 2003). Some areas of the nation, particularly more rural areas, also lack sufficient physician staffing, particularly for specialists. Recent estimates show that within 20 years a shortage of 200,000 physicians will exist in the United States (Cooper, 2004). Some shortages of EMS staff also exist (Maguire & Walz, 2004). All of these shortages, which are challenges during regular EHS system operations as they impair throughput, can become serious impediments to an EHS system’s capability to respond to disasters.

Financial stressors have also adversely affected the EHS system. Providers face increasing labor and supply costs while suffering from a decrease in reimbursement, when reimbursement is even possible. These financial pressures are reflected in the closure of hospitals, bankruptcy proceedings for a major private EMS provider, and decreasing budgets for many other EMS agencies. Given these survival challenges, EHS providers have difficulty meeting routine operational needs, let alone undertaking other projects such as disaster planning, particularly when these projects are not externally funded (California Medical Association, 2006).

The current sickly state of EHS is a challenge. However, the current recognized need for improved disaster response provides opportunities for emergency managers to use their preparations to address current challenges as they prepare for potential disasters. By integrating disaster technology, terminology, and actions into routine operations, one can increase their likely success during a disaster (Auf der Heide, 2006).

MAJOR EHS CONCEPTS ASSOCIATED WITH DISASTERS

Management Agency [FEMA], 1992). Any influx of patients from a single incident that exceeds the capacity of the EHS system can be considered an MCI (ASTM F-30 Committee, 1996; Auf der Heide, 1989; Emergency Medical Services Committee, American College of Emergency Physicians, 2001). A bus accident in a small town may quickly become an MCI if the responding EMS agency or local emergency department resources are overwhelmed. In a metropolitan area, however, an accident of the same magnitude could be considered a routine event, requiring additional transport units and dispersal of patients to multiple hospitals but not to such an extent that it overwhelms the system. This same incident, therefore, affects two EHS systems differently, but in both cases would not constitute a “disaster.”

In turn, EHS will typically refer to a disaster as a natural or man-made phenomenon that results in the destruction or dysfunction of the available response infrastructure to meet the community’s need for health care (ASTM F-30 Committee, 1996; Auf der Heide, 1989; Emergency Medical Services Committee, 2001; FEMA, 1992). Thus in the case of a hurricane or power outage, only a few injured people may require medical care; however, because the health system infrastructure may have been destroyed, the disaster may clearly require outside assistance to meet the health care demands of the community. This type of disaster is sometimes referred to as a “paralytic” disaster because it has the potential to eliminate the EHS’s ability to respond to any call for services, let alone extra demands for care resulting from the event.

The Joint Commission on Accreditation of Healthcare Organizations also defines a third level of crisis—a catastrophe. A catastrophe is considered a disaster in which the community and hospital are overwhelmed and isolated for 3 or more days. This is exemplified by the Sumatra tsunami in 2004 and by Hurricane Katrina in New Orleans in 2005 (Berger, 2006). For our purposes, this category will be considered a disaster.

The EHS system must be prepared for both MCIs and disasters; fortunately, the planning is similar for each. Throughout the rest of the chapter, we refer to MCIs and disasters interchangeably, but the difference is important to appreciate. Unfortunately, it is impossible to precisely describe disaster events due to the multiple types of disasters that can occur, and the variability in the characteristics of each disaster (Green, Modi, Lunnery, & Thomas, 2003). Although this complexity makes disaster planning very difficult, there are a number of unifying concepts that must be considered with particular regard to EHS disaster planning.

All disasters have a time component. For most, the time line is very short. With an explosion, a shooting, or a tornado, the damage will occur during a brief period and recovery will follow. However, the impact from this type of event can endure, even beyond 3 months (Sheppa, Stevens, Philbrick, & Canada, 1993). In contrast, a biological attack, infectious epidemic, or flood may cause damage over a longer period, with new patients appearing continuously. For a routinely overwhelmed EHS system, the premise that most disasters cannot be planned is extremely important for preplanning. The EHS system must be capable of rapidly expanding its ability to treat and to transfer patients from the field to the ED and from the ED to their appropriate disposition (admission, specialty care, home, or morgue) in order to effectively respond to the incident at hand.

The types of disasters vary widely. Some result from planned activity, such as the World Trade Center attacks, while others are accidental, such as the Chernobyl meltdown. Still others are natural, such as the severe acute respiratory syndrome, or SARS, epidemic, Indian Ocean earthquake and tsunami, or Hurricane Katrina. Damage may be caused by a contagion such as influenza or SARS, a contaminating event such as a chemical release, or kinetic trauma. Disasters may also entail multiple mechanisms of damage patterns. For example, an explosion resulting in kinetic trauma and chemical exposure further complicates terminology. The EHS disaster plan must account for different types of disasters and be flexible depending on the incident. For example, treatment and transport of contagious patients will require significantly different resources than victims of a building collapse. Some events, such as Hurricane Katrina, may involve large population displacement and destruction of infrastructure, while others are much more localized (Nieburg, Waldman, & Krumm, 2005).

RESOURCES FOR THE EHS SYSTEM

The scope of a disaster can vary greatly and is partially dependent on the location of the disaster. A disaster in a rural community may not be considered a major event in an urban area because of the greater resource availability characteristic of urban areas. Conversely, an event that would have an impact in an urban setting may have next to no impact in rural areas because of low population densities. State, regional, and federal support does exist and will likely be made available in the event of a disaster (Richards, Burststein, Waeckerle, & Hutson, 1999). However, because a required chain of notification must be completed to obtain outside support and because it takes time for state or federal officials to marshal the proper resources, disasters are usually local for the first days (Auf der Heide, 1989, 2006; Kaji & Waeckerle, 2003), which was exemplified by the federal response to Hurricane Katrina. After the first few days, the extent of the support may be limited by the nature of the disaster. A widespread infectious epidemic may require that
resources be dispersed to a number of regions, while a purely local disaster could result in state and federal resources being focused only on one location (Hirschberg, Holcomb, & Mattox, 2001).

Regional and Federal Assets

A number of regional assets may also be available to the EHS system. The Metropolitan Medical Response System (MMRS) program is one of the better-known local/regional EHS auxiliary programs. This program identifies metropolitan areas that are vulnerable to terrorist events and, through federal grant funding, supports the development of local, organic response capabilities (FEMA, 2006; “History of the Metropolitan Medical Response System [MMRS],” 2005). Member organizations of a comprehensive MMRS program include EMS, fire/HAZMAT, law enforcement, public health, and local hospitals, while other agencies may be involved as is locally appropriate (emergency management, public works, etc.). Funding is used to develop the capability to respond to and mitigate a terrorist event of any type. Basing their organization on the disaster medical assistance teams (DMATs) that are a part of the National Disaster Medical System (NDMS), some states such as North Carolina have developed and funded State Medical Assistance Teams (SMATs). These teams provide statewide medical response capability for disaster mitigation.

The NDMS is also a key organization for the efficacious management of a potentially overwhelming patient load associated with a disaster. Blockages in patient “outflow” from health care facilities will eventually result in blockages against “inflow.” By transferring patients out of regions affected by disasters and by providing DMATs (and other important services), the NDMS can both decrease inflow and remove blockages to outflow, improving a community’s ability to cope with a disaster using its own resources. Although NDMS resources are constantly prepared for deployment, the time from notification to patient care is on average 48–72 hours. Thus, although the NDMS is an essential resource for large-scale disaster response, it cannot be relied on to provide medical care and operational control during the first days of a large-scale incident. This responsibility falls to local and regional response agencies.

In an attempt to assure universal availability of medical equipment, pharmaceuticals, and vaccines, the Strategic National Stockpile (SNS, formerly the National Pharmaceutical Stockpile) is a federally funded program that maintains a reserve of these items. In the event of disaster, the SNS may be activated to meet critical supply needs, particularly for those items that are rapidly consumed in the early management of patients during a disaster. Understanding the request procedure, types of equipment and pharmaceuticals available, the extensive distribution requirements of the SNS, and the time lag for arrival of the SNS is essential to being able to use this resource effectively and must be made part of the local/regional disaster plan.

Critical Resources

Three types of EHS system resources are critical to responding to any sort of MCI: facilities, personnel, and materials. Health facilities serve as the location for patient care and shelter. These facilities require specialized resources for decontamination, isolation, and medical and surgical treatment. However, these facilities are not immune to being impacted by disasters. As seen in the California earthquakes and Florida hurricanes, disasters can affect these facilities, making the health facility both a victim and responder. Also, health facilities can be contaminated, further limiting access. Planners must consider the likelihood and potential impact of the degradation or loss of health facilities in any disaster plan and consider alternate facilities to render care (Aghababian, Lews, Gans, & Curley, 1994; Chavez & Binder, 1996).

Human resources are a second critical resource (Hogan, Waechterle, Dire, & Liflibridge, 1999). As described previously, staffing shortages already exist. During a disaster, staff may be lost because of the event itself, as occurred when health care providers in the SARS outbreak contracted the disease, or staff may be exhausted over the course of the event. Planners must remain cognizant that it is rarely possible for the same personnel to work for the duration of a disaster, and relief schedules should be incorporated into planning. Complicating plans to this end are concerns that staff may be unwilling to respond because of fear or personal obligations (i.e., to care for their families) or because of their own isolation, injury, or death. This may lead to further shortages and limitations of the EHS that can be provided.

A third critical resource is material: supplies and medications (Hogan et al., 1999). If supplies and medications are lost or exhausted because of the nature of the disaster, EHS cannot be provided. Complicating the matter is the need for both sufficient and appropriate supplies based on the type of incident. A traumatic disaster may require large amounts of radiological supplies and bandages, while an infectious disease incident may require laboratory testing supplies and isolation equipment. Most incidents will need medications of various types and all require electricity. During the anthrax attacks, a significant concern existed regarding the availability of antibiotics to treat anthrax. During the California earthquakes, hospitals lost power, meaning that
equipment could not function. All systems had to be manually operated; for example, intubated patients had to be manually ventilated (Chavez & Binder, 1996). The Strategic National Stockpile will alleviate some of these pressures depending on the disaster but may not be available in a timely manner. Furthermore, the SNS is stocked based on expectations and past lessons learned, thus a particular event may have requirements that cannot be met by the SNS alone.

Fortunately, in the United States, these resources are generally available. A study of 29 mass casualty disasters showed that 6% of hospitals suffered supply shortages and 2% had staff shortages (Quarantelli, 1983). A more recent report discussing this issue did not dispute that finding (Auf der Heide, 2003). However, the situation must be monitored to ensure that changes in the system, such as the closure of hospitals and ED overcrowding, do not lead to shortages during an MCI. Furthermore, given the tremendous reliance on technology, an incident such as a contaminated water supply, power outage, or disrupted telecommunications system can lead to a dramatic impact on the EHS system and severely strain the available resources (Auf der Heide, 2006; Quarantelli, 1983). As the events in New Orleans after Hurricane Katrina showed, a catastrophic disaster with widespread devastation will create a resource strain and lead to significant shortages (Berger, 2006; Nates & Moyer, 2005).

### PATIENT ACCESS TO EHS DURING A DISASTER

The impact of a disaster on EHS will vary based on the characteristics of the incident. For purposes of this discussion, we will concentrate on a brief and isolated event such as an explosion. When such a disaster occurs, the EHS system will immediately experience a large influx of patients accessing the system. Some have estimated that the EHS system in an MCI will face a sudden surge of up to five times the usual number of patients (Chen, Cheng, Ng, Hung, & Chuang, 2001; Henderson et al., 1994). The first wave of the influx will present in two ways. One group of first-wave patients will be cared for by EMS when they respond to the scene of the incident and will be transported to health facilities. The second group of first-wave patients will directly present to EDs by foot, personal vehicle, or nonmedical public transport such as bus or taxicab. After this initial first wave, a second wave of patients will usually follow. These patients are usually more sick or injured than the first wave of “walking wounded” because they need to be extricated and assisted, actions that take some time to perform. Overall, the majority of patients will arrive via means other than EMS, and the majority of patients are not critically ill (Auf der Heide, 2006; Henderson et al., 1994; Hinshaw et al., 2001; Hogan et al., 1999).

Upon presentation, each of the patients must be rapidly triaged. A complete discussion of the various triage algorithms and their advantages and disadvantages is beyond the scope of this chapter, however, recent studies have shown that upward of 50% of patients are overtriaged, regardless if the triage occurs at the ED or by EMS (Frykberg & Tepas, 1988; Gutierrez de Celis-Ballo et al., 2005; Israeli Defense Forces Medical Corps, 1997; Pesik, Keim, & Iserson, 2001). This overtriage rate is concerning because the triage process exists to distribute resources optimally. If patients are overtriaged, those who need rapid and critical interventions may not receive them and, according to one study, the mortality rate of severely injured patients increases with an increasing overtriage rate (Frykberg & Tepas, 1988).

Recently, increased attention has been paid to the practice of reverse triage. Although the precise environment in which this practice should be used has not been defined, nor have there been any studies to validate its use, the concept of reverse triage may become part of the initial management of a large-scale disaster (Tzong-Luen & Chi-Ren, 2005). In brief, there may be certain disasters, such as nerve agent release, whereby treatment of the most acutely injured may be futile and expend too many limited resources. Instead, those with less severe symptoms should be treated because they have a greater likelihood of survival from exposure to the agent, similar to military triage wherein the least injured are treated first to allow their return to the battlefield (Wiseman, Ellenbogen, & Shaffrey, 2002). Similar triage algorithms have been discussed for victims of infectious agents and blast injuries (Chaloner, 2005). Although a complete discussion of reverse triage is beyond the scope of this chapter, the disaster planner should be familiar with the concept and the forthcoming literature on this controversial topic.

For EMS, the ED is the typical destination. However, requiring that all patients from a disaster go to an ED is an inefficient use of a community’s available resources. To prevent unnecessarily clogging EDs, some disaster plans employ alternate resources for the healthier patients, reserving EDs as primary resources for critically ill patients. In the attack on the Pentagon on 9/11, an urgent care center across the street from the Pentagon provided significant stabilizing care as well as definitive care for the less injured. Although the center’s location was an accident of location rather than planned, it was nonetheless highly effective (“Arlington County after action report,” 2002).

Even within a destination category, patients are often poorly distributed. One review of 26 disasters found that on average 67% of patients were treated at one ED even though other EDs were available (Auf der Heide, 1996). In the Oklahoma City bombing, 7 of 13 hospitals...
used only the ED to provide services, while the other 6 triaged appropriate patients to other areas of the hospital (Hogan et al., 1999). The proper distribution of patients is required to ensure that specialized interventions can be delivered to patients requiring those services (Auf der Heide, 1989; Einav et al., 2004; Hirschberg et al., 2001). In 2000, after a pedestrian bridge collapsed at a NASCAR event in North Carolina resulting in more than 89 injuries, EMS continued to send patients to a local hospital despite that hospital’s statement that they could not handle more patients (CNN, 2000). However, two local trauma centers saw less than 5% of the total patients. This misdistribution occurred because the bridge collapsed across a major road and the responding ambulances arrived on the north side of the bridge, putting them closer to the local community hospital. Rather than driving back a quarter mile and taking a bypass route, the EMS providers simply drove another half mile to the local hospital, dropped off their patients, and returned to the scene. In this case, significant issues with patient distribution occurred because of communication failures.

One specific concern relates to the conflict of appropriate patient distribution and the goal of “clearing” all the patients from the scene as quickly as possible. Although critically ill patients certainly require definitive treatment (and thus transport) as quickly as possible, rapidly transporting all patients, including noncritical patients, may have the effect of simply moving the disaster from the scene to the emergency department. A built-in “pause” to reevaluate severity of illness and appropriate destination after all critical patients have been transported may alleviate the risk of certain “downstream” elements of EHS being overwhelmed. EMS planning efforts should include consideration of these effects.

That patients access the EHS system for different reasons during a disaster complicates patient distribution plans. Although many individuals access the system for conditions directly related to the disaster, such as illness or trauma, others have indirect issues, such as loss of electrical power or the inability to obtain needed resources such as oxygen tanks or social services (Prezant et al., 2005; Rand, Mener, Lerner, & DeRobertis, 2005). Still others access the system due to psychiatric issues related to the disaster (Jones et al., 2000). Finally, the worried well often access the system for evaluation and reassurance, particularly during chemical or biological exposures. One amusing but extreme case of this was a homeless gentleman well known to an ED who presented with concerns regarding the SARS virus during winter 2003–2004 (S. M. Schneider, M.D., personal communication). Although there was no chance he had been to Canada or the Far East or had been exposed to anyone with SARS, he was still concerned and presented to the ED, thus potentially diverting resources from others.

Even during a disaster, individuals still access the EHS system for routine conditions unrelated to the disaster. Recent data from the SARS epidemic in Taiwan found a decrease in regular EMS requests during the extended disaster conditions (Ko et al., 2004). Three major challenges exist regarding patients presenting for concerns unrelated to the disaster. The first is to ensure that ill patients continue to access care. A patient having a myocardial infarction should not avoid care due to concerns regarding the disaster. The second is to accurately triage these requests for assistance to provide care to patients in an optimal time frame at the optimal site. Finally, in the event of a chemical, biological, or infectious exposure, it is critical to segregate potentially contaminated patients from noncontaminated patients.

MAJOR EHS ISSUES

In the discussion of the current EHS system, a number of major issues for planners have been identified. This section will directly discuss those and related issues and propose possible solutions. For a more detailed and technical discussion, planners should refer to the National Incident Management System (NIMS) developed by the Department of Homeland Security (Department of Homeland Security, 2006).

System Survey

The first major task faced by planners is to assess the current state of the EHS system. Significant variability exists in the components of the EHS system. Planners must know the exact capabilities of each component. For the EMS dispatch system, how is dispatch performed and how can it be used to make triage decisions? For EMS, how many ambulances and EMS providers exist? How many can be requested from surrounding regions? How are the destinations of EMS patients determined? For EDs, how many can handle major trauma? Minor trauma? Intensive care patients? How can a massive influx of patients be handled? What alternate sites for care exist? What transportation resources are available for distributing treated patients efficiently to maintain ED inflow and outflow? What alternate shelter sources exist? What preparations for mass decontamination are in place? This survey must be continually repeated to ensure that the latest data are available to planners.

Resource Availability

A second, related item is the availability of resources. The modern health care system is extremely lean and operates at nearly 100% capacity. This has resulted in a system that has great difficulty handling sudden
changes such as the influenza season, let alone the influx of patients from a disaster. Studies have reviewed the increase in ED patients after a disaster, and the ED volume seems to increase between two- and fivefold over the first few days, based on a variety of factors (Chen et al., 2001; Henderson et al., 1994).

Ensuring the availability of human resources—administrative, physician, nursing, and support staff—is a major issue and studies have shown that organizations are not prepared to respond properly (Treat, 2001). Large numbers of people are not necessarily needed to respond to the disaster, but individuals at the right levels of training are needed. It is imperative to consider not only skilled health care staff but also the numerous ancillary staff that ensure proper facility operation such as housekeeping, food service, maintenance, and security personnel. This became clear during the health care response to Hurricane Katrina when, after the primary health care needs were met, many requests through the Interstate Mutual Aid Compact were for “technician” and support staff, not direct patient care providers.

The task of ensuring sufficient human resources is complicated. At baseline, nearly all aspects of the EHS system face staff shortages, particularly nurses. The effect of this shortage may be exacerbated during a disaster because of an increased need for both short- and long-term staff and the potential “loss” of staff. Staff may be functionally “lost” if they are impacted by the disaster and cannot work, as they were in the “9/11” earthquake and the SARS epidemic (236 paramedics were unable to work at the peak in Toronto; Chen et al., 2001; Verbeek, McClelland, Silverman, & Burgess, 2004). Staff can be “lost” if they are required to report for other duties. For instance, many EMTs work at multiple agencies or work in EDs, while others may have National Guard or military reserve duties or may be members of specialty disaster teams. Planners must be careful to identify each individual’s primary reporting site. Staff may also be functionally lost if they become exhausted from a prolonged event. The physical and mental health of staff must be protected and supported to ensure that they can continue to function in potentially difficult circumstances. This requires secure areas for personnel to sleep, relax, bathe, and eat between extended shifts.

Staff may be lost if they are unable to physically get to work. A disaster may destroy or make bridges and roads unusable. Debris, flooding, or an energy shortage may prevent use of cars or mass transit. For example, a catastrophic earthquake in San Francisco could destroy all of the bridges and many of the roads, preventing staff who live outside San Francisco from getting to jobs within the city.

Finally, staff may be lost if they refuse to report to work. Data are conflicting as to whether staff will report to work during a disaster. Two studies have found staff are less likely to respond in event of a disaster (Chen et al., 2001; Syrett et al., 2003). However, one has shown that staff will respond when asked (Chavez & Binder, 1996) and a report from the Madrid bombing indicates that sufficient staff responded (Gutierrez de Ceballos et al., 2005). More important to planners are studies that have identified factors, including better communication, providing means of transportation, staff and family prophylaxis, appropriate day care, and so on, that increase the likelihood that staff will report to work (Auf der Heide, 2006). These factors must be directly addressed to ensure sufficient human resources exist throughout the EHS system.

The opposite problem may also develop. The phenomenon of convergent volunteerism is likely to occur and is widely reported for a number of large disasters (Auf der Heide, 2003, 2006; Cone, Weis, & Bogucki, 2003). At the Oklahoma City bombing and the World Trade Center disaster, well-meaning volunteers rushed to help, possibly encouraged by press reports requesting medical assistance. This can prove to be problematic because when convergent volunteerism occurs, not only do professionals need to manage the disaster and maintain scene safety but they also need to maintain scene command, crowd control, security, organization of volunteers, volunteer safety, medical oversight, accountability, liability, patient tracking, and credentialing. As an extreme example, a volunteer medical provider, who had no training for urban search and rescue, was killed by debris during the Oklahoma City disaster (Cone et al., 2003).

The availability of capital resources is equally important. As mentioned, the current health care system—including the emergency, acute, and chronic care components—are all operating at maximal capacity. However, EMS vehicles, ED and hospital beds, and operating rooms will be needed in differing levels based on the incident (Auf der Heide, 2006; Pesik et al., 2001). For the EMS system, planners must know and address mutual aid issues. In upstate New York, Rural Metro Medical Services provides EMS in many cities and has a plan to shift resources between cities in event of crisis. Thus, additional ambulances, communications equipment, and maintenance facilities can be deployed throughout the region. In other areas, mutual aid pacts must be in place to allow for the immediate recruitment of as many additional EMS units as are needed (Auf der Heide, 2006).

For the EDs, bed space is a significant issue. Many hospitals have closed and the remaining EDs are at or exceed capacity. Plans to shift the existing patients and open beds must exist. Plans to address contaminated or damaged EDs must also exist (Chavez & Binder, 1996). Ideas such as satellite EDs and alternate care sites must be considered and developed. For hospitals, similar plans are necessary. Specialized resources,
Communication and Coordination

Communication of information and coordination of the response are major challenges due to the current structure of the EHS and health care systems. Unlike those found in other countries, the U.S. health care system is splintered (Lee, Chu, Ng, & Chen, 2002). Competing health care systems are reluctant to share information and resources because it could place them at a competitive disadvantage. This makes sharing of medical information from one hospital to the next, or from a private physician’s office to the ED, difficult if not impossible (Susman, 2005).

Additionally, the components of the EHS system are not integrated and do not share information and resources well. For instance, the EMS, fire, and other public safety agencies are often splintered without regional integration (Susman, 2005). Furthermore, communication is limited because of technical considerations as these splintered agencies use different radio frequencies that may not be compatible with each other. The disaster itself can also complicate the poor preexisting communication and coordination systems (Auf der Heide, 2006; Cone et al., 2003; Garske & Burk, 1999).

As a result, it is difficult for any disaster manager to have a good sense of the resources available, the needs of the community, and the evolving mass casualty incident. Recognizing this, guidelines and federal grants now exist to support communication interoperability for emergency responders (O’Connor et al., 2004).

The Department of Homeland Security has revised the structure of the NIMS and has required its use for all public safety agencies that request federal grant funds. Developed by communications and disaster experts, the system provides an excellent template to enable and to foster communication and coordination and should provide a foundation for disaster preparedness. All planners must be familiar with NIMS and consider the issues discussed and solutions proposed in this document (Department of Homeland Security, 2006).

Three key organizational systems are central to NIMS: the incident command system (ICS), multiagency coordination systems, and public information systems. Public information refers to communicating timely and accurate information to the public. Multiagency coordination refers to the organization and operation of supporting agencies at local, regional, state, and federal levels. Finally, ICS refers to the organization and operation of an emergency response to an incident. ICS has been used for years by fire and EMS agencies to deal with incidents such as a large fire or major motor-vehicle crash and has become ingrained in the initial incident management of these agencies, making its scalability, flexibility, and familiarity to EHS personnel its greatest strength during an MCI or disaster. ICS is very well developed and excellent for scene-level activity where numerous agencies or teams are working simultaneously. It does not, however, provide the same level of coordination for scene to EMS to ED activity such as monitoring available resources and tracking patients. These problems with ICS were particularly notable during the Singapore Airlines crash in 2000, which resulted in 82 fatalities overall and where resource and patient misallocation occurred as a result of poor communication
and coordination from the scene to health care facilities (Lee et al., 2002).

To address the limitations of ICS, NIMS introduces the concepts of unified command, area command, and multiagency coordination systems. These concepts take ICS to the regional level, allowing for monitoring of the overall scenario and providing scalability in the event multiple incidents occur at once, or a single incident affects multiple jurisdictions. This system establishes one group to address overall priorities, allocate resources, track resources, and maintain communications. It hoped that it can overcome many of the inefficiencies that occur when a variety of agencies or organizations become involved in an incident. Furthermore, it addresses the belief that medical resources are not necessarily in short supply, just poorly distributed (Quarantelli, 1983). The importance of the unified medical command system was noted as a strength of the response to the collapse of the Versailles Wedding Hall in Jerusalem in 2001 (Avitzour et al., 2004).

One issue that can impede communication and coordination is the interagency conflicts and turf battles that may occur. EMS agencies, police and fire departments, hospitals, and others have some overlap in their roles and duties. These overlapping duties can prevent individuals from knowing their roles in an MCI, a key deficiency noted in previous disaster responses (Kaji & Waeckerle, 2003). These misunderstandings can lead to conflict, impeding the efficiency by which the disaster response can occur. These challenges can be mitigated, however, by taking action to ensure all agencies participate in the evidence-based disaster planning process.

During the planning phase, all agencies must be focused on the overall goal. They must work together, clearly delineating and documenting each agency’s roles and responsibilities to help minimize future conflicts, and maximize efficient use of resources. This interaction during the planning phase can also allow the staff of the different agencies to achieve a comfort level with each other. This familiarity can help significantly when the agencies must work together during a stressful disaster response. The very structure of NIMS, which incorporates the planning and implementation of incident command, unified command, and area command structures, can also help minimize conflict because within the system lie defined lines of command and responsibility.

Two additional ways to minimize conflict include training and technology. Training will allow those who would respond to a disaster to work together and become more comfortable doing their jobs. The training will also challenge the disaster plan while allowing for continuing education of those participating (Sweeney, Jasper, & Gates, 2004). If no drills are run, there will be no detection of problems, no achievement of comfort between staffs, and no improvement in the system (Auf der Heide, 2006; Kaji & Waeckerle, 2003). In addition, the drills need to be real drills, without an announced incident, without common knowledge of the start and stop times, and with all agencies participating to ensure an accurate analysis of the system’s ability to respond to such a disaster. Training exercises alone are not necessarily sufficient, however (Sweeney et al., 2004). Shortly before the Singapore Airlines crash in Taiwan, the airport had just completed a set of drills. A review of the incident found that the responders failed to use the MCI protocols, however (Lee et al., 2002).

Modern technology can also help maximize communication and coordination and address issues of staff failing to follow MCI protocols. Human factors have been shown to be influential in the failures of MCI plans and were particularly noted as a failure in the response to the 2000 Singapore Airlines crash in Taiwan (Lee et al., 2002). To minimize these human factors, computer software or predesigned response plans and protocols can be used to guide both managers and responders in a disaster. These resources can direct the organization and definition of roles, the activities that must be performed, the notifications that must be made, and various other aspects of the response plan to ensure no components are ignored.

How to Deal With the Influx

During a disaster, the EHS system will face a huge surge in patients. Depending on the type of disaster, the surge will have different patterns. In a single event, such as a plane crash or explosion, there will be a single large surge over the first hours after the incident (Auf der Heide, 2006; Chen et al., 2001; Quarantelli, 1983; Wattanawintuechaisri, Peacock, & Jitpratoom, 2005). In contrast, a large constant number of patients may be seen in the event of a bioterror attack or emerging infection (Tham, 2004). Most of these patients will be low acuity and need minimal care, but some will be critically ill and require large amounts of resources, particularly specialized resources (Hirshberg et al., 2001). Patients will also present that are indirectly impacted by the disaster, such as the worried well, the chronically ill who can no longer receive their services at home or in a skilled nursing facility, and the mentally ill. As previously described, the “usual” EHS system patients will also require evaluation and treatment. However, it is currently unclear whether the numbers of usual patients will decrease as it did during the SARS epidemic in Toronto (Verbeek et al., 2004). Actual numbers of usual patients will likely depend on the nature of the disaster itself and the emotional impact the disaster has on the patient population. An effective and important tool to ensure patients’ access to health care, while minimizing the number of “worried well” presenting to the EHS system, is to work with media outlets in advance of the disaster to ensure...
that an appropriate and accurate message is relayed to the local population.

One source of patient influx will be from individuals calling 911 for assistance, which classically results in EMS responding to all patients. However, in a disaster situation, the proper distribution of EMS resources must be considered. All patients probably do not need an EMS response immediately. Although the published data are limited, the evolving literature shows that patients assigned certain MPDS dispatch codes are of lower acuity and thus can receive a delayed response (Shah et al., 2003; Shah et al., 2005). All patients also need not be taken to the nearest hospital or to any hospital. Paramedics do undertake patients when deciding whether a patient needs to get immediate medical care (Schmidt et al., 2001). However, the undertriage rate, which ranges up to 10%, while significant during normal operations, may be acceptable during a disaster. This rate could be decreased by involving a physician in the telephone triage decisions. Alternative transport mechanisms should also be considered. If a paramedic evaluates the patient and finds that he or she is stable to be transported by an alternative mechanism such as a taxi, the paramedic and ambulance would be able to return to service more rapidly. Unfortunately, no data exist regarding this option. Alternative destinations, not currently allowed in most states, are an additional option. Satellite EDs have been used successfully while physician’s offices and urgent care centers may be appropriate alternatives during a disaster.

When patients are being transported, proper distribution between all of the hospitals in the system must be considered, particularly hospitals with specialized resources (Auf der Heide, 1989, Tham, 2004). Systems monitoring the availability of beds and resources and directing the flow of patients should be devised to help the response. Currently, North Carolina; Maryland; Rochester, New York; and many other regions are working on such a project in which real-time in-hospital patient bed status data will be available to EMS agencies, public health, and emergency managers. Proper distribution of patients cared for by EMS, regardless of how they are transported to definitive care, is a challenging task that is, in many ways, analogous to the job of air-traffic controllers. Ideally, the available resources and incoming demands should be actively monitored to ensure access and distribution of patients to the best possible care.

The second source of influx will be from patients presenting to the ED for care. Instead of providing ED care to all patients, in a MCI other options need to be created to protect the ED for critically ill patients. For some patients, a medical screening exam could be performed, and then they would be either discharged home or transferred to alternate sites for care. These sites could include urgent care centers, physician offices, or other buildings within a medical center. However, when these plans are developed, issues such as potential contamination and available resources must be considered. For trauma, this model has proven highly effective in the Iraq war. Death rates for injured soldiers has been almost halved as surgeons perform only those procedures required to prevent death in the first 6 hours and transfer patients to other facilities for definitive care (Gawande, 2004).

To deal with the influx, operations within the ED can be modified to improve the efficiency of care and handle the increased volume. Although a thorough discussion is beyond the scope of this chapter, improving ED efficiency should be undertaken regardless of disaster planning, given their daily overcrowded condition. Additional treatment space is also needed in the ED to deal with the influx of patients. This space can be generated by improving influx from the ED. This presents a major challenge as hospitals and nursing homes are full, and during a MCI, it will potentially be difficult to arrange home health services. Regardless of the solutions considered, it is important to note that hospital planning teams seem to overestimate their ability to respond (Hirschberg et al., 2001). Solutions to consider include canceling elective admission, including surgery. Although this will open a number of beds and free up significant resources, health systems may be resistant to do this due to the large financial cost of canceling these procedures. Other solutions include transferring patients to either nursing homes or lower-acuity hospitals or sending specialized resources such as trauma surgeons to other centers to expand their capabilities. Whether these solutions will be possible depends on the nature of the incident, but they and others must be considered and prepared for. Lastly, although the NDMS and its member organizations can move large numbers of patients out of a region to other care facilities, this will take at least 24 hours to begin, requiring at least temporary means for expanding capacity, a requirement that should be an annex to any disaster plan.

It is also important to consider the issue of patient decontamination. Many hospitals rely on local fire or HAZMAT resources to decontaminate patients prior to arrival at the emergency department. This model is almost always effective as the typical HAZMAT or chemical exposure is an isolated event in which a limited access/egress quarantine can be established, and in which patients can be controlled and decontaminated. However, as was demonstrated during the sarin gas attack in Tokyo, in a disaster, there is no control over the scene or scenes. Patients will self-refer to emergency departments without being decontaminated (Auf der Heide, 2006; Okumura, Suzuki, & Fukuda, 1998; Okumura, Takasu, & Ishimatsu, 1996).

During a disaster, hospitals must expect to perform decontamination themselves and cannot rely on the fire department or HAZMAT team as those assets will be on scene mitigating the consequences of the disaster.
Regional decontamination hospitals are unrealistic as there will still be a large number of self-referred patients that will present to local hospitals (Auf der Heide, 2006). Resources organic to the hospital must be available to perform decontamination and prevent the emergency department from becoming contaminated. If the patient is allowed into the emergency department for a screening exam and contaminates the ED, that ED is effectively closed for all patients (not just victims of the disaster) until cleanup is complete. If the ED refuses to allow entry and tells the patient to go to the “decontamination” hospital, then that ED has committed an Emergency Medical Treatment and Active Labor Act (EMTALA) violation. Therefore, all hospitals must have the capacity to lock down the hospital, restrict access, and perform decontamination of any self-traumatized and self-transported victim of a disaster who presents for care.

There are, of course, certain extenuating circumstances. During Hurricane Katrina there were concerns among treating hospitals that they could unwillingly violate EMTALA obligations simply because of the health and safety considerations existing during the initial days of the disaster. It was only through a formal declaration from Health and Human Services Secretary Michael Leavitt that ensured that hospitals could transfer or divert patients away from their facilities due to disaster and perform decontamination of any self-triaged and self-transported victims of a disaster who presents for care.

Disaster planners have many complicated problems to address, particularly given the current daily stresses on the EHS system. A thorough understanding of the EHS system and its challenges can help ensure that the developed system can work efficiently and safely during a mass casualty incident or disaster. This brief overview should provide sufficient protection from violating EMTALA standards (“Does EMTALA apply,” 2002).

**SUMMARY**

Disaster planners have many complicated problems to address, particularly given the current daily stresses on the EHS system. A thorough understanding of the EHS system and its challenges can help ensure that the developed system can work efficiently and safely during a mass casualty incident or disaster. This brief overview should provide sufficient protection from violating EMTALA standards (“Does EMTALA apply,” 2002).

**CRITICAL ACTIONS**

1) Understand your current system by performing resource evaluations.
2) Understand the impact of different disasters on your EHS system.
3) Create backups to your EDs, EMS, and hospitals, and get those people to regularly participate.
4) Create and test EMS protocols for dealing with large influx of patients.
5) Create and test community plans for dealing with large influx of patients.
6) Create and test ED plans for rapid efflux of patients.
7) Create and test communication and coordination plans.
8) Create and test good data collection systems, connecting all data from EMS to ED to hospitals.
9) Develop relationships with all participants and agencies that will be involved in a disaster response now, before a disaster occurs.

**REFERENCES**


dem homepage


Chapter 3: Emergency Health Services


Key Messages

- The American Red Cross is a humanitarian organization led by volunteers.
- The American Red Cross is part of the International Red Cross and Red Crescent Movement.
- The Red Cross is the only nongovernmental organization with a lead responsibility (mass care) under the U.S. National Response Plan.
- The Red Cross responds to more than 70,000 disasters annually.
- The Red Cross has important roles for and engages thousands of volunteer nurses in disaster and emergency preparedness activities at local and national levels.
- The structure of the American Red Cross and its governance are undergoing significant change.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the foundations for the Red Cross work: American Red Cross Congressional Charter, the fundamental principles of the Red Cross, and Red Crescent Movement.
2. Appreciate the importance of the American Red Cross as a lead or support agency for several of the emergency support functions identified in the National Response Plan.
3. Identify the mission of the American Red Cross Disaster Health Services.
4. Describe health services, mental health, and staff health as the major activity areas for the American Red Cross disaster nurse.
5. Identify challenges that American Red Cross nurses encounter during disaster relief efforts.
6. Delineate the key action items for shelter nursing.
American Red Cross
Disaster Health Services
and Disaster Nursing
Dianne Yeater and
Nancy McKelvey

CHAPTER OVERVIEW

For more than 125 years, the American Red Cross has played an integral role in disaster response in communities across the United States. This chapter provides a historical overview of the structure and governance of the Red Cross, its conceptual foundation, fundamental principles and congressional charter, and a detailed description of its disaster health services. The role of the American Red Cross nurse and the core components of shelter nursing are reviewed.

INTRODUCTION

The American Red Cross is a humanitarian organization that provides relief to victims of disasters. The American Red Cross responds to all types of natural and man-made disasters, including hurricanes, floods, earthquakes, fires, and other situations that cause human suffering or create human needs that those affected cannot alleviate without assistance. It is an independent, humanitarian voluntary organization that functions independently of the government but works closely with government agencies, such as the Federal Emergency Management Agency (FEMA), during times of major crises. It is responsible for giving aid to members of the U.S. Armed Forces and to disaster victims at home and abroad. It does this through services that are consistent with its Congressional Charter and the fundamental principles of the International Red Cross and Red Crescent Movement allowing the Red Cross to stay neutral and impartial (American Red Cross, 2007a).

FUNDAMENTAL PRINCIPLES

The fundamental principles of the International Red Cross and Red Crescent Movement include:

- Humanity
- Impartiality
- Neutrality
- Independence
- Voluntary service
- Unity
- Universality
CONGRESSIONAL CHARTER

The Congressional Charter of 1905 includes the statement that the American Red Cross will “carry on a system of national and international relief in time of peace and apply the same in mitigating the sufferings caused by pestilence, famine, fire, floods, and other great national calamities, and to devise and carry on measures for preventing the same” (U.S. Congress, 1905). This charter is not only a grant of power but also specifies the agency’s duties and obligations to the nation, disaster survivors, and the donors who support its work.

MISSION OF THE AMERICAN RED CROSS

The Red Cross provides “relief to victims of disaster and helps people prevent, prepare for, and respond to emergencies” (American Red Cross, 2007a). The agency organizes and provides services consistent with its Congressional Charter and the principles of the International Red Cross and Red Crescent Movement (see Figure 4.1).

AMERICAN RED CROSS AND THE UNITED STATES ARMED FORCES

The 1905 charter granted to the Red Cross required it to act “in accord with the military authorities as a medium of communication between the people of the United States and their armed forces” (U.S. Congress, 1905). Since that time, the American Red Cross has provided communications and other humanitarian services to members of the U.S. military and their families around the world. Red Cross field staff, who must frequently live and work in the same perilous circumstances as U.S. troops, have given comfort to soldiers thousands of miles from home by providing emergency messages regarding deaths and births, comfort kits, and blank cards for troops to send home to loved ones (2007b).

HISTORY OF THE AMERICAN RED CROSS

The Red Cross idea was born in 1859 when Henry Dunant—a Swiss businessman traveling to Solferino (modern-day Italy) to petition Napoleon III on a matter of land rights—came upon the aftermath of a bloody
battle between the armies of imperial Austria and the Franco-Sardinian alliance. Some 40,000 men lay dead or dying on the battlefield and the wounded were lacking medical attention. Dunant, a Calvinist and lifelong humanitarian, organized the local population to gather needed materials and provide care to the injured of both armies. On his return to Geneva, he called for the creation of national relief societies to assist those wounded in war, and pointed the way to the future Geneva Conventions (Gumpert, 1938).

In October 1863, the International Red Cross Movement was created in Geneva, Switzerland, to provide nonpartisan care to the wounded and sick in times of war. The Red Cross emblem, the Geneva cross, was adopted at this first international conference as a symbol of neutrality and was to be used by national relief societies. In August 1864, the representatives of 12 governments signed the Geneva Convention Treaty. The extraordinary efforts of Henry Dunant led to the eventual establishment of the International Red Cross. Today, the Red Cross Movement incorporates the Geneva-based International Committee of the Red Cross and the International Federation of Red Cross and Red Crescent Societies (the International Federation), as well as National Societies in 175 countries, including the American Red Cross.

Modeled on the International Red Cross, the American Red Cross was founded in the late 19th century by Clara Barton (1821–1912). While Barton did not originate the Red Cross idea, she was the first person to establish a lasting Red Cross Society in America. She successfully organized the American Association of the Red Cross in Washington, DC, on May 21, 1881. Created to serve America in peace and in war, during times of disaster and national calamity, Barton’s organization took its service beyond that of the International Red Cross Movement by adding disaster relief to battlefield assistance. She served as the organization’s volunteer president until 1904.

OVERVIEW OF AMERICAN RED CROSS DISASTER HEALTH SERVICES

The American Red Cross Disaster Services mission is to ensure nationwide disaster planning, preparedness, community disaster education, mitigation, and response that will provide the American people with quality services in a uniform, consistent, and responsive manner. The Red Cross responds to all types of natural disasters and any situation that causes human suffering or creates human needs that those afflicted cannot alleviate or survive without assistance. Red Cross disaster relief focuses on meeting the individual’s or family’s immediate disaster-caused needs. When a disaster threatens or strikes, the Red Cross provides shelter, food, and health and mental health services to address basic human needs. In addition to these services, the core of Red Cross disaster relief is the assistance given to individuals and families affected by disaster enabling them to resume their normal daily activities. The Red Cross also feeds emergency workers, handles inquiries from concerned family members outside the disaster area, provides blood and blood products to disaster victims, and helps those affected by disaster access other needed resources (American Red Cross, 2007a).

Planning is an ongoing feature of all Red Cross disaster activities. The Red Cross disaster response plan documents what it will take to respond to each type of disaster, what resources will be needed, how the resources will be coordinated and used, and contains policies, procedures, and protocols to ensure a systematic management of each facet of response, including those related to health (see Appendix I). The role of the Red Cross in disaster relief is that the Red Cross supplements the resources and services of the local, state, and federal government and does not override or substitute for the local, state, and federal governments’ responsibilities in times of disasters. The American Red Cross is not a first responder—all disasters are local—but its services can be activated when the local need exceeds the available resources.

RED CROSS DISASTER PARTNERS

On the local and national levels, the Red Cross works together with government, business, labor unions, faith-based organizations, and community organizations as well as other voluntary agencies to identify resources, negotiate roles, gather and share vital information, and to continually seek ways to ensure a coordinated and efficient response to all disaster events (American Red Cross, 2007a).

THE NATIONAL RESPONSE PLAN AND THE AMERICAN RED CROSS

The American Red Cross is the only nongovernmental organization with lead responsibility for one of the emergency support functions (ESF) delineated in the National Response Plan (NRP). The organization shares responsibility for ESF 6 with the Department of Homeland Security and the Federal Emergency Management Agency (FEMA). As the primary agency for the mass care component of ESF 6, the Red Cross coordinates federal mass care assistance in support of state and local mass care efforts. As defined in the NRP, mass care involves coordinating nonmedical services to include...
sheltering of victims, feeding operations, providing first aid at designated sites, collecting and providing information on victims to family members, and coordinating bulk distribution of emergency relief items.

Although the services in this function are designated “nonmedical,” there are significant roles for nurses in this mass care function. Nurses who volunteer for the Red Cross need to have excellent critical thinking, assessment, and referral skills; they must be able to remain calm, flexible, and creative while working effectively with people (both disaster victims and disaster workers) under stress in unusual environments; and they must use their public health training to ensure a safe, healthy physical environment in shelters. Other attributes required include good communication skills, ability to use reference material efficiently, and being in good health.

In addition to sharing a lead role in the ESF 6, the American Red Cross is named as a support agency in several other emergency support functions, including ESF 8, health and medical. This could involve activities such as providing logistic support for vaccine administration or adapting usual shelter services in catastrophic situations (such those that existed after Hurricane Katrina).

AMERICAN RED CROSS AT THE LOCAL LEVEL

Local communities are served by Red Cross chapters, which meet the day-to-day needs of individuals affected by local emergencies, such as single-family house fires (the most common type of disaster), or those, like floods and tornadoes, that affect small, localized areas. These needs typically include short-term shelter, food, clothing, and the provision of mental health and physical health services (American Red Cross, 2007b).

AMERICAN RED CROSS AT THE STATE AND NATIONAL LEVELS

When a disaster exceeds the human and material resources of a given Red Cross chapter, the affected chapter can look to neighboring chapters and other chapters within their regional area for assistance. In situations where the demands of a given incident exceed what the local and regional chapters can accommodate, the Red Cross may deploy resources from within its broader service area (e.g., the Northeast Service Area) or from across the country. For example, during and after the devastating hurricanes of 2004 and 2005, other Red Cross national societies provided volunteers and resources to aid in the Gulf Coast response.

THE AVIATION DISASTER FAMILY ASSISTANCE ACT OF 1996 (ADFAA)

In 1996, the National Transportation Safety Board (NTSB) was assigned the role of integrating the resources of the federal government with those of local and state authorities and the airlines to meet the needs of aviation disaster victims and their families. As a result, the Federal Family Assistance Plan for Aviation Disasters was developed and implemented. This plan describes the airline and federal responsibilities in response to an aviation crash involving a significant number of passenger fatalities or injuries (NTSB, 2006, 2007).

In addition, the Aviation Disaster Family Assistance Act of 1996 (ADFAA) mandated that the NTSB identify a human service organization to coordinate family assistance and mental health services to surviving victims and the families of the deceased and to coordinate a nondenominational memorial service. The NTSB, in turn, named the American Red Cross to oversee the coordination of these services. In the event an aviation disaster meets these criteria and the ADFAA is enacted, the national headquarters of the American Red Cross will deploy a Critical Response Team to engage the Federal Family Assistance Plan for Aviation Disasters. This team will work with local, state, and federal resources to meet the mental health and spiritual care needs of those involved (NTSB, 2007).

MAJOR DISASTERS IN RED CROSS HISTORY

The natural disaster with the highest death toll in U.S. history was the Galveston, Texas, hurricane of 1900 in which an estimated 6,000 people were killed. Hearing news of the disaster, Clara Barton, founder and president of the American Red Cross, gathered a team and traveled by train from Washington, DC, to Galveston to provide relief.

Hurricane Katrina, which made landfall on August 29, 2005, was the most expensive single natural disaster in the organization’s history and necessitated the largest mobilization of Red Cross workers for a single relief operation. In the weeks and months that followed, that devastating storm and two subsequent severe hurricanes—Rita and Wilma—that struck the Gulf Coast states during the 2005 Atlantic hurricane season, more than 233,000 Red Cross workers were activated or deployed to provide shelter, food, water, and other immediate necessities for millions of storm survivors. Ninety-five percent of those workers were volunteers. As the response to Hurricanes Katrina, Rita, and Wilma shifted from emergency relief to providing recovery...
assistance, cost estimates for the operation reached $2.116 billion (see Case Study 4.1).

RED CROSS DISASTER NURSING

Historically, nurses have always had a central role in American Red Cross service provision during times of disaster and conflict. While nurses played a significant part in Red Cross relief efforts for the 1888 yellow fever epidemic and the 1889 Johnstown floods, it wasn’t until 1909 that, under the leadership of Jane Delano, this role became formalized as part of the newly created Red Cross Nursing Service. Since then Red Cross nursing has had a major role in the evolution of nursing and nursing leadership in the United States. Many Red Cross nurses, including such luminaries as Jane Delano, Clara Noyes, and Julia Stimson, played strategic roles in the development of American nursing (American Red Cross, 2007c).

The vision for American Red Cross Nursing is as follows:

American Red Cross Nursing... a presence throughout... uplifting lives with compassion and special skills... competent and prepared... strengthening the organization with innovation and support... enhancing our communities. (American Red Cross, 2007c)

More than 30,000 nurses are involved in paid and volunteer capacities at all levels and service areas of the American Red Cross. Their activities include, but are not limited to:

- Providing direct services: local Disaster Action Teams (DATs), responding to national disasters, chapter health reviewer, volunteering in military clinics and hospitals, blood collection team, first aid stations
- Teaching and developing courses: disaster health services, staff health, and mental health, CPR/first aid, family caregiving, nurse assistant training, and babysitting, preventing disease transmission
- Acting in management and supervisory roles: Chapter and Blood Services region executives, Service Area State Nurse Liaison Advisor
- Serving as consultant, subject-matter expert, or capacity development roles: Health Services Mentors, State Nurse Liaisons, or Service Area State Nurse Liaison Advisors
- Functioning in governance and advisory roles: local board or committee member, Service Area Health Professional Liaison, National Nursing Committee, national Board of Governors (American Red Cross, 2007c)

The Office of the Chief Nurse is responsible for supporting and strengthening paid and volunteer nurse involvement throughout the Red Cross. This includes maintaining liaisons with business entities, disaster response and preparedness, and managing nurse enrollment and field infrastructure programs. In addition, the Office of the Chief Nurse represents Red Cross nursing with external health-related professional organizations, educational institutions, and regulatory groups. The office is led jointly by the Chief Nurse and the National Chairman of Nursing and includes the National Nursing Committee, a large field infrastructure of volunteer nurse leaders, local volunteers, nursing student interns, and a nurse historian (American Red Cross, 2007c).

ROLE OF THE AMERICAN RED CROSS NURSE DURING A DISASTER

Because nurse involvement is such an essential part of American Red Cross disaster services, nurses participate in various components of the preparedness, mitigation, response, and recovery phases of a disaster (see Case Study 4.2). The primary roles for Red Cross nurses involve caring for the health and mental health needs of disaster victims and disaster workers with a special focus on activities that facilitate the agency’s ESF 6 responsibilities including mass care sheltering and feeding.

The three primary Red Cross nursing activity areas are labeled health services, mental health, and staff health. All three activity areas require general Red Cross disaster orientation training, as well as specific activity training. This training is typically required to be eligible for an assignment but, in large disasters, “just in time” training may be provided to facilitate surge capacity needs. On an actual disaster response operation, one individual may be assigned responsibility for multiple activities (American Red Cross, 2007c,d).

Health Services

Health services provides essential and preventive services to ensure the highest quality of care to disaster victims in their time of need. This activity supplements the existing service delivery system for community health care and coordinates its effort with those of the local health authorities and medical and nursing communities.

What They Do

- Assess health status and health care needs of disaster-affected individuals and families.
- Refer individuals/families to appropriate health care resources and services.
Part I
Disaster Preparedness

■ Provide first aid, replacement medications, and health supplies to disaster victims.
■ Supply health services personnel to various sites such as shelter and service centers for client care.
■ Provide disaster-specific health promotion and disease prevention education.
■ Collect, record, and provide surveillance data to the Centers for Disease Control and Prevention.
■ Collaborate with local public health authorities for care of special medical need clients, environmental concerns, contagious disease, and control/reporting.
■ Follow up with clients after disaster relief operations close.

Assignment Settings
Health services personnel will work in three categories of settings, depending on their expertise and experience:

■ Red Cross Shelters—where disaster victims take temporary shelter to meet their basic needs for daily living
■ Red Cross Service Centers—where disaster clients interview with caseworkers
■ Other:
  □ Outreach
  □ Home visits
  □ Hospital visits
  □ Staging areas
  □ Kitchens
  □ Warehouses
  □ Emergency aid stations

Disaster Mental Health
The disaster mental health activity provides for and responds to the psychosocial needs of disaster constituents, both victims and paid and volunteer staff, across the continuum of disaster preparedness, response, and recovery.

What They Do
Mental health personnel provide the following services on relief operations:

■ Psychological triage, crisis intervention, psychological support
■ Take action in support of an individual
■ Advocacy
■ Problem solving
■ Education
■ Referrals
■ Supervision and support to Red Cross workers providing psychological first aid
■ Assessing, monitoring, and alleviating organizational and environmental stress as possible
■ Casualty support
■ Coordinate service delivery efforts with professional and community partners involved in relief and recovery operations

Staff Health
The staff health activity supports the mission of the American Red Cross in providing relief to the victims of disaster by promoting a healthy workforce available to serve on disaster relief operations.

What They Do

■ Identify and prevent potential health problems before, during, and after a disaster relief operation—environmental and personal
■ Conduct prescreening evaluations by reviewing self-assessment forms submitted by potential Red Cross disaster responder applicants; evaluate suitability for disaster relief assignments, including coding for special exceptions (e.g., if a responder needs refrigerated medication, he or she could not be assigned to an area where electricity is unavailable)
■ During a disaster operation, provide preventive, episodic, and emergency care and follow-up 24 hours a day, 7 days a week as assigned
■ Identify health and safety issues associated with the work sites or living quarters locations and inform the site manager; make recommendations where health concerns exist
■ Follow approved health services protocols when caring for staff
■ Make appropriate, cost-effective referrals; may include accompanying staff to treatment facility or to home of residence
■ Document appropriately, including keeping morbidity and mortality reports for CDC surveillance
■ Work as part of a team

Assignment Settings

■ Community services kitchen
■ Service delivery site
■ Warehouses
■ Headquarters
■ In-processing center
■ Response center
■ Staff lodging

(American Red Cross, 2007b,c,d)

SHELTER NURSING—(THE ART OF DISASTER)

Shelters are very unique, dynamic environments and health professionals working in shelter environments
must draw on a variety of skill sets. General shelters have people of all ages and present many demographic, health, behavioral, cultural, and ethnic challenges. Diverse and vulnerable populations seek safety in shelters and an awareness of the community demographics is essential to starting, maintaining, and closing a shelter. The American Red Cross uses a team approach with several units operating simultaneously within a shelter. This includes shelter, staff health, mass feeding, mental health, casework, partner services, disaster public affairs, and facility management, as well as both governmental and nongovernmental liaisons. American Red Cross Nurses receive extensive training on how to set up, maintain, and close a shelter operation (American Red Cross, 2007d).

Health Services Competencies

To work effectively within a disaster environment, American Red Cross nurses and volunteers are expected to develop and maintain certain competencies to ensure quality service. Competencies are applied to practice in differing ways, depending on the situation and the environment.

- Critical thinking—Use clinical judgment and decision-making skills in assessing the client for appropriate, timely individual, family, and community care during a disaster.
- Assessment—Assess the safety issues for clients, other volunteers, and self in any disaster situation.
- Technical skills—Use the appropriate skill level based on assessment data and within the Red Cross protocols.
- Illness and disease management—Record and take appropriate action in conjunction with the local public health department, Centers for Disease Control and Prevention, and other partners in monitoring illness and disease within a community.
- Information and health care technologies—Use computer technology competently to communicate health information.
- Ethics—Maintain professional behavior in the practice of health services delivery and maintain the confidentiality of clients in all settings.

(American Red Cross, 2007c,d)

Shelter Start-up

The following essential checklist is used to start a shelter operation:

- Meet the shelter administration, obtain current reports, review the disaster assessment, and obtain maps.
- Analyze information and answer the most immediate information:
  - How large is the affected area? What counties, parishes are affected?
  - Deaths, injuries, hospitalized?
  - How many shelters are in operation?
  - Demographics, race, culture, language, age ranges, income, employment, family composition, person with disabilities, tribal and border issues.
  - Immediate health risks in area? Predisaster outbreaks, chemical hazards, poisonous insects, public health, and sanitation issues.
  - Have there been other recent disasters in the area?
  - Health care delivery system affected? Hospitals, EMS, psychiatric facilities, long-term care, elderly/disability services, home health agencies, blood services, assisted living facilities, cemeteries, senior meal sites, pharmacies, medical equipment suppliers, EMS dispatch, urgent care centers, eye care, dialysis units, physician offices, hearing and dental care, Meals on Wheels, and Visiting Nurse Associations.

Other services affected:

- Power outages? How long? Damage assessment to the area? How long?
- Before power is restored? Other utilities affected? Gas, phone, cell phones, pagers, Internet access, length of outages?
- Garbage and water issues, wells, city sanitation systems.
- Are there any warnings, advisories, alerts issued? Environmental and public health.
- Evacuations, stranded areas, extent of destruction?

Based on the above analysis, the health services professionals determine

- Who are our clients?
- How many families and individuals may present at shelters?
- What services and items of assistance will they need?
- Is there a need for translators, sign language interpreters, or other accommodations?

Staffing. What staffing will be necessary to maintain health professionals in shelter for multiple shifts and settings?

Equipment and Supply Lists. Nursing shelter kits have basic first aid and sanitation supplies for start-up of an operation.

Client Assessment Tool. American Red Cross uses an assessment tool for quick assessment at registration. The
Part I  Disaster Preparedness

The purpose is to assess urgent and potential emergent need for health, behavioral, equipment, or translation services as well as personal items necessary for immediate stabilization and recovery.

Maintaining Shelter Operations

- Infection control/sanitation
- Appropriate infection control measures are essential in nursing shelter management

Health services protocols are used by health professionals and are reviewed and signed yearly by local volunteer physicians. There are standard protocols, but they are individualized based on risk assessments and specific health issues that may affect a region of the United States. An example of a health issue that might need to be addressed would be fire ants. Local public health authorities are contacted immediately for any outbreak of disease.

Shelter infection control guidance includes:

- Hand hygiene
- Clean living areas—surface and item disinfection and sanitizing
- Laundry
- Garbage—waste-disposal compliance with local requirements
- Medical waste disposal including syringes. Sharp waste disposal or substitute container (disasters create necessity measures)
- Management of infectious disease—isoaltion and precaution measures
- Transfer plan for individuals with potentially communicable diseases
- Transmission-based precautions—personal protective equipment
- Caring for pregnant women, children, and infants
- Environmental exposures
- Guidelines for shelter play areas
- Diapering and diaper stations
- Hypersanitation

The following administrative responsibilities occur simultaneously:

- Completion of Centers for Disease Control and Prevention morbidity and mortality forms
- Shelter disease surveillance (depends on event and public health intervention)
- Outreach to homes, hospitals, emergency aid stations, integrated care teams, shelter casework teams, morgues, and service centers that provides comprehensive case work with partner agencies
- Identification of individual losses—medications, eyeglasses, medical equipment, batteries, dentures, and mobility devices (i.e., wheelchairs, canes)
- Ongoing access to directives and composing of narratives and situational reports
- Performance reviews on staff (staff rotates 2–3 weeks)
- Budgeting for the health services activity (initial and ongoing)
- Guidelines on conducting orientations
- In-kind donation management
- Recordkeeping
- Health services statistics
- Confidentiality and the Health Insurance Portability and Accountability Act
- Itinerating nurse responsibilities

(American Red Cross, 2007c,d)

Transition and Closing of Shelters

Transition plans are developed to close the operations and transition to local Red Cross chapters. This involves multiple levels of communications and includes:

- Identification of remaining tasks with completion deliverables.
- Transfer of health service cases with disposition plans.
- Manager narrative—Summary of all of the activities, relations with other agencies and community groups, relations with other Red Cross activities, significant or unusual factors in the operation, recommendations for future study or actions
- A final report
- Disposition of supplies and reports and return of nurse shelter kits to chapters

(American Red Cross, 2007c,d)

SUMMARY

Although it is not a governmental agency, the American Red Cross has a congressional mandate that requires action in time of emergency to alleviate human suffering. As a donor-funded, volunteer-driven organization, the Red Cross relies on donations of time, money, and blood to do its work. Responding to over 70,000 disasters each year, including catastrophic events such...
as Hurricane Katrina, Red Cross nurses and health services volunteers play a vital role in disaster response in the United States. Establishing shelters and aid stations and providing meals, minor first aid, emotional support, and mental health care, the Red Cross is a constant and dependable resource for disaster-stricken communities.

REFERENCES

APPENDIX I
DISASTER SERVICES POLICY STATEMENTS
The American Red Cross hereby affirms its purpose, desire, leadership, and intent to continue its service to victims of disasters in accordance with the following policies:

I. The American Red Cross will maintain its status as an independent voluntary body dedicated to performing the disaster preparedness and relief obligations entrusted to it by the Congress of the United States of America, consistent with the fundamental principles of the International Red Cross Movement.

The American Red Cross will provide a planning, preparedness, education, and relief program throughout the United States and its territories to assist individuals with urgent and verified disaster-caused needs.

II. All American Red Cross disaster relief assistance is based on the premise that disaster victims are ultimately responsible for their own recovery. The American Red Cross disaster relief assistance will be given on the basis of uniform corporate management procedures, regulations and directives. This assistance is provided to:
(1) Sustain human life.
(2) Reduce the harsh physical and emotional distress that prevents victims from meeting their own basic needs.
(3) Promote the recovery of victims when such relief assistance is not available from other sources.

The American Red Cross will assist disaster victims in obtaining government or other assistance, and will coordinate Red Cross assistance with all private and government agencies.
CASE STUDY

4.1 American Red Cross Milestones in History

The 125th anniversary of the founding of the American Red Cross was celebrated in 2006. Great milestones in the history of the American Red Cross are presented here.

1882 United States Senate ratifies the first Geneva Convention.
1896 Clara Barton and associates travel to the Middle East to conduct a 5-month campaign to bring relief to Armenian victims of Turkish oppression.
1906 Earthquake and fire ravage San Francisco and President Theodore Roosevelt calls on the Red Cross to lead a major relief effort lasting for months.
An International Congress revises the original Geneva Convention of 1864, expanding it to include protection of the war wounded at sea as approved by a Hague conference of 1899.
1916 The Red Cross introduces its Home Service to aid families of U.S. troops involved in skirmishes along the Mexican border.
The Women’s Bureau of the Red Cross recruits women across the nation to make surgical dressings, hospital garments, and refugee clothing for sister Red Cross societies and military hospitals in war-torn Europe, the beginnings of what becomes the Red Cross Production Corps.
1917 After the United States went to war in April 1917, the Red Cross staff and volunteers tended to the needs of the wounded and sick, and the able-bodied and disabled veterans and civilians overseas.
Red Cross dedicates its headquarters building in Washington, DC, as a memorial to “the heroic women of the Civil War,” both North and South.
President Woodrow Wilson calls on youth to join the newly formed Junior Red Cross.
1931 The public meets President Herbert Hoover’s call for $10 million in donations to support Red Cross relief during the drought affecting 23 Midwestern states in the “Dust Bowl.”
The American Red Cross joins 20 other Red Cross societies in providing relief to survivors of one of the worst floods in history as overflowing rivers in China cause an estimated 1 million deaths.
1932 Red Cross begins the distribution of government surplus wheat and cotton products to victims of drought in the Dust Bowl.
1942 Red Cross makes strides to expand its ranks by convening meetings with African American leaders to encourage their participation.
1946 The Red Cross inaugurates AMCROSS, its own telecommunication network that improves domestic communications, while it continues to use military networks for overseas transmission of messages.
1956 The Andrea Doria sinks following collision with another ocean liner, the Stockholm, in thick fog off Nantucket Island, causing 51 deaths. Red Cross nurses and other volunteers aid survivors as they arrive in New York City.
1962 The American Red Cross begins collecting medicines and food for Cuba in exchange for release of Bay of Pigs prisoners of war.
1967 In an effort to increase the donations of extremely rare blood types, American Red Cross national headquarters agrees to host a national Rare Donor Registry for blood types occurring less than once in 200 people.
1977 President Jimmy Carter makes his 51st blood donation in a blood mobile at the White House.
1981 The American Red Cross adopts the slogan, “Ready for a New Century,” as it celebrates its 100th anniversary during a five-day convention in Washington, DC, its birthplace.
1986 The Red Cross introduces the National Bone Marrow Donor Registry, based in its St. Paul, Minnesota, Blood Services Region.
1987 The American Red Cross opens its Holland Laboratory dedicated to biomedical research.
1992 The first National Testing Laboratory, applying standardized tests to ensure safety of Red Cross blood products, opens in Dedham, Massachusetts. The Red Cross responds as Hurricane Andrew blasts Florida and leads to multi-year Red Cross aid.
1995 More than 9,000 Red Cross workers respond to the bombing of the Alfred P. Murrah Federal Building in Oklahoma City by providing a range of immediate and long-term assistance to victims.
and their families that continues today in some forms.

1996 The U.S. Congress passes the Aviation Disaster Family Assistance Act that leads to creation of Red Cross Aviation Incident Response (AIR) Teams to assist victims’ families. The Red Cross is the first national blood bank to implement a new Food and Drug Administration approved test for early detection of the presence of the Human Immunodeficiency Virus in blood rather than the body’s response to it, further reducing the risk of transmission of the disease.

2005 Following Hurricane Katrina the Red Cross provided hurricane survivors with nearly 3.42 million overnight stays in nearly 1,100 shelters across 27 states and the District of Columbia. More than 220,00 Red Cross disaster relief workers responded and over 27 million meals were served.

### CASE STUDY

#### 4.2 The Role of the American Red Cross Nurse

### Preparedness (Predisaster)

**Nursing Role** (orders are given to evacuate)
- Mobilize personnel and supplies
- Open and staff shelters 24 hours a day, 7 days a week
- Provide information to residents of the shelter
- Maintain inventory of supplies

### Mitigation (Nondisaster)

**Nursing Role**
- Mitigation activities
- Prepare shelters
- Check supplies
- Establish contact with other emergency groups
- Assess needs and resources of community
- Educate personnel and public

### Response (Impact)

**Nursing Role**
- Assess health needs of shelter residents
- Provide physical care and psychological support
- Report health issues to public health
- Make appropriate referrals
- Provide information to reduce rumors

### Recovery (Postimpact)

**Nursing Role**
- Continue actions for impact phase of disaster
- Provide goods and services within Red Cross protocols
- Refer to community resources to promote long-term recovery
- Mitigation to prevent or reduce effects of future disasters

### Discussion

- Health of individual
- Individual’s ability to cope
- Effects on community
- Community reactions
- Commitment and values of DHS

### Assignment Settings

- Shelters
- Service centers
- Emergency aid stations
- Kitchens or warehouses
- Home visits or outreach
- Hospital contacts
- Staging areas
DHS Emergency Assistance

- Eyeglasses
- Dentures
- Hospital expenses
- Prosthetic devices
- Funeral expenses
- Contact lenses
- Medications
- Temporary housing
- Durable Medical Equipment
- Other

Case Management

Identification of the needs of the family (emergency and long term)
Additional information needed
Identify what resources you have available

- Red Cross
- In the community

Determine actions/assistance for each family
Key Messages

- No one who is involved in a disaster is left untouched.
- Estimating the psychosocial impact of a disaster can help guide the deployment of resources.
- Mental health workers need to be members of the disaster response team from the onset.
- Mental health services must be taken to the survivors.
- A range of psychological and emotional responses to disaster are normal and should not be "pathologized" or "medicalized."
- First responders and disaster workers are also vulnerable to stress reactions.
- Communities as well as individuals react to disaster.
- Noting milestones and anniversaries can facilitate normal grieving among all affected.

Learning Objectives

When this chapter is completed, readers will be able to

1. Identify the psychosocial effects likely to occur in various types of disasters.
2. Identify the elements of a community impact and resource assessment.
3. Describe the normal reactions of children and adults to disaster.
4. Formulate strategies that helpers can use to assist children and their families in the immediate aftermath of a disaster.
5. Discuss the impact of disaster trauma on first responders and helpers.
6. Describe community reactions to a large-scale disaster.
7. Describe the manifestations of normal grief and mourning.
Involvement in a disaster is a life-altering event, whether one is a survivor, a bereaved family member, a neighbor, or a helper. Although we know that individuals closest to a disaster will be most affected, information about the type and scope of the disaster can enhance estimates of the intensity and duration of the psychosocial resources that will be needed to assist those who will be affected by it. Resistance to psychosocial intervention, however, is such a common reaction among disaster survivors that mental health services must be made readily available and easily accessible to those at greatest risk, by taking services out to survivors and the bereaved. All helpers need to know that many types of emotions, thoughts, behaviors, and sensations are normal reactions to a disaster, however, and should not be “pathologized.” Outreach provided by well-trained mental health workers is especially crucial for our most vulnerable populations, and in particular, for our most valuable resource—America’s children. First responders and other helpers need to take special precautions to mitigate the psychological impact of disaster, as secondary traumatization is an ever-present hazard of disaster response. The rituals of normal grief and mourning can help individuals and communities draw on the strengths of the group to promote healing and eventual resolution.

Disasters, by their very nature, are stressful, life-altering experiences, and living through such an experience can cause serious psychological effects and social disruption. Disasters affect every aspect of the life of an individual, a family, or a community. Depending on the nature and scope of the disaster, the degree of disruption can range from mild anxiety and family dysfunction (e.g., marital discord or parent-child problems) to separation anxiety, posttraumatic stress disorder (PTSD), conduct disorders, addictive behaviors, severe depression, and even suicidality. Austin and Godleski (1999) cite data indicating that slightly more than half (54%-60%) of individuals exposed will develop psychiatric symptoms immediately after a disaster; that number...
disasters, such as floods, hurricanes, and tornadoes, property loss and dislocation occur most frequently. When physical injury and loss of life are minimal, the incidence of psychiatric sequelae is relatively low. In man-made disasters, however, such as plane crashes and bombings, the loss of life can be overwhelming. And if the presence of symptoms in the short term is very high, the prevalence of disorders in the aftermath is also likely to be quite high.

Hurricane Katrina was unique in that it was not only a natural disaster but also a man-made disaster in the sense that much of the suffering occurred as a result of delayed or ineffective rescue. The loss of life due to poor preparation and response was stunning. Massive devastation and dislocation led to separation of families. Many victims lost virtually all personal possessions, their livelihood, and all their support systems. For these reasons, usual predictions for psychological trauma following a natural disaster may not apply to Katrina victims. Experts estimate that Katrina’s impact on mental health is likely to last years (Voelker, 2006). For affected children, symptoms may not show up for 6–12 months. The impact on first responders was also of particular concern, in that two New Orleans police officers committed suicide within the first week after the hurricane. How and where to reach many of the dislocated children and adults poses particular logistical and financial challenges for the mental health system. Some Gulf Coast areas were hit again by Hurricane Rita, which strained already compromised relief efforts. According to early reports from a study, 47% of Gulf region respondents reported feeling blue, 82% became upset when thinking about the event, and 6% had thoughts of ending their life (Stong, 2006).

Not only does the type of symptomatology tend to vary by disaster but also the number of individuals likely to require mental health treatment in the aftermath of a specific disaster. Austin and Godleski (1999) have examined the rates of psychiatric morbidity by the impact the disaster has on the survivor and/or the bereaved.

The experience of terror or horror when one’s own life is threatened or one is exposed to grotesque or disturbing sights. After tornadoes, for example, PTSD occurs in 22%–59% of survivors. Up to 40% of people responsible for body handling and recovery show signs of distress and are thus at risk for PTSD. Traumatic bereavement, which occurs when beloved friends or family members die as a result of a disaster. In the Zeebrugge ferry disaster, psychological disturbances were found to be higher among bereaved relatives who did not experience the disaster than among those who survived the disaster but were not left bereaved. Also, following the eruption of Mt. St. Helens, the bereaved not directly involved in the disaster were more distressed than those who suffered property loss as a result of the disaster.

Distruption of normal living. Not only is this a common element in virtually all disasters, it is the most difficult to quantify, since the nature of the disruption can vary from disaster to disaster and from person to person. Dislocation stress is the most commonly encountered disruption to daily life in these events. Disruption in normal living without loss of a loved one or the experience of horror, however, appears to pale in significance when compared with the other two types. There is also no apparent correlation between the amount of property loss and the degree of distress because those with bigger houses (and, therefore, greater financial loss) may also have more in the way of financial reserves to rebuild than someone whose entire net worth was tied up in their home. There is also a great variability in response to dislocation. Women experience greater distress than men, while nonrelocatees can have as much distress as relocatees, depending on the disruption to their normal lives.

Nonetheless, human beings are remarkably resilient. Historically, slightly more than 75% of those exposed to a disaster will heal on their own in time, without intervention. When the disaster involves intentional violence and human malfeasance, however, such as with 9/11, preliminary data indicate that the rates of probable PTSD (11.2%) in the metropolitan New York area may be even higher than previously thought (Shefler et al., 2002).

BIOTERRORISM AND TOXIC EXPOSURES

Bioterrorism has an entirely different profile from that of natural disasters or even sudden violent events, such as bombings and explosions. Although bioterrorism is also a man-made disaster, the effects are more uncertain and occur over a longer period of time. Those exposed to toxic agents in the Gulf War are still unsure of the long-term health effects. This creates an environment of continual anxiety, which, under the right circumstances, can be exacerbated into a full-blown panic attack. The data from Three Mile Island also indicate that psychological symptoms persist over relatively long periods of time in instances of exposure to toxic contamination, largely due to the uncertain nature of the eventual outcome of the exposure. Obsessive thoughts and suspiciousness have been detected among Three Mile Island subjects up to 5 years after the event (Green, Lindy, & Grace, 1994).

The October 2001 anthrax scare was probably designed to be more of a psychological attack than a
physical one. In an editorial by Wessely, Hyams, and Bartholomew (2001), the authors note that biologic and chemical weapons are notoriously ineffective methods of mass destruction but are much more effective as weapons of terror—by introducing fear, confusion, and uncertainty into everyday life. Fear of biological warfare can lead to mass sociogenic illnesses in which common, everyday symptoms are believed to be signs of a biological exposure. Common psychological reactions to biological exposure include:

- Horror, anger, or panic
- Magical thinking about microbes and viruses
- Fear of invisible agents or fear of contagion
- Attribution of arousal symptoms to infection
- Anger at terrorists, the government, or both
- Scapegoating, loss of faith in social institutions
- Paranoia, social isolation, or demoralization

Following the anthrax exposures in the United States, many of these psychological reactions were seen around the world. For example, in the Philippines, local clinics were deluged by more than 1,000 people suffering from flu-like symptoms because of rumors that those symptoms were due to bioterrorism. Sixteen students and a teacher in Washington State panicked and went to the hospital mistakenly fearing bioterrorism when simply exposed to paint fumes in the building. Thirty-five people in Maryland feared biological exposure after experiencing nausea, headache, and sore throat when a man sprayed an unknown substance in a subway. The substance turned out to be window cleaner.

In response to these incidents, the American Psychological Association is now strongly recommending that people limit their exposure to the news media, as overexposure may heighten one’s anxiety. In addition, Holloway and colleagues (2002) suggest the following interventions by medical personnel to minimize the potential psychological and social consequences of suspected or actual biological exposures:

1) Prevention of group panic
2) Careful, rapid medical evaluation and treatment (to distinguish between hyperarousal, intoxication, and infection)
3) Avoidance of emotion-based responses (e.g., knee-jerk quarantine)
4) Effective communication regarding potential risk
5) Control of symptoms secondary to hyperarousal (provide reassurance, and if unsuccessful, consider diazepam-like anxiolytics for acute relief)
6) Management of anger, fear, or both
7) Management of misattribution of somatic symptoms
8) Provision of respite as required
9) Restoration of an effective, useful social role (e.g., as worker at triage site)

COMMUNITY IMPACT AND RESOURCE ASSESSMENT

By brainstorming about potential disaster scenarios and the scope of resources anticipated to be needed under each scenario, the intensity and duration of the mental health response can also be anticipated. The U.S. Department of Health and Human Services (2004) has developed a population exposure model that planners can use to estimate the psychological impact of mass violence and terrorism and, therefore, the resources that might be needed. The model’s underlying principle is that individuals who are most personally, physically, and psychologically exposed to trauma and the disaster scene are likely to be affected the most (Figure 5.1).
Research comparing the psychological effects of human-caused versus natural disaster has yielded equivocal results. No one type of disaster is “worse” than another, although the number of associated deaths and serious injuries can be expected to have the most significant and longest lasting impact on physical and emotional well-being.

Given the numbers of individuals potentially at risk in a large-scale disaster resulting in deaths or injuries, effective community planning requires the deployment of mental health resources in the most efficient manner. Therefore, knowing what the public and private mental health resources are ahead of time is key to effective crisis management. Questions that should be addressed during predisaster planning include:

- What are the types of disasters that are most likely to occur in my community? Is this region most vulnerable to natural, technological, toxic, or man-made disasters?
- Is there a county and state mental health disaster plan? If so, what does it entail, and how might it support local efforts?
- What kind of expertise is needed? Will the anticipated disaster affect a certain age group, racial, ethnic, or religious subpopulation; or individuals having a specific disability, such as hearing impairment, mental illness, dementia, or mental retardation?
- Who are the qualified mental health professionals in my agency or community that can be called upon in the event of a local disaster? Do they have a clinical specialty or language proficiency? Who authorizes them and what training do they have/need?
- What resources can the local American Red Cross chapter provide to responders and/or victims? Do providers have existing memoranda of understanding with the Red Cross?
- Is there a team of mental health workers specifically trained in critical incident stress management available to debrief rescuers and hospital personnel? If not, who will be available to provide stress management for rescue/medical personnel?
- Are there other nonpsychological services that local mental health providers can offer? For example, are there programs or agencies that could provide space and food for staff or victims?

REDDUCING RESISTANCE TO PSYCHOSOCIAL INTERVENTION

One major reason that medical professionals are often reluctant to include mental health professionals on the team and that victims do not seek psychiatric consultation, is the concern that emergency mental health intervention implies that emotional distress is equated with mental illness. This is a barrier that needs to be overcome, however, as the immediate mental health response to a disaster should be educationally oriented, not treatment oriented. In fact, a main goal of postimpact intervention is to foster and stimulate the natural healing process that occurs within the community (Austin & Godleski, 1999).

Resistance to outside help can be so difficult to overcome that survivors are not likely to present themselves to an emergency room or a clinic for psychiatric treatment even when in extreme need (Austin & Godleski, 1999; DeWolfe, 2000). Therefore, a plan that includes outreach services is critical. In fact, Austin and Godleski (1999) suggest that a second goal of mental health intervention ought to be decreasing the resistance to treatment among individuals whose emotional suffering exceeds the natural healing capacity of the group and to make that treatment easily available. In addition, primary care providers can play an important role in the assessment of their patients for the presence of mental disorders and referral for treatment with a specialist when it is indicated.

It is of critical importance, therefore, that mental health workers are part of the response team from the outset. Alexander (1990) has identified four main reasons to include mental health workers as part of the immediate medical response:

1) Personal experience of the disaster and its immediate aftermath may increase the credibility of mental health counselors in a way that is likely to facilitate their subsequent work with victims and responders.
2) Early intervention allows mental health professionals to be seen as part of the medical team, rather than as distant and possibly threatening figures.
3) In the emotionally charged atmosphere of the postimpact phase of the disaster, a special bonding may occur between helper and victim, which may facilitate subsequent counseling and treatment.
4) Early intervention provides an opportunity for “psychological triage” and identification of those who may be at particular risk for adverse reactions.

NORMAL REACTIONS TO ABNORMAL EVENTS

Normal reactions to stress and bereavement can and do vary—sometimes even among members of the same family. Factors that affect expressions of stress and bereavement include age, gender, ethnicity, religious background, personality traits, coping skills, and previous experience with loss, especially traumatic loss. Adults
5.1 Common Reactions of Disaster Survivors

**Emotional**
- Depression, sadness
- Irritability, anger, resentment
- Anxiety, fear
- Despair, hopelessness
- Guilt, self-doubt
- Unpredictable mood swings

**Behavioral**
- Sleep problems
- Crying easily
- Avoiding reminders
- Excessive activity level
- Increased conflicts with family
- Hypervigilance
- Isolation or social withdrawal

**Cognitive**
- Confusion, disorientation
- Recurring dreams or nightmares
- Preoccupation with disaster
- Trouble concentrating/remembering things
- Difficulty making decisions
- Questioning spiritual beliefs

**Physical**
- Fatigue, exhaustion
- Gastrointestinal distress
- Appetite changes
- Tightening in throat, chest, or stomach
- Worsening of chronic conditions
- Somatic complaints

Source: DeWolfe (2000).

and children need not be present at a traumatic event to have stress symptoms, especially if they consider themselves similar to the victims (Schuster et al., 2001). As these reactions can be quite startling and overwhelming to those who have not experienced them before, it is helpful for survivors to hear that their experiences are entirely normal, given the tremendous stress to which they have been exposed. (See Table 5.1 for the common reactions of survivors.)

The American Red Cross (1995) recognizes four phases of emotional recovery following impact of a disaster:

- the heroic phase,
- the honeymoon phase,
- the disillusionment phase,
- the reconstruction phase.

The time frames for each phase can vary greatly, but the emotional reactions of children and adults are often good indicators of the phase of recovery. Thus, in the heroic phase, numbness, shock, and, even elation when a life is saved, may be most evident. In the honeymoon phase, survivors are grateful, and the community pulls together to cope with the disaster.

In the disillusionment phase, however, depression and hopelessness may become more prominent, as the reality of how life has changed postdisaster becomes ever more apparent. The enormous drain of reserves—physical, financial, and emotional—takes its toll. Adults may experience physical reactions such as headaches, increased blood pressure, ulcers, gastrointestinal problems, and sleep disorders. Emotional reactions may vacillate between emotional numbness and expressions of intense emotion. Anxiety and depression are common emotional reactions, as are anger and frustration—sometimes displaced onto relief workers when anger about the disaster seems “less rational.” The reconstruction phase gradually becomes more apparent as intense emotions are replaced by a sense of acceptance, increasing independence, and emotional reinvestment in relationships and activities of daily life.

### STRESS REACTIONS AMONG CHILDREN AND YOUTH

General risk factors for stress reactions among children include being female, being near to the event, having a physical injury, having a parent/close family member injured or killed, having a parent with significant psychopathology, or having a family environment that is depressed and irritable or volatile. The personality and temperament of the child are also associated with risk for psychiatric symptoms. Children who are intrinsically shy are at greater risk for trauma-related symptoms, and those who are chronically depressed are prone to feelings of guilt (Shaw, 2000). Children often appear to cope well initially, and adverse reactions may not be apparent for weeks to months later. And, children who have trauma histories or unstable family lives are particularly vulnerable to reactivation of psychiatric symptomatology. Thus, those having preexisting emotional and family problems will likely need greater support and counseling during a disaster.

It is particularly important for helpers to be aware that there are also a wide range of emotional and physiological reactions that children of differing ages may also display following a disaster:

- Infants will sense their parents’ anxiety and fear and will mirror the parent or caregiver’s reaction to the disaster.
- Preschool children are extremely anxious and will react strongly to any disruption in their
daily routine. They may exhibit mild to extreme helplessness, passivity, and a lack of responsiveness to things in their environment. A heightened level of arousal, confusion, and generalized fear may be present. Other symptoms of distress include a lack of verbalization, sleep disturbances, nightmares and night terrors, fears of separation and clinging to caregivers, irritability, excessive crying, and neediness. Somatic complaints may include stomachaches, headaches, and nondescript pains. At this developmental stage, children may have a tendency to assume that the disaster is related to something they did or did not do. Shaw (2000) cites an instance where a child in Miami thought the hurricane occurred because he had an altercation with his little brother. This age group is also more likely to relive the traumatic experience in play or behavioral reenactments. Resumption of bed-wetting, thumb-sucking, and clinging to parents is not uncommon.

School-aged children are more mature, both cognitively and emotionally, but remain highly vulnerable to events involving loss and stress. Whereas younger children may exhibit symptoms of separation anxiety, school-aged children may present with more classical symptoms of PTSD, as well as depressive and anxiety disorders. However, reactions to stress at this age may also include sleep and appetite disturbances, academic problems, and occasionally behavioral difficulties such as oppositional or aggressive conduct. Behaviors more typical of a younger child may also be seen, such as clinginess or whining, while others may react by withdrawing from friends and familiar activities.

Adolescents tend to respond to a disaster much the same as do adults. However, this may also be accompanied by the awareness of a life unlived, a sense of a foreshortened future, and the fragility of life (Shaw, 2000). Adolescents may also exhibit a decline in academic performance, rebellion at home or school, and delinquency, as well as somatic complaints and social withdrawal. Adolescents may feel a strong need to make a contribution to the recovery effort and find meaningful ways to “make a difference.”

Resiliency in the Face of Disaster

Because not all survivors of a disaster display symptoms beyond the initial phases of recovery, researchers have become increasingly interested in the factors that might promote resiliency in the aftermath of a devastating disaster. In fact, resiliency is often the most commonly observed outcome trajectory after exposure to a potential traumatic event (Bonanno, Rennicke, & Dekel, 2005). Characteristics associated with resiliency include family stability, social support, and capacity to tolerate stress and uncertainty. And while it appears that there may be a social cost to self-enhancement, further study is needed to understand this relationship, as well as the relationship between resiliency and PTSD symptoms and the ability to function over time and across differing types of traumatic events (Litz, 2005). By promoting resilience and coping after disaster, mental health professionals can draw on the individual’s strengths or create the supports needed to ward off lasting symptoms or functional difficulties and avoid interventions that may actually interfere with one’s own innate resilience and therefore impede recovery. See Case Study 5.1 for a disaster mental health volunteer’s perspective on survivor resilience in the aftermath of Katrina and the tsunami.

THE CARE AND SAFEGUARDING OF AMERICA’S CHILDREN

Clearly, children of all ages find comfort and stabilization in the routines of daily life. Family interactions, going to school, playing with friends—these activities provide structure to the child’s world. When disasters interrupt this routine, children become scared, anxious, and confused. Experience from Oklahoma City also underscores the importance of not separating children and parents during the aftermath of disaster. A separate waiting/play area had been set up for children at the notification center, but once the importance of maintaining family unit was recognized, all waited for services together in a general family room (Pfefferbaum, Call, & Sconzo, 1999).

Children, in infancy through age 19, are particularly vulnerable to psychological harm because of their unique developmental status. Some general guidelines by age group include the following:

**Infants.** Provide physical comfort and maintain routines as much as is possible. Maintain safety at all times—avoid taking out one’s frustration on a colicky or fussy infant; use other, familiar caregivers, if necessary.

**Preschoolers.** Avoid unnecessary separations from parents. It is okay for parents to allow children of this age to sleep in their parents’ room on a temporary basis. Give plenty of verbal reassurance and physical comfort. Monitor media exposure to disaster trauma. Encourage expression through play activities.

**School-aged children.** Provide extra physical comfort and reassurance; however, gentle, firm limits should be set for acting out behavior if it should occur. Provide reassurance that they are not responsible for the disaster. Use of puppets, dolls, and other “props” facilitates the expression of anxiety-producing emotions among young children. By assisting children to identify sources of stress and loss, and correct distortions in thinking, a
5.2 Helping Children, Teens, and Their Families Cope With Tragedy

Be honest and give age and developmentally appropriate explanations about the traumatic event.

For young children, in particular, only provide answers to questions they are asking and do not overwhelm them with too much detail. Use language that young children can understand. Do not expose young children to visual images that are terrifying in the newspapers or television.

Help children and teens to express how they are feeling about what they have seen or heard. If children have difficulty verbally expressing their feelings, ask them to make a drawing about how they are feeling. Older school age children and teens can benefit from writing about how they feel.

Ask children and teens, “What is the scariest or worst thing about this event for you?”

Reassure children that they did nothing wrong to cause what happened. Toddlers and preschool children especially feel guilty when something tragic happens.

Tell children and teens that what they are feeling (e.g., anger, anxiety, helplessness) is normal and that others feel the same way.

Alleviate some of their anxiety by reassuring children that we will get through this together and will be stronger as a result of what we have been through. Emphasize that everything is now under control and that adults will be there to help them through this and that they are not alone.

Help children and teens to release their tension by encouraging daily physical exercise and activities.

Continue to provide structure to children’s schedules and days.

Recognize that a tragic event could elevate psychological or physical symptoms (e.g., headaches, abdominal pain, or chest pain) in children and teens who are already depressed or anxious.

Remember that young children who are depressed typically have different symptoms (e.g., restlessness, excessive motor activity) than older school age children or teens who are depressed (e.g., sad or withdrawn affect, difficulty sleeping or eating, talking about feeling hopeless).

Anger can be a sign of anxiety in children and teens.

Children, even teens, who are stressed typically regress (e.g., revert to doing things that they did when they were younger, such as sucking their thumbs, bed-wetting, or acting dependent upon their parents). This is a healthy temporary coping strategy. If these symptoms persist for several weeks, however, talk to your health care provider about them.

Use this opportunity as a time to work with children on their coping skills.

Be sure to have your child or teen seen by a health care provider or mental health professional for signs or symptoms of depression, persistent anxiety, recurrent pain, persistent behavioral changes, or if they have difficulty maintaining their routine schedules.

Remember that this can be an opportunity to build future coping and life skills as well as bring your family unit closer together.


SPECIAL NEEDS POPULATIONS

Survivors and family members most likely to experience adverse reactions are seemingly those with the fewest tangible resources: the unemployed or poor, divorced, or female. Along these lines, Solomon and Smith...
Older Adults

Older adults are particularly vulnerable to loss. Research has shown they are less likely to heed warnings, may delay evacuation, or resist leaving their homes (DeWolfe, 2000). They are often lacking in social supports, may be financially disadvantaged, and are traditionally reluctant to accept offers of help. Older adults are also more likely to have preexisting medical conditions that may be exacerbated, either directly because of the emotional and psychological stress, or because of disruptions to their care, such as loss of medications or needed medical equipment, changes in primary care providers, lack of continuity of care, or lack of consistency in self-care routines due to relocation. Older women are at particularly high risk for PTSD in that they live longer than men, are more likely to be widowed, have limited social supports, and are disproportionately victims of crimes such as muggings and robberies (Lantz & Buchalter, 2003).

Loss of irreplaceable possessions—photographs, mementos, and heirlooms—may have even greater meaning and value for older adults. Disasters may serve as a reminder of the fragility and ultimate finality of life. Older adults may be also more likely to withhold information or refuse help due to fears of losing their independence. Institutionalization remains a real concern among senior citizens who suffer the trauma of a disaster. The frail elderly are especially vulnerable to relocation stress and may experience exacerbations of chronic health problems. Disorientation can occur when the frail elderly are moved to unfamiliar surroundings, especially without substantial support from caregivers.

In the aftermath of 9/11, an entire high-rise of elderly individuals not only witnessed the horrifying crash of the airplanes into the World Trade Center, they also experienced the sickening sensation of watching the towers collapse, followed by the thick and choking debris that rained down on the neighborhood, including their building. All the residents had to be evacuated and relocated for several months while the building was thoroughly cleaned. Visiting psychiatric nurses were brought in to provide additional support, screening, and follow-up for the relocatees until after they were returned to their own building.

The Severely Mentally Ill

According to Austin and Godleski (1999), the most psychologically vulnerable people are those with a prior history of psychiatric disturbances. Although previous psychiatric history does not significantly raise the risk of PTSD, exacerbation of preexisting chronic mental disorders, such as bipolar and depressive disorders, are often increased in the aftermath of a disaster. Those with a chronic mental illness are particularly susceptible to the effects of severe stress, as they may be marginally stable and may lack adequate social support to buffer the effects of the terror, bereavement, or dislocation.

Assertive Community Treatment (ACT) teams played a vital role in maintaining connections with those who were most vulnerable to the effects of stress following Hurricane Hugo. In the 3 months following the hurricane, not one ACT recipient required a psychiatric hospitalization (Lachance, Santos, & Burns, 1994). After 9/11, at least three individuals with a chronic mental illness in a small rural county over 500 miles from the disaster location, developed delusions that incorporated hijacked planes, such as believing that they were part of a conspiracy to crash a plane into a building. With follow-up from police and mental health workers, however, outpatient connections were able to be developed, averting potentially dangerous incidences.

Cultural and Ethnic Subgroups

Sensitivity to the cultural and ethnic needs of survivors and the bereaved is key not only in understanding reactions to stress and grief but also in implementing effective interventions. Mental health outreach teams need to include bilingual, bicultural staff and translators who are able to interact effectively with survivors and the bereaved. Whenever possible, it is preferable to have bilingual staff or trained translators, rather than relying solely on family members, because of privacy concerns and the importance of maintaining appropriate family roles and boundaries. The availability of written materials in other languages can also increase access to information for those who do not speak English, and can serve as a reminder of information only partially understood at the time of the greatest stress.

Understanding the local norms, history, and politics can be important in providing culturally appropriate services. Issues that need to be addressed include level of acculturation, gender and parental roles, religious belief systems, child-rearing practices, and use of support systems, including extended family (Cohen, 1992). In many transportation disasters, understanding and addressing the cultural needs of survivors and the bereaved can be complicated by a lack of cultural competence on the part of the responders, as well as separation from usual
supports and familiar environments on the part of survivors and the bereaved.

First Responders and Other Helpers

The list of those vulnerable to the psychosocial impact of a disaster does not end with the survivors and the bereaved. Often overlooked victims can include emergency personnel, police officers, firefighters, military personnel, Red Cross mass care and shelter workers, cleanup and sanitation crews, the press corps, funeral directors, staff at receiving hospitals, and trauma/grief counselors. For example, cleanup and recovery workers at the World Trade Center site were found to suffer debilitating consequences of their work, including depression, drug use, and PTSD, and need to be included in the preparation given to first responders (Johnson et al., 2005).

Some studies of PTSD among firefighters and other first responders have found the frequency of PTSD to be 21%–25%, and that PTSD may have comorbidity with other psychiatric disorders (Austin & Sir, 2004). Clearly, stress-induced symptoms are a hazard of disaster work and can lead to absenteeism and burnout, as well as difficulties in family, work, and social life and physical and psychiatric disorders. Table 5.3 lists the common stress reactions experienced by disaster workers.

Nurses and Hospital Personnel

Those medical personnel receiving disaster victims and families at the local hospitals can also be affected by the intense emotions of those seeking help. Often, nurses and other medical personnel are reporting for emergency duty after having worked their regular shift, such as in the case of the San Francisco Bay area earthquake (Barash, 1990). These workers not only treat injured survivors but also must provide needed services to the families of the injured. This includes identifying cultural needs, obtaining translators if needed, and facilitating connections to relief organizations. Through all of this, staff must manage their own emotional reactions to the disaster. Secondary traumatization is a hazard that comes with exposure to the horrific stories of the bereaved and injured. Hospital personnel are also subject to the stress of increased workload due to increased admissions and discharges (to make room for the trauma victims) and the need to communicate timely information not only to families but to the ever-burgeoning members of the media. In addition, the numbers of individuals requiring treatment also does not end with impact—many people will sustain serious injuries in the process of disaster cleanup.

Nurses and other medical professionals may be afraid to show their emotions during the disaster and...
therefore will often experience profound emotional reactions afterward. There may be a sense of emotional “letdown” followed by an “emotional rollercoaster,” in which emotions may vacillate between the euphoria of saving a life to the sadness or anger of losing lives. Psychological debriefing can assist staff by normalizing these reactions and providing the support of a group of people who have had similar experiences. Such groups ought not only to include doctors and nurses but also to include X-ray personnel, laboratory staff, and housekeeping. The stress on hospital workers may also continue for some time after the disaster, as those with psychological and physiological manifestations of trauma begin to seek assistance for symptoms they can no longer deny or ignore.

Mental Health Counselors

Ongoing support for the mental health counselors at the disaster site is crucial. Cohen (1997) relates that it was often difficult for mental health counselors to avoid identifying with the bereaved in the aftermath of the TWA Flight 800 crash off the coast of Long Island. Like the bereaved, counselors were also vulnerable to the impact of rumors, delays, and misinformation. A study by Lesaca (1996) further found that at 4 and 8 weeks after a 1994 airline disaster, trauma counselors experienced significantly more symptoms of PTSD and depression than a comparison group. Fortunately, the only significantly increased symptom after 12 weeks was avoidance behaviors, specifically of situations that aroused memories of the crash.

Vicarious traumatization was a significant problem, however, among mental health disaster workers in the Oklahoma City bombing aftermath (Call & Pfefferbaum, 1999). The impact of the traumatic scenes and the intense emotions of the survivors led to an increased physical illness, psychological distress, and absenteeism. Experience in Oklahoma indicates that a mental health consultant, separate from those providing direct services, ought to be brought in to provide support to staff, so as not to discourage open sharing of personal feelings and reactions. The use of young therapists, with little personal or professional experience in dealing with bereavement, was viewed as a mistake by the authors. They recommend that therapists be mature, culturally sensitive, and trained in specific techniques, such as critical incident stress debriefing. Similarly, a recent study of counselors responding to the 9/11 terror attack found higher levels of secondary traumatic stress was associated with a heavier prior trauma caseload, less professional experience, younger age, longer lengths of assignment, and more time spent with child clients, firefighters, or clients who discussed morbid material (Creamer & Liddle, 2005). This indicates that potential recruits need to be informed of the potential risk of secondary traumatic stress, those at-risk should have lower risk assignments whenever possible and ongoing monitoring of counselor exposure to risk should occur at regular intervals during the course of deployment.

COMMUNITY REACTIONS AND RESPONSES

The cohesiveness of the survivor network can take on special prominence in the recovery following a disaster. This network appears to develop a boundary of its own that has special permeability properties. Although these properties include an early permeability to anyone who seems willing to help, this “trauma membrane” later becomes tightly sealed and outsiders are only allowed in under certain circumstances and for certain functions (Lindy & Grace, 1985). By addressing the emotional and social needs of disaster victims, counselors and other disaster workers can establish trust and engender a sense of support within the community. Some of the needs that are commonly seen among disaster survivors, regardless of the type of disaster, include

1) Basic survival, personal safety, and the physical safety of loved ones.
2) Grieving over loss of loved ones and loss of valued and meaningful possessions.
3) Concerns about relocation and the related isolation or crowded living conditions.
4) A need to talk about events and feelings associated with the disaster, often repeatedly.
5) A need to feel one is part of the community and its recovery efforts.

Schools provide a key mechanism for reaching children almost 9 months a year. Teachers and principals are in contact with students throughout the day, and they are in an excellent position to disseminate information, allow expression of feelings, and screen children for unusual difficulties and make referrals when indicated. Both over- and underexposure to the disaster are potential pitfalls that schools can avoid with consultation from professionals. The first step, however, is to have established a preexisting, warm, open consulting relationship between mental health professionals and the schools (Terr, 1992). Minimally, mental health professionals can work with principals and teachers to see that schools have the latest information about reactions of children to disaster and supplement school counselors on-site when large numbers of children are anticipated to need crisis intervention. In addition, professionals can provide guidance about the age-specific strategies that might be used in discussing
a community-wide disaster. In Oklahoma City, schools have been inundated by individuals and groups promoting various interventions—most well meaning but some inappropriate (Pfeiferbaum et al., 1999). Screening of requests by a committee that includes a disaster mental health professional can assist schools in identifying resources consistent with their needs as well as accepted standard practices.

Large-group preventive techniques for children have been used for some time in California during the aftermath of community-wide trauma (Eih, 1992). This type of school-based intervention occurs as soon after the event as possible, and follows three phases:

1) Preconsultation—identifying the need; preparing the intervention with school authority.
2) Consultation in class—introduction, open discussion (fantasy), focused discussion (fact), free drawing task, drawing or story exploration, reassurance and redirection, recap, sharing of common themes, and return to school activities.
3) Postconsultation—debriefing with school personnel and triage/referrals.

(See Case Study 5.2 for an example of a school-mental health consultation in the wake of community-wide response to a victim of murder.)

Community-based consultation in the workplace can also be requested when large numbers of employees are affected by a disaster. In the aftermath of both Oklahoma City and 9/11, mental health teams were called on to conduct debriefings in the workplace. Between September 26, 2001, and November 6, 2001, for example, mental health teams in New York City facilitated 112 debriefings, mostly for employees of government and nonprofit agencies (Herman, Kaplan, & LeMelle, 2002). The debriefings consisted primarily of information about responses to disaster, normal and traumatic; advice for helping children who have been exposed to trauma; and practical steps that participants might take to feel safer.

Mourning, Milestones, and Anniversaries

The normal process of mourning is often facilitated by the use of rituals, such as funerals, memorials, and events marking key time intervals, such as anniversaries. It is important to include the community in the services, as well as the immediate family members. Community-wide ceremonies can serve to mobilize the supportive network of friends, neighbors, and caring citizens and provide a sense of belonging, remembrance, and letting go. Newsletters are also a nonintrusive way of maintaining links among survivors and the bereaved and can also provide special support during important anniversaries or milestones. Ceremonies or memorials in schools should be developmentally appropriate and involve students in the planning process.

Many different terms have been used to describe grief and grieving. Understanding the various nuances in meaning can be helpful in properly identifying and labeling the experiences and reactions of survivors and relatives of the deceased. Grief is an intense sorrow or mental suffering resulting from loss, affliction, or regret—an emotion experienced by virtually all disaster survivors. Mourning, however, is the act of sorrowing or expressing grief, especially for the dead, but disaster survivors can and also do mourn other losses, such as material possessions, homes, and jobs. Bereavement means to leave saddened by someone’s death or to feel deprived, as of hope or happiness, and is generally ascribed to family members of disaster victims. Depression refers to a state of feeling sad or, more specifically, is an emotional disorder marked by sadness, inactivity, difficulty in thinking and concentrating, and feelings of dejection. Feeling sad is a common reaction to disaster, but clinical depression is a much less frequent occurrence, depending on the nature of the disaster. (See Table 5.4 for a list of the normal manifestations of grief.)

Working with the bereaved is a common need following a disaster because loss is such a predominant theme in virtually every disaster. Grief counselors facilitate the normal process of mourning by assisting individuals to express emotions, begin to detach from the deceased, and eventually, to reinvest in life—including the possibility of another close relationship. The phases of the mourning process have much in common with the emotional phases of disaster recovery, and Worden (1982) has identified specific tasks that need to be accomplished at each phase of mourning for successful resolution:

- **Period of shock,** or “numbness.” The task is to accept the reality of the loss (as opposed to denying the reality of the loss).
- **Reality,** or “yearning” and “disorganization and despair.” The tasks are to accept the pain of grief (as opposed to not feeling the pain of the loss) and to adjust to an environment in which the deceased is missing (as opposed to not adapting to the loss).
- **Recovery,** or “reorganized behavior.” The task is to reinvest in new relationships (as opposed to not loving).

One indicator of mourning coming to an end is when one is able to think of the deceased person or loss without pain or the intense physical sensations. Another is when the survivor can reinvest his or her emotions into life and the living. In some ways, however, mourning never ends; only as time goes on, it manifests itself less frequently. Old losses are mourned again with each new loss.
5.4 Normal Manifestations of Grief

<table>
<thead>
<tr>
<th>Feelings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sadness</td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td></td>
</tr>
<tr>
<td>Guilt and self-reproach</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
</tr>
<tr>
<td>Loneliness</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
</tr>
<tr>
<td>Helplessness</td>
<td></td>
</tr>
<tr>
<td>Shock (most often after sudden death)</td>
<td></td>
</tr>
<tr>
<td>Yearning (for the deceased person)</td>
<td></td>
</tr>
<tr>
<td>Emancipation</td>
<td></td>
</tr>
<tr>
<td>Relief</td>
<td></td>
</tr>
<tr>
<td>Numbness</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thoughts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Disbelief</td>
<td></td>
</tr>
<tr>
<td>Confusion</td>
<td></td>
</tr>
<tr>
<td>Preoccupation</td>
<td></td>
</tr>
<tr>
<td>Sense of presence</td>
<td></td>
</tr>
<tr>
<td>Hallucinations</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Sensations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hollowness in stomach</td>
<td></td>
</tr>
<tr>
<td>Tightness in chest</td>
<td></td>
</tr>
<tr>
<td>Tightness in throat</td>
<td></td>
</tr>
<tr>
<td>Oversensitivity to noise</td>
<td></td>
</tr>
<tr>
<td>Sense of depersonalization/derealization</td>
<td></td>
</tr>
<tr>
<td>Breathlessness, shortness of breath</td>
<td></td>
</tr>
<tr>
<td>Weakness in muscles</td>
<td></td>
</tr>
<tr>
<td>Lack of energy</td>
<td></td>
</tr>
<tr>
<td>Dry mouth</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behaviors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep disturbance</td>
<td></td>
</tr>
<tr>
<td>Appetite disturbance</td>
<td></td>
</tr>
<tr>
<td>Absentmindedness</td>
<td></td>
</tr>
<tr>
<td>Social withdrawal</td>
<td></td>
</tr>
<tr>
<td>Avoiding reminders (of deceased)</td>
<td></td>
</tr>
<tr>
<td>Dreams of deceased</td>
<td></td>
</tr>
<tr>
<td>Searching, calling out</td>
<td></td>
</tr>
<tr>
<td>Restless overactivity</td>
<td></td>
</tr>
<tr>
<td>Crying</td>
<td></td>
</tr>
<tr>
<td>Treasuring objects</td>
<td></td>
</tr>
<tr>
<td>Visiting places/carrying objects of remembrance</td>
<td></td>
</tr>
</tbody>
</table>


**SUMMARY**

The psychosocial impact of a disaster and the resources that will be needed to respond to the disaster can be estimated based on data from past experiences with a variety of natural and man-made disasters. Normal reactions to abnormal events include a range of distressing thoughts, emotions, sensations, and behaviors, which ought not to be characterized as a mental illness. However, early outreach can set the stage for those at risk for a psychiatric disorder to accept help in the future, should it be needed. Children display a variety of reactions that are normal given the extreme nature of the stressor and their level of emotional and cognitive maturity. Mental health responders must be culturally competent and attuned to the needs of special populations, and they, along with first responders, disaster workers, and hospital personnel, are particularly vulnerable to stress-induced symptoms. Work groups, schools, and entire communities not only react to a disaster but also serve as a conduit for support and psychoeducational information. There is no timetable for grief, and expressions of mourning and bereavement reflect the characteristics of the person, the loss, and the disaster.

**STUDY QUESTIONS**

1. What are the common psychosocial effects seen following a major disaster?
2. What are common psychological reactions to bioterrorism?
3. Describe the normal reactions of children to disasters. Describe the normal reactions of adolescents to disasters.
4. What types of strategies should be used to protect the emotional and psychological well-being of our nation’s children?
5. A small community in rural Massachusetts experiences a chemical explosion. Ten thousand people live in the community, with an average of four people in each household. Estimate the psychological impact of the disaster and the resources needed.
6. Identify populations that may have special needs for mental health services following a disaster. How would you attempt to meet these needs?
7. What types of reactions do disaster relief workers experience?
8. How can nurses help other nurses deal with the emotional aftermath of a disaster?
9. Describe the purpose of mourning, milestones, and anniversaries in dealing with the aftermath of a disaster.

**INTERNET ACTIVITIES**

can parents minimize the negative effects of watching the news?

2. Go to the Center for the Study of Traumatic Stress Web site at www.centerforthestudyoftraumaticstress.org. Click on Fact Sheets, then click on “Information for Relief Workers on ‘Emotional Reactions to Handling Human Bodies.’” Scroll down and click on “Information for Relief Workers on Emotional Reactions to Handling Human Bodies” and then click on “Leadership and Supervision for Body Recovery in Mass Death.” How should relief workers handle victims’ personal effects? What is the recommendation regarding use of perfumes, and so on, to mask odors? Is pairing relief workers with a buddy a suggested practice? What factors may increase the traumatic nature of the experience?

3. Go back to the Center for the Study of Traumatic Stress Web site at www.centerforthestudyoftraumaticstress.org and click on “Terrorism Preparedness.” Then click on the “New Normal.” What is “Secondary Traumatization” and who may be affected? When should children be referred to a pediatrician or mental health specialist?

4. Go to the Substance Abuse and Mental Health Services Administration home page at www.samhsa.gov, and click on “Publications” and select “Online Publications.” Scroll down the list of publications, select “Disaster/TRAUMA,” and then click on “Anniversary Reactions to a Traumatic Event: The Recovery Process Continues (NMH02-0140).” What are the common anniversary reactions experienced by survivors? What types of responses appear to facilitate coping?

**USEFUL LINKS**


Substance Abuse and Mental Health Services Administration of the Health and Human Services Department. Disaster and emergency services. http://www.mentalhealth.samhsa.gov/cmhs/EmergencyServices/reltopics.asp

**REFERENCES**


In September, 2005, I spent two weeks as an independent volunteer at Kelly Air Force Base in San Antonio, Texas where between 2,000 and 4,000 Katrina evacuees were cared for daily. I worked along with local professionals in a satellite mental health clinic at the base. We spent time “roaming” in the huge dormitories to talk with folks informally, provide support, and identify individuals and families who might benefit from more specific services in the clinic itself. In the clinic, we provided assessments of mental health needs, arranged for assistance with practical matters such as securing prescriptions; provided counseling around issues such as insomnia, flashbacks, anxiety; and provided support as people “told their stories” of horror.

The people we worked with in the clinic included people with severe and persistent mental illness who were being treated prior to Katrina. Many of these folks came seeking refills of their medications, or depot injections for their antipsychotics, knowing that their level of stress was leading to a potential or already actual exacerbation of symptoms. Others, without any previous psychiatric history, came seeking help for symptoms they had never experienced before. Many told of sleepless nights, increasing anxiety and agitation, poor appetite, and feelings of depression and uncertainty about the future.

The severity of these symptoms in the aftermath of the flooding and the chaotic and uncertain rescue conditions was compounded by the living conditions in the dorms. Several hundred people slept in each dorm with cots laid head to head and side by side, with no provision for privacy and no screen against the noise of such crowded conditions. Despite what these evacuees had experienced prior to their arrival and during their stay in the shelter situation, their overall response was generally one of gratitude for the help they were receiving. People I had not worked with approached me in the hallways and dorms to say “Thank you for what you are doing.” Individuals in the clinic were uniformly grateful for the assistance they were offered. And most of these folks had lost everything they had owned, some were still awaiting word on what had happened to other family members, and many already knew they had lost loved ones. Most were uncertain about what their future held.

The stories of two individuals with whom I worked, stand out for me. One was a 60-year-old gentleman named Donald who was diagnosed with schizophrenia. He appeared outside the clinic door one morning. He appeared exhausted, discouraged, and anxious. He was reluctant to come in but agreed to talk with me in the hallway. He related that he had been seen in the clinic a week earlier and been given prescriptions for his antipsychotic medication. The prescriptions had been sent to the emergency pharmacy, but as he went daily to pick up his medications, he had been told that either the medications were not ready or that he was no longer in the computer. Donald had not slept for several nights, which in part he attributed to not having his medication. I invited him to come into the clinic and register so we could give him new prescriptions. He just shook his head no and said, “It wouldn’t do any good this time either.” I was able to keep him talking to me in the hallway long enough so that eventually he began to relate to me in a way that allowed me to convince him to come in for new prescriptions and start over.

While he was waiting to be seen by the psychiatrist, he overheard me talking with another staff member about how to distribute a large number of Beanie Babies that a friend had sent with me to San Antonio. When I finished talking, Donald motioned for me to come sit by him again in the waiting area. He said, “I couldn’t help overhearing what you were saying. Do you think I could have a couple of those dolls for my wife? She is diabetic and depressed and I think those Beanie Babies would help to cheer her up.” Of course I replied that he could have the dolls. The next day, while roaming in the dorms, I came across the cots where Donald and his wife were staying. He called me over to meet his wife where she expressed her gratitude for the dolls propped up on her pillow. The expression on their faces represented the return of hope for this couple and the love of a man for his wife in the midst of despair. And fortunately, by this time, he had also obtained the medication that he needed.

The second story is that of Robin. Robin was 53 and had no previous psychiatric history. As she registered, she began to cry, with silently flowing tears and then with her body convulsing with sobs. She was unable to talk. After sitting with me in this state for several minutes, she started to choke out phrases, “I
can’t take a shower,” “I can’t flush the toilet,” “I can’t be around water.” I said, “You were in the floodwaters?” She described walking from her home for three and a half days looking for food for her children. She was in water up to her neck. The water was murky so she couldn’t see her feet. Several times she lost her footing and started to slip under the waters. Since she couldn’t swim, she was terrified that she would drown and that her children would be left alone. And now she couldn’t be near water, she couldn’t sleep, and she was afraid of letting her children see how afraid she was.

As Robin told her story, she began to calm some and respond to support. I was able to assure her that her reactions were normal, that it was all right to cry in front of her children and thereby give them permission to express their emotions. After a time she was able to tell me something about her life prior to Katrina, her work as a cook in a four-star hotel, her accomplishment of buying a house for her family the previous year, and her love of her family. Robin clearly responded to an opportunity to tell her story, to understand that her reactions were normal in an abnormal situation, and to identify her strengths from the past for use in the future.

Three months after my work in San Antonio, I traveled to India with a team of 16 nonprofessional short-term missionaries. Our task was to be family for 52 tsunami orphans at Christmastime and to be with them during the first anniversary of their losses. On the plane over, I wondered to myself what we could possibly do to help these children, most of whom did not speak English. I had no experience working professionally with children, and my role on this trip was not a professional one. Once we arrived at the orphanage, however, the children from our team led the way in connecting immediately with the orphans, without language, on the playground.

Taking our lead from them, the adults broke out toys and games we had brought with us. Soon we were laughing and hugging and playing together. The next day, one of the children told us through an interpreter, “We are so happy you came to be with us all the way from America and we were amazed that you adults took time to play with us.” Other “play” opportunities included taking the children to a Pizza Hut they had never before experienced, and treating them to a day at a water park where they began to learn that water could be fun instead of a terrifying and deadly experience. More serious activities included asking the children to draw their experience of the tsunami and then explain their pictures to us. The pictures were graphic and horrifying, but the children clearly found release in the activity and in talking about their experiences in the presence of people they knew cared about them.

We also participated with the children in a memorial service on the first anniversary of the tsunami, the last day of our stay. I had been asked to talk about my personal experience of grief and loss in the death of my husband in the same week as the tsunami. I shared some of my experience while also emphasizing the differences in their losses being so unpredictable, sudden, and premature. Knowing the burden of guilt that many carried in addition to their grief, I emphasized the normalcy of guilt as part of grief and the importance of finding ways to resolve that sense of guilt. As I talked about this piece of guilt, the children’s eyes were glued to me with what seemed a sense of connection and relief. I thought of the story one boy of 8 had told of holding the hands of two siblings, aged 1 and 2 and his inability to hold on to them through the swirling waves. And of the boy of 14 who was so traumatized by his inability to save his grandparents who drowned before his eyes, that he was mute for 4 months when he first arrived at the orphanage.

In the week we spent at the orphanage it was clear that although the children were still scarred by their heavy burdens of grief and guilt, they were healing. They were responding to the day-to-day care provided (often in better living conditions than they had ever experienced since they were untouchables from poor fishing villages along the coast), to the love of people who truly cared for them, to the structure of education that most had not enjoyed before, and to the therapeutic interventions that were being provided.
CASE STUDY

5.2

School-Mental Health Collaboration

Kathleen Coyne Plum, PhD, RN-CS, NPP

In early 1997, a 6-year-old named “Samantha” disappeared, allegedly on her way to school. Missing posters were visible throughout this rural western New York County. The entire community responded by participating in several large-scale search efforts in subzero weather. When the ground thawed that spring, her body was found by a farmer plowing his field late on the Friday before Memorial Day weekend. The girl’s mother’s boyfriend was the prime suspect in the murder.

The school already had a previous working relationship with the county mental health provider and opened the school on Saturday for counseling. That Saturday also provided an opportunity for mental health professionals, the principal, and teachers to develop a comprehensive and collaborative strategy for assisting children the next school day. A letter was drafted to parents, informing them of the event and the plans the school had made. Bus drivers also received information about the tragedy and what to do if a child had a problem. A mental health intensive case manager for children and youth and the school psychologist, who lived in the neighborhood, rode the school bus Tuesday morning; the principal greeted the children as they exited the buses. Teachers and retired teachers from that school were visible, friendly faces in the hallways. Retired teachers were also available to spell teachers who may have themselves felt drained or in need of a break.

The principal held a crisis meeting with teachers Tuesday morning before class, with mental health counselors present to provide information and answer questions. Access to the building was monitored, and the press was given information only through designated spokespeople (the principal and the mental health coordinator). Memory boxes were created in classrooms in which students could submit writings or drawings expressing their feelings about Samantha. A sundial was later selected as a permanent memorial for the elementary school courtyard. At the end of the day on Thursday—the day of the memorial service for the family, the school, and the community—a debriefing was held with teachers and counselors that focused on a review of how the situation was handled. Overwhelmingly, teachers felt that the event had gone smoothly and that children and parents seemed to find the experience supportive and emotionally beneficial.

Five mental health counselors were available to meet with individuals or groups referred by teachers on the Saturday after Samantha’s body was found, the first day back to school, and the day of the memorial service. Forty-seven children received 58 contacts; 7% of contacts included a parent; 24% occurred on an individual basis; and 69% occurred in a group setting. Almost half of contacts (49%) resulted in a referral to the school psychologist for ongoing monitoring and counseling. By far, most of the children referred were girls (79%), and elementary and middle schoolers, being housed in the same building, were equally affected.

A range of emotions, behaviors, and issues were manifested by the children during contacts with the counselors. Those most commonly encountered were sadness; fear, anxiety, or worry; loss and grief (present as well as past); vulnerability or lack of safety; guilt; powerlessness; anger and frustration; clingingness; teasing or provocative behavior; physical aggression; confusion; withdrawal; listlessness; difficulty concentrating; parental divorce, conflict, violence, or drug use; flight (wanting to go home); and listlessness or hyperactivity.

This poem, written by the second-grade class and their teacher, and poignantly read at the memorial service by two little girls, illustrates the effect of a traumatic event on the most vulnerable:

Little Girls

Little girls are full of giant-sized dreams,
brightness, and joy.

Little girls give us reasons to love and laugh.

Little girls play with their friends in a fun way.

Little girls make us believe in yesterday.

Little girls are proud of who they are and what
they can be.

Samantha will always be a little girl.
It has been recognized for more than a decade that disaster workers and first responders such as firefighters and rescue personnel may experience vicarious or secondary traumatization as a result of their exposures to mass casualties/disaster victims and the suffering of others (Figley, 1995). Yet very little formal research has been conducted that documents the nature and extent of this traumatization and its impact on those affected. Furthermore, numerous preventive and remedial self-care approaches have been proposed to counter the effects of secondary traumatization, but little formal evaluation of these approaches has been conducted to date. The goals of this case study are to briefly summarize the secondary traumatization research literature and to discuss some organizational and personal approaches that might prevent, deter, or ameliorate secondary traumatization in emergency workers and disaster personnel.

Secondary traumatization is an occupational hazard for all health care providers who provide direct patient care. In certain settings, exposures to traumatic situations may be repeated and potentially cumulative (Beaton & Murphy, 1995). The symptoms of secondary traumatization are often similar to those of primary posttraumatic stress disorder though the symptoms of secondary traumatic stress are generally thought to be less intense or potentially less enduring. Complicating the distinction between primary and secondary traumatic stress is the reality that many disaster workers and first responders are also directly exposed to potentially life-threatening events in the line of duty. Furthermore, the number and frequency of secondary exposure(s) to patients or disaster victims varies widely, with some data suggesting a cumulative impact across one’s career (Cornell, Beaton, Murphy, Johnson, & Pike, 1999).

Some evidence suggests that certain types of secondary exposures such as those experienced by body handlers (Taylor & Fraser, 1982) and to child and adolescent victims (Martin, McKean, & Veltkamp, 1986) may be potentially more harmful. Research with a sample of urban firefighters suggested that the most stressful incident scenarios that firefighters could imagine involved witnessing a line-of-duty death of one of their co-workers (Beaton, Murphy, Johnson, Pike, & Cornell, 1998). In this same study, the incident stressor that firefighters ranked as the second most stressful (out of 33 scenarios) was learning secondhand of a co-worker (firefighter) line-of-duty fatality.

Thus it should not be too surprising that firefighters throughout the United States were distressed and even traumatized by the line-of-duty deaths of 343 New York City firefighters on September 11, 2001, as a result of the terrorist attacks on the World Trade Center. At that time, my colleagues and I were conducting ongoing research with firefighters in a metropolitan fire department in a Northwest state. We were collecting, among other data, self-reports of traumatic stress symptoms from these firefighters as part of an investigation funded by the National Institute for Occupational Safety and Health (NIOSH). One of our twice yearly survey cycles had just begun on September 10, 2001. No firefighters in this investigation completed surveys on September 11, 2001, as they learned of the unprecedented numbers of line-of-duty deaths of their New York City Fire Department colleagues. The fire service is very much an occupational “family,” and it was obvious as I talked to several of the study participants that this tragic news hit the firefighters in the participating fire department very hard. In the days and weeks following 9/11, firefighters taking part in this study began to complete surveys; some 1–2 days post-9/11; some 1 and 2 weeks post-9/11; and some approximately 1 month following 9/11. Based on the posttraumatic stress disorder caseness cutoff employed, approximately one third of the firefighters in the participating fire department experienced new and clinically significant acute traumatic stress symptoms at one week post-9/11. Perhaps as importantly, within a few weeks their scores on the traumatic stress index employed were not significantly different from the baseline (September 10, 2001) reference group. A more complete description and analysis of these findings were published in the Journal of Traumatology (Beaton, Murphy, Johnson, & Nemuth, 2004).

In terms of prevention and management of secondary traumatic stress, both organizational and individual (self-care) approaches need to be considered (Morante, Moreno, Rodriguez, & Stamm, 2000). The disaster or first responder agency has an obligation to minimize the impact of a disaster event on its workers by incident management strategies such as rotating worker...
assignments so that the same workers are not assigned to the most stressful duties.

In terms of self-care, NIOSH (Centers for Disease Control and Prevention, 2002) has published a Traumatic Incident Fact Sheet for emergency workers that is educational and, at the same time, offers numerous suggestions for managing traumatic stress on-site at an incident and later after a disaster worker has returned home. Still, more research is needed to determine whether early interventions such as psychological first aid can deter the onset and progression of traumatic stress disorders in disaster personnel (National Child Traumatic Stress Network, 2005).

REFERENCES


Key Messages

■ The legal framework for dealing with a bioterrorist attack and the resultant public health crises combines government authority at the national, state, and local levels.
■ States are currently the leading source of legal authority for dealing with a public health crisis, and laws are different in each state.
■ Staff nurses and nurse administrators need to learn from the legal counsel in their institutions the legal framework for their state.
■ The ANA Code of Ethics for Nurses helps set forth a framework for dealing with the ethical implication of nurses’ response in a public health crisis.
■ The broader bioethical framework for dealing with a bioterrorist attack and the resultant public health crises is in flux.

Learning Objectives

When this chapter is completed, readers will be able to

1. Understand the sources of ethical and legal obligations for nurses and nurse administrators.
2. Discover that legal and ethical obligations may be similar, or may change, in the event of a bioterrorist attack or other public health crisis.
3. Explore and identify personal beliefs about disaster response and consider the impact they may have on professional values.
4. Be familiar with major legal and ethical issues related to nurses’ response in a disaster.
5. Become familiar with sources for legal and ethical guidance in the event of a bioterror attack and learn when it may be necessary to consult such sources.
Legal and Ethical Issues in Disaster Response
Amy T. Campbell, Kevin D. Hart, and Sally A. Norton

CHAPTER OVERVIEW
This chapter introduces various legal and ethical issues that may arise during a disaster or major public health crisis. It will begin with an overview of the legal system and describe the sources of law and ethical obligations, the importance of the various levels of government in public health regulation, and describe the resources that are available to nurses for legal and ethical advice. The second half of the chapter discusses specific legal and ethical issues that may arise in a public health crisis.

LEGAL AND ETHICAL FRAMEWORK AND BACKGROUND
Introduction to the Legal System
In order to understand how the law will impinge on nursing practice during a public health crisis, it is necessary to recall that in the United States there are three separate levels of government, all with a role in public health regulation. At the national level, the federal government oversees certain aspects of public health regulation, primarily through such executive branch agencies such as the Department of Health and Human Services and the Environmental Protection Agency. Yet, the U.S. Constitution limits the role the federal government can play in public health, as it grants to the national government only those powers specifically enumerated in the Constitution. Regulating health is not specifically mentioned in these powers, and, thus, to operate in this area the federal government must use one of its other enumerated powers, such as the power to raise and spend revenue. The impact of this constitutional restriction, as well as a frequently used method to circumvent it, can be illustrated through an example. Although it would probably not be constitutionally permissible for the federal government to directly impose a mandatory vaccination requirement, it could do the same thing by requiring all states that receive federal funds from some federal health program to require the vaccination or face the loss of funds. Through this use of the constitutional power to allocate funds, the federal government could extensively regulate in the
public health field, although it generally has not used this means.

As a result of the constitutional division of governmental powers, and in the absence of federal action, it usually falls to the state governments to engage in the primary regulation of public health. State governments are endowed with the complete array of public health powers, including the power to enforce quarantines, require vaccinations, impose disease reporting requirements, and any other power needed to protect the public’s health. This power is generally unlimited, save for the requirement that any public health law, or any other law, must not violate any restrictions imposed by either the state or federal constitutions.

Local governments may also exercise public health regulatory powers, but because local governments are considered creations of the state, their powers are, in most states, limited to those powers specifically granted by the state government. For example, in most states a local government (like a city or county) could not impose a mandatory vaccination law, absent a law passed by the state legislature granting them this power.

Ideally, the division of responsibility would be based on what makes the most sense in terms of the optimum functioning of the public health system. In practice, there are overlaps and gaps in the division of responsibility. Even more troubling for someone trying to fathom public health policy, each state is free to adopt its own regulatory scheme, making it difficult to make simple statements about what the law allows or requires—nurses—or other health professionals—to do in a public health crisis. In the discussion in the second portion of this chapter, the reader is cautioned to seek professional advice on the law in his or her own state.

**EFFECT OF LAW ON NURSE PROFESSIONALS**

Law, that is, the rules and regulations under which nurses must carry out their professional duties, can come from many different sources. The most commonly thought of laws are what lawyers call statutes. These are the laws enacted by the legislative body—Congress in the case of the national government and in the case of the states, the state legislatures, often called the state assembly and state senate. These are not the only source of law governing nurses. Both federal and state agencies (often the departments within the executive branch, such as the U.S. Department of Health and Human Services) typically have the authority to issue regulations, sometimes called rules, which have the same effect as the statutes the legislative body enacts by governing implementation of such statutes. A third source of law is the decisions of the courts, which interpret the laws enacted by the legislative branch.

All of these sources of law can affect nurses in many different ways. For example, laws may require them to do some affirmative act, such as report new cases of certain diseases to the local or state health department. There may be criminal penalties for those who fail to comply with these requirements. The laws may also give the authority to certain government officers to require nurses to either do or refrain from doing something in a particular circumstance. Law can also create certain responsibilities for nurses, such as laws that impose civil liability for the failure to provide professionally adequate care. (Civil liability is where an individual may be required to pay monetary damages to another individual, or in some cases to the government, for failure to comply with a legal obligation.)

Unfortunately, because laws are the result of compromises and are meant to cover a broad array of circumstances, some of which the drafter may not be able to contemplate when writing the laws, legal rules do not always provide a specific course of conduct in a particular situation. Nursing professionals must work with the legal professionals on the hospital’s staff when questions arise concerning the proper course of conduct in a particular circumstance.

**RELATIONSHIP BETWEEN ETHICAL AND LEGAL OBLIGATIONS**

As will be seen in some of the specific situations discussed later in this chapter, there can be different relationships between a nurse’s ethical and legal obligations. In some cases the ethical and legal obligations will be coextensive. That is, both what the law and the ethical obligations require will be the same. In other situations the legal obligations may be less stringent that what is required ethically of the nurse. In some cases there may be no legal obligation imposed at all, yet, there is an ethical obligation. In this way, ethics operates in tandem with, but often covers more scenarios than, the law.

Nurses’ ethical obligations come from many different sources, but one formal source is the professional code of ethics. The American Nurses Association (ANA) Code of Ethics for Nurses (see Table 6.1) proscribes the ethical obligations of nurses, in nonnegotiable in nature, and expresses the profession’s commitment to society (ANA, 2001). Nurses can also turn to the broader field of bioethics for additional resources.

As the field of bioethics develops, it has reflected issues of import in society, such as abortion, euthanasia, self-determination, and the ethical conduct of research. Much of contemporary bioethics has roots in the values
of individualism and autonomy (Moreno, 2002). Emphasis in bioethics has tended to be on issues of individual rights, personal freedom, and choice; there has been less emphasis on the public good (Gostin, 2002). These values are important to note because they also reflect how resources are allocated, with the vast majority of funds allocated to biotechnology and health care and much less to population-based services (Gostin, 2002). Since the events of 9/11, assessments of vulnerability to terrorism and how best to respond to mitigate harms have had a nationwide focus (Shalala, 1999). This broadened view has only increased in the wake of Hurricane Katrina and fears over a pandemic influenza outbreak. As the focus shifts to public response and public good, leaders in bioethics may begin to reevaluate the prominence of autonomy. According to Moreno, “the emphasis on autonomy and individual rights may come to be tempered by greater concern over the collective good” (2002, p. 60). An increased emphasis on the collective good would have profound effects on the delivery of health care in the United States (Richards, 2005).

THE MODEL STATE EMERGENCY HEALTH POWERS ACT

Following the events of 9/11, the National Governors Association, the National Conference of State Legislatures, the Association of State and Territorial Health Officials, and the National Association of County and City Health Officials recognized the need to revamp state public health laws to increase the ability of states to deal with a public health crisis. A few states, either through their statutes or administrative regulations, had adopted legal frameworks to deal with a bioterrorist attack (Hodge, 2006). Most, however, lacked a legal response framework, or had only outdated or inadequate measures in place (Hodge, 2006). The Center for Law and the Public’s Health at Georgetown and Johns Hopkins Universities has drafted a model law, the Model State Emergency Health Powers Act (MSEHPA), to give state governments a clear legal framework for dealing with a public health crisis, particularly one caused by an act of bioterrorism.

The model law is one that states are free to adopt or not, and to amend in any way they wish. As of April 2006, 44 state legislatures and the District of Columbia have introduced bills based on the MSEHPA; 37 states and D.C. have passed related bills (Hodge, 2006).

The MSEHPA grants to the governor of the state the power to declare a public health emergency in the event of a bioterrorist attack (and some other types of events such as a chemical attack or a nuclear accident). The declaration of the public health emergency would give the state health department (or other designated state agency) certain powers during the duration of the public health emergency. The Model Act is structured to reflect five basic public health functions to be facilitated by law: (1) preparedness, comprehensive planning for a public health emergency; (2) surveillance, measures to detect and track public health emergencies; (3) management of property, ensuring adequate availability of vaccines, pharmaceuticals, and hospitals, as well as providing power to abate hazards to the public’s health; (4) protection of persons, powers to compel vaccination, testing, treatment, isolation and quarantine when clearly necessary, and (5) communication, providing clear and authoritative information to the public. The Model Act also contains a modernized, extensive set of principles and requirements to safeguard personal rights. As such, law can be a tool to improve public health preparedness (Gostin et al., 2002, the nature and extent of these powers will be discussed in the second part of this chapter.)
THE ROLE OF GOVERNMENT IN A PUBLIC HEALTH CRISIS

As stated earlier, the federal government has a somewhat limited role in public health and consequently in managing a public health crisis. The model of federal government intervention in public health crises is to assume a subservient role to state and local government, unless or until the state requests federal intervention. Historically, the health of a population is presumed to be a local/state matter (Hillsborough County v. Automated Medical Laboratories, Inc., 1985). Following the events of 9/11, Congress has focused more federal attention on helping manage a public health crisis. The following sections will outline the present role of local, state, and federal governments in managing a public health crisis. (Although outside the scope of this chapter, international law may also apply. In 2005, the World Health Organization passed new International Health Regulations, which go into effect in the United States in 2007.)

Local Government

In many public health crises arising from a bioterrorist attack, local governments—in most states city, town, or county government—will be the first to respond. Most state laws authorize (and some may require) that local governments draft local disaster preparedness plans, to plan the coordination of resources, manpower, and services in the event of an emergency (e.g., see New York Executive Law, § 23 [2002]). There is frequently a provision in state law allowing for the creation in local governments of an agency to deal with emergencies.

In order to deal with emergencies, the local government executive, such as the mayor of a city, may be authorized by state law to declare an emergency or may request the state governor to declare a state of emergency (e.g., New York Executive Law, § 24(1) [2002]). Once the state of emergency is declared, the executive is frequently authorized by state law to suspend certain laws or to put into place special regulations for the duration of the state of emergency. For example, under New York State law, the local government executive has the authority, among other powers, to put into place a curfew, prohibit or limit the movement of individuals, and establish emergency medical shelters (New York Executive Law, § 24(1) [2002]).

State Government

Local governments are limited in the resources they can employ in an emergency, and, thus, the state government will frequently become involved when the emergency is large. State law may allow the governor to declare an emergency in the event of a state of emergency is declared, the executive is frequently authorized by state law to suspend certain laws or to put into place special regulations for the duration of the state of emergency. For example, under New York State law, the local government executive has the authority, among other powers, to put into place a curfew, prohibit or limit the movement of individuals, and establish emergency medical shelters (New York Executive Law, § 24(1) [2002]).

Federal Government

States themselves may not have sufficient resources to handle emergencies, and when this occurs, they may request assistance from the federal government. Typically the state governor will request that the President declare all or a portion of the state a federal disaster area, which will allow the use of federal resources to deal with the emergency (42 U.S.C. § 5191(b) [2002]). The President may, under certain circumstances, declare an emergency without a request from the state’s governor (42 U.S.C. § 5191(b) [2002]). The federal agency currently designated to coordinate the federal response to an emergency is the Federal Emergency Management Agency (FEMA). Created in 1979 by Executive Order, on March 1, 2003, FEMA became part of the Department of Homeland Security (DHS), once the latter was formerly created by the Homeland Security Act of 2002. The stated mission of DHS is to prevent terrorist attacks and reduce our vulnerability to such, as well as to mitigate any effects from attacks. FEMA’s role falls under DHS’s “Emergency Preparedness and Response” branch, with domestic emergency preparedness and response functions. Within DHS, FEMA’s mission continues as it was since its inception: to lead preparedness for all domestic hazards and manage the federal response and recovery efforts following a national incident. Its actions, however, following Hurricane Katrina, as well as the numerous communication failures among and between all levels of the government response, have put FEMA—and its
partners—under greater scrutiny than ever (MSNBC, 2005). When there is a public health and medical services component to the emergency, the Public Health Service, within the Department of Health and Human Services (HHS), is the lead federal agency to coordinate the federal response (DHS, 2004). In 2002, an office within HHS—the Office of Public Health Preparedness—was created and charged with advising the Secretary of HHS on matters relating to bioterrorism and public health emergencies and coordinating the national response to such (67 Federal Register 1980 [2002]).

After 9/11, the federal government adopted a National Response Plan (NRP), built on the template of the National Incident Management System (NIMS), which adopts an all-hazards approach to emergency management, helping streamline a national response irrespective of the cause of the emergency (i.e., terrorist or natural; DHS, 2004). The NRP applies to all incidents requiring a coordinated federal response and is scalable to the nature of the event. However, NRP maintains the local/state primary role in public health response, with a continued premise that state and local authorities will handle the first response. (A private-sector role is also envisioned.)

Both Congress and the state governments are currently addressing some of these issues, which may result in clearer roles for the different levels of government.

**SPECIFIC LEGAL AND ETHICAL ISSUES**

**Privacy Issues**

**Case Example:** An outbreak of an infectious disease leads public health officials to believe that a bioterror attack has occurred. To avoid panic in the public, however, they have made no public announcement of their suspicions. They have requested, however, that nurses be on the alert for new cases of the infectious disease and to report it to them immediately, along with certain information about the patient. A nurse asks her supervisor if she can legally make such reports.

**Reporting of Diseases**

Under their police powers, states have the constitutional authority to require health care providers to report new cases of diseases. Although such reporting raises an issue concerning patient privacy, the U.S. Supreme Court has upheld the authority of states to require the collection of disease information.

Each state varies considerably as to which diseases must be reported, to whom the information is reported, who is required to report, and what information they are required to provide concerning the patient. For example, whereas almost all states require reporting of new cases of anthrax, either within 24 hours or sometimes beyond 24 hours of diagnosis, less than half of the states require any reporting of new cases of smallpox (Horton, Misrahi, Matthews, & Kocher, 2002). (For a summary of the different state laws on the reporting of diseases that might possibly be associated with a bioterrorist attack, see Horton et al., 2002.)

The release of infectious agents as a result of a bioterrorist attack may well be covert, and the release may be discovered only through careful reporting and tracking of disease information. With this in mind, the MSEHPA would, if adopted by a state, allow the state to mandate the reporting and tracking of diseases specified by the state public health agency. In addition, the state could require pharmacies to report unusual or increased prescription rates, unusual types of prescriptions, or unusual trends in pharmacy visits that might accompany a public health crisis.

Nurses should already be aware of the reporting requirements of the state and local governments in the areas where they currently practice. In the event of a public health crisis resulting from a terror attack, nurses will need to keep current on any additional reporting requirements that may be imposed by state and local health authorities. If the reporting is anonymous, then there is not concern for confidentiality of the individual. Where the reporting requires the naming of a particular individual, however, this raises both legal and ethical concerns surrounding the privacy and confidentiality of medical information, which will be discussed in the next section.

**Disclosure of Health Information**

When health information contains information that would identify the individual, issues are raised concerning both privacy and confidentiality. Frequently these two terms are used interchangeably (Gostin, 2000, p. 127), but there are technical distinctions between the two. Privacy is an individual’s claim to limit access by others to some aspect of his or her life (Gostin, p. 127), whereas confidentiality is a type of privacy aimed at preserving a special relationship of trust (Gostin, p. 128), such as the relationship between medical care provider and patient.

Medical information can be identifiable not only when it contains the name of the individual, but also when it contains sufficient other information to identify the individual. This would include such information as the person’s address, telephone number, social security number, date of birth, or other personal characteristics.
that allow a third person to connect the health information with the individual. When data are collected about individuals within a small geographical area, such as a small town or a zip code, even data such as a person’s race or ethnic origin can be sufficient to allow personal identification.

Although one U.S. Supreme Court decision appears to recognize a constitutionally protected right to privacy of medical information (Whalen v. Roe, 1977), this right is fairly narrow (Gostin, 2000, p. 133), and, thus, any protection of health information must be either the result of federal or state legislative action. Currently there is a complex web of federal and state laws and regulations that govern privacy of medical information.

In the Health Insurance Portability and Accountability Act of 1996 (HIPAA, 2001, pt. 160 and pt. 164), Congress authorized HHS to issue regulations governing the privacy of health information in the hands of providers. The new regulations provide protection for patient health information that is in the hands of doctors, hospitals, insurance companies, and some other entities. The exact protections and coverage of the regulations are complex and subject to revisions by HHS (for a summary of the regulations, see http://www.hhs.gov/ocr/hipaa/). Generally, the regulations tell providers what protections they must provide for identifiable medical information and when the patient must approve release of medical information. In July 2006, HHS also released a new Web-based, interactive HIPAA Privacy Decision Tool to assist emergency preparedness planning and HIPAA compliance (accessible via Web site at http://www.hhs.gov/ocr/hipaa/decisiontool/).

However, though extensive, two provisions of the HIPAA regulations, taken together, remove most public health information from its reach. First, the regulations permit providers to disclose protected information “for public health activities and purposes” to public health authorities (HIPAA, 2001, pt. 164.512(b)). In addition, another provision of the regulation recognizes that state law will govern the disclosure of medical information for purposes of “public health surveillance, investigation, or intervention” (HIPAA, 2001, pt. 160.203(c)). Thus, under HIPAA, health care providers can still share patient information to prevent or lessen a serious or imminent threat to the public health, consistent with other law and professional standards. HIPAA also does not affect disclosure by noncovered entities (Centers for Disease Control and Prevention, 2003).

The MSEHPA would address the issue of confidentiality in two ways. First, access to health information of a person who has participated in medical testing, treatment, vaccination, isolation, or quarantine programs or “efforts by the public health authority during a public health emergency” is limited. Only persons who will provide treatment, conduct epidemiological research, or investigate the causes of transmission may gain access to this information (MSEHPA, 2002, § 607(a)). The MSEHPA also addresses limitations on disclosure. Generally, disclosure of health information could not be made without the consent of the individual. Five exceptions are:

1. Disclosure directly to the individual.
2. Disclosure to the individual’s immediate family members or representative.
3. Disclosure to appropriate federal agencies or authorities pursuant to federal law.
4. Disclosure pursuant to a court order to avert a clear danger to an individual or the public’s health.
5. Disclosure to identify a deceased individual or to determine the manner or cause of death (MSEHPA, 2002, Section 607(b)).

Nurses have ethical obligations to protect the privacy and confidentiality of the patients with whom they work. The dual obligations of privacy and confidentiality arise out of the fiduciary relationship between a patient and a nurse. Breaches in confidentiality and privacy endanger the patient–nurse relationship and may pose risks to the patient. However, the nurse’s ethical obligation to maintain the privacy and confidentiality of the patient is not absolute (ANA, 2001). Under several circumstances a nurse’s obligation to maintain privacy and confidentiality may be superseded by competing obligations in order to protect the patient (e.g., an actively suicidal patient at risk for imminent harm), to protect innocent others (e.g., mandatory reporting of child or elder abuse), and mandatory disclosure for public health reasons (ANA, 2001). In the context of a disaster response, especially responses to biological or chemical terrorism, disclosures of identifiable patient information may be ethically obligatory.

Quarantine, Isolation, and Civil Commitment

One of the traditional public health tools is government-compelled isolation of persons with infectious diseases. Although often used interchangeably both by public health professionals and in public health laws (Gostin, 2000, pp. 209–210), there is usually a distinction made between the terms quarantine, isolation, and civil commitment. Quarantine had its origins in maritime law and practice. It was the forced isolation of a vessel, its crew and passengers, and its cargo for a period—traditionally 40 days—when the vessel was suspected of carrying an infectious disease. Today quarantine is usually considered to be the restriction of the activities of a healthy person who has been exposed to a communicable disease, usually for the period of time necessary for the disease to reveal itself through physical symptoms (Gostin, p. 210). Isolation, on the other hand, is usually defined to mean the separation of a person known to
have a communicable disease for the period of time in which the disease remains communicable. Some make the distinction between status-based isolation, which is the confinement of infected persons based on their diseased status alone, and behavior-based isolation, which is the confinement of infected persons who engage in dangerous behavior (Gostin, p. 210). (For a helpful discussion clarifying between quarantine and isolation, see Centers for Disease Control and Prevention, 2005.) Civil commitment is often associated today with proceedings in the mental health system to forcibly confine someone who is mentally ill and a danger either to themselves or to others. More broadly in public health, civil commitment “is the confinement (usually in a hospital or other specially designated institution) for the purposes of care and treatment” (Gostin, p. 210).

Because of the restriction on a person’s liberty, the courts have long had to struggle with exactly when the state can limit an individual’s freedom in order to protect the public’s health. Today’s jurisprudence recognizes the authority of the state to confine a person for public health purposes, but imposes several important limitations. First, there must be a compelling state interest, which means that there must be a significant risk of disease transmission. Second, the intervention must be narrowly and directly related to the group that is infected. Thus, a state-mandated isolation of all in a particular geographic area, which included both those infected and those who were not, would likely be invalid (Gostin, 2000, p. 214). The restriction on free movement must be the least restrictive alternative to achieve the state’s health objectives. Finally, there must be procedural fairness in the process used to confine an individual for public health purposes (Gostin, p. 215), including notice, counsel, a hearing, and a right to appeal.

As can be imagined, in a public health crisis the need to provide procedural protections may conflict with the need to act rapidly to avoid the spread of disease. Thus, the MSEHPA provides for temporary isolation and quarantine without notice, if delay would “significantly jeopardize the public health authority’s ability to prevent or eliminate the transmission of a contagious or possibly contagious disease to others” (MSEHPA, 2002, § 605(a)). After exercising this emergency power, the public health authority would be required to petition a court within 10 days to continue the isolation or quarantine. The public health authority would also be authorized to seek isolation or quarantine through a judicial proceeding that would provide notice and a hearing for the individuals involved (MSEHPA, 2002, § 605(b)).

A private individual who confines another individual without consent commits a civil wrong (called a tort), which could possibly result in the payment of damages. Hospitals that are operated by the government are required to follow constitutionally mandated procedures for isolation and quarantine. Thus, nurses and nurse administrators at both private and public hospitals need to proceed with caution in attempting to restrict the movement of a potentially infectious person. The hospital’s legal counsel and the appropriate health official in the state should be contacted to find out how to proceed.

Ethically, the restriction of movement of a potentially infectious person is highly problematic. It violates the core of the ANA Code of Ethics, respect for the inherent dignity of individuals—the nurse’s primary commitment to the patient (ANA, 2001). In the event of a public health emergency, a nurse may have a corresponding obligation to the community. The nurse should work to resolve the dilemma in such a way to “ensure patient safety, guard the patient’s best interests and preserve the professional integrity of the nurse” (ANA, 2001, p. 10).

Vaccination

Under their police powers, states have the governmental authority to require citizens to be vaccinated against disease. The U.S. Supreme Court, early in the last century, upheld the authority of states to compel vaccination, even when an individual refused to comply with the mandatory vaccination laws (Jacobson v. Massachusetts, 1905). All states currently have laws that require school children to obtain vaccinations against certain diseases, such as measles, rubella, and polio, before attending school. In a public health crisis, however, the question may arise whether the state (or local) government could require an individual to be vaccinated against an infectious agent released into the general population. The state or local government must have the authority to do so. This may arise from a specific grant of authority by the state legislature to mandate vaccinations in the wake of a public health crisis, or the authority may be found in more general grants of authority given specific government agencies to protect the public’s health. Given that the latter may be too vague to assure the public health agency the authority to act, MSEHPA would specifically grant the state public health authority the power to require vaccination in the event of a declared public health emergency (MSEHPA, 2002, § 603(a)).

Mandatory vaccinations impinge on the rights of individuals to freely decide their own health care, but, as noted earlier, the courts have generally upheld mandatory vaccinations. Because all laws are subject to the constraints of the federal and state constitutions, which grant protection for religious freedom, mandatory vaccination laws frequently are challenged as violating constitutionally protected religious freedom. The U.S. Supreme Court has upheld laws that require vaccinations before children attend school, even in the face of religious freedom claims. Most states, however, although not constitutionally required to do so, allow
exceptions for individuals raising religious objections to mandatory vaccinations. The state courts, however, often strictly construe these rights. The MSEHPA currently does not contain an exception based on religious objections, although a state adopting the Act would be free to add one if it chose.

A second difficulty raised by mandatory vaccination requirements is that some individuals may react adversely to vaccinations, particularly individuals who have other health conditions or who are taking medications for chronic illnesses. States often recognize this problem and provide exceptions to their mandatory vaccination laws for those who are susceptible to adverse reactions. These provisions vary from state to state. The proposed MSEHPA contains a provision that requires the vaccination “must not be such as is reasonably likely to lead to serious harm to the affected individual” [MSEHPA, 2002, § 603(a)].

State laws on mandatory vaccination vary considerably in the legal implications for nurses and administrators. Typically, it is the individual who falls within the class required to be vaccinated who bears the legal burden. Thus, laws that condition the attendance in public schools on first having a vaccination for a particular disease typically bar the individual from school if there is no vaccination. Other laws may impose a criminal fine or other criminal penalty on the individual who refuses to be vaccinated. In some cases, state laws may allow for the isolation or quarantine of individuals who refuse to be vaccinated. Some state laws may require that health professionals, including nurses, inform certain patients about vaccination requirements and might possibly require some action, such as notification to a local or state health department, if the vaccination is refused. Nurses will need to check with the legal counsel of their hospital for the specific requirements in their state.

Treatment for Diseases

The U.S. Supreme Court affirmed the right of adults to select the course of treatment for their disease, including the right of adults to refuse treatment. This right is not absolute, however. For example, when children are involved, the courts have consistently upheld the power of the state to step in and require treatment, even in the face of religious objections by the parents to medical treatment (Prince v. Massachusetts, 1944). Moreover, most state public health laws contain provisions mandating treatment for certain contagious diseases, such as sexually transmitted diseases and tuberculosis (Gostin, 2000, p. 218).

As with the authority of the state to mandate vaccination during a public health crisis, there must be some authority granted by the state legislature to the state or local agency to require treatment. In order to clarify the authority of the state public health authority to require treatment in a public health crisis, the MSEHPA would allow mandatory treatment of persons with infectious diseases during a declared public health emergency (MSEHPA, 2002, § 603(b)). Persons who refuse treatment on grounds of religion, conscience, or health could be isolated or quarantined (MSEHPA, 2002, § 603(b)(3)).

Screening and Testing

**Case Example:** Because public health officials suspect a “stealth” bioterror attack, they request that hospitals secretly test all of their new patients for the suspected contagious disease. The patient is to be notified only if he or she tests positively for the disease, and he/she will be offered standard medical treatment. Reports are to go directly to public health officials. Can a nurse legally or ethically participate in such a program?

Screening and testing are two related, yet distinct, public health tools. Testing usually refers to a medical procedure to test whether an individual has a disease. Screening, on the other hand, might be thought of as testing all the members of a particular population. Although this distinction is important to public health officials, public health laws often use the terms interchangeably or make no sharp distinction between the two.

Laws on testing and screening can take many different forms (Gostin, 2000, pp. 193–194). Some screening or testing laws are compulsory; they apply to anyone who is a member of a particular population. An example is laws that require all pregnant women to be tested for sexually transmitted diseases (STDs). Other testing or screening laws are conditional on a person receiving some public benefit or service. Examples would be laws requiring individuals to be tested for STDs prior to getting a marriage license and laws requiring testing for tuberculosis before a student can attend public schools.

Legal controversy arises in several different situations. First, there is an implied right in the civil law (called a common-law right) for individuals to consent to all medical procedures, including testing, before it is performed (Gostin, 2000, p. 195). Thus, a medical professional who performs a test without first obtaining consent is open to a lawsuit for monetary damages. There are some cases where the testing is so routine and has come to be expected that the courts will imply consent on the part of the patient when they seek medical
care for a particular condition, as is the case with testing for certain blood-borne diseases (Gostin, p. 195).

Where the medical professional is a government employee, such as nurses working in a local, state, or federal hospital, testing or screening without consent can raise issues based on the constitutional protections against government searches and seizures. The court decisions in this area are very complex and often hinge on a host of factors. Generally, if the screening is for public health purposes, rather than for the prosecution of a criminal case, the courts find there is no constitutional problem to screening or testing without consent. (For a more complete discussion of the legal nuances in this area, see Gostin, 2000, p. 196.)

In the event of a public health crisis resulting from a bioterror attack, there may be a public health need to screen the population for a disease. The MSEHPA would allow medical examinations and testing performed by any qualified person authorized by the public health authority (MSEHPA, 2002, § 602(a)). Persons who refuse the medical examination or treatment could be isolated or quarantined (MSEHPA, 2002, § 602(c)). The authors of the MSEHPA recognize that testing can cause harm to particular individuals and, thus, require that the tests “must not be such as are reasonably likely to lead to serious harm to the affected individual” (MSEHPA, 2002, § 602(b)). It is not clear who would make this determination. It may be that this would be left to the discretion of the health professional administering the test. On the other hand, it may be that the public health authority (such as the state health department) would issue exceptions for particular classes of individuals (MSEHPA, 2002).

Nurses and nurse administrators who are ordered to perform mandatory testing or screening in a public health crisis face both legal and professional ethical issues. Because civil liability for performing a screening test without proper consent can fall on both the nurse and the institution, nurses and administrators must work closely with the legal counsel to assure they are acting properly in carrying out the testing.

Beyond legal liability, however, is the question of whether nurses may ethically perform mandatory testing, even in the event of a public health crisis, without proper consent. One of the cornerstones of contemporary bioethics is patient autonomy (Beauchamp & Childress, 2001), effectuated by the ability to give informed consent. Patients have the right to refuse testing and treatments based on the right to self-determination. However, provisions within the ANA Code of Ethics leave open the possibility that the right to self-determination may be superseded in the event of a public health emergency. Overriding such a basic right, however, requires compelling justification because of the tremendous risks and harms associated with limiting freedoms.
health counseling, and provision of care supportive to or restorative of life and well-being, and executing medical regimens prescribed by a licensed physician” (New York Education Law, § 6902(1), 2002). Clearly, this language gives wide latitude to the scope of legally permitted nursing activities.

In the event of a public health crisis following a bioterrorist attack, there may well be a shortage of qualified medical personnel, particularly in the early stages. Clearly, the law in some states has anticipated this to some extent and allows for nurses from other states to help out without running afoul of the licensing laws. Even where there is not express legal authority to waive licensing requirements for out-of-state nurses, it is difficult to conceive that a state professional licensing board would not use discretion in allowing out-of-state nurses to practice during a health emergency.

A more difficult legal problem arises if during a public health crisis nurses are called on to perform medical services not typically viewed as within the scope of nursing practice. Again, it is difficult to conceive that licensing boards would raise objections in the face of a serious public health crisis. However, practicing outside the scope of their nursing license might subject nurses to civil liability from injured patients. Some states have dealt with this problem through Good Samaritan laws, which are covered in the section following that deals with liability issues. The MSEHPA would relieve out-of-state emergency medical workers of liability for civil damages arising out of care provided in a public health emergency, unless the care exhibited a “reckless disregard for the consequences so as to affect the life or health of the patient” (MSEHPA, 2002, § 608(b)(3)).

Although this is a dynamic arena, efforts to anticipate and plan for what nurses may be called on to do in the event of an emergency are well under way. Emergency and disaster nurse leaders have identified new core competencies for all nurses regarding emergency preparedness in the event of a disaster or bioterrorism emergency (see chapter 28 for further discussion). Nurses who have already completed their basic education have an ethical obligation to update their training to encompass these new core competencies.

A call to act outside of the scope of practice presents a complex dilemma. Not all events can be anticipated and planned for in advance. Nurses may be asked to perform duties not within their normal scope of practice and expertise imposing a risk to the patients. A nurse may be morally justified in taking such action if the nurse takes due care to minimize harm. “Due care is taking sufficient and appropriate care to avoid causing harm, as the circumstances demand of a reasonable and prudent person” (Beauchamp & Childress, 2001, p. 118). Ethically and legally emergency situations often justify risks that would not be justified in a nonemergency situation, for example, performing a needle decompression to relieve a tension pneumothorax on a victim of blunt trauma (Beauchamp & Childress). Indeed, a failure to act in such a situation may be ethically unjustified.

Resource Allocation

Despite preparation, a bioterrorist attack or a disaster involving a large number of casualties or casualties in excess of personnel and resources will challenge providers to justly allocate resources. In this case resources might be medical supplies, antibiotics, antitoxins, pain medications, vaccines, and/or personnel. One aspect of justice in health care is the concept of distributive justice. Distributive justice links to such issues as the fair and equitable allocation of scarce resources (Edge & Groves, 1994). There is currently much debate about the fair distribution of health care resources in the United States; disasters provide an even more complex challenge to distributing resources.

Triage is one mechanism for allocating scarce resources in emergency situations. Triage is a French word meaning to sort. Emergency room and military personnel use triage to prioritize treatments of wounded persons. Utilitarian theory, “to do the greatest good for the greatest number” (Beauchamp & Childress, 2001, p. 270) is the ethical basis for triage. The categories by which one sorts, however, can be different. For example, in the military, the practice of triage is to sort the wounded into three groups—the walking wounded, the seriously wounded, and the fatally wounded. The walking and seriously wounded receive immediate attention, the walking wounded so that they may be returned to fight in battle, the seriously wounded to save their lives. Those deemed fatally wounded are given narcotics to be kept comfortable, but their wounds are not treated (Edge & Groves, 1994). In emergency rooms and at disaster sites the wounded are also sorted into categories according to medical need and medical utility (Beauchamp & Childress). Treated first (triage level 1) are those people who have major injuries and will die without immediate help; second are those whose treatment can be delayed without immediate danger (triage level 2). The third group treated is those with minor injuries (triage level 3), and the last group is those for whom treatment will not be effective. In emergency rooms treatment for those with minor injuries tends to be delayed because the order of treatment is based on only medical need and medical utility.

Military triage is based on medical need, medical utility, and an additional category, social utility. Social utility is the notion of allocating resources to those who may be the most useful or most valued in a society (Edge & Groves, 1994). In the military there is a social utility to treating those with minor injuries quickly because
to do so serves a larger social purpose of returning soldiers to the battlefield to help win the battle. In contrast, emergency room triage is based on only medical need and medical utility. The use of social utility as a factor in triage decisions in emergency rooms is highly problematic.

Treating large numbers of persons in a disaster raises ethical questions for nursing. Clinicians are called to use their expertise to provide maximum benefit to the greatest number of people (Pesik, Keim, & Iserston, 2001). Exactly how to provide the greatest benefit for the greatest number, however, is ethically complex. For example, is it ethically justifiable to treat a nurse with minor injuries (triage level 3) before treating someone with serious but stable injuries (triage level 2)? Typically level 2 patients would be treated prior to level 3 patients. The argument for treating health care persons with priority is that those persons, once treated, will assist in the effort of treating all the casualties. Thus, treating health care providers first will serve the larger social goal of saving as many lives as possible. This is based on a judgment of the social utility of a health care provider.

In an emergency situation, this justification holds “if, and only if, his or her contribution is indispensable to attaining a major social goal” (Beauchamp & Childress, 2001, p. 271).

The use of medical utility to justify triage decisions is well established; the use of social utility is more problematic. For example, with the advent of hemodialysis during the early 1960s, demand for dialysis therapy exceeded the capacity to provide such therapy. Committees were set up to sort through the existing patients and prioritize them for treatment. Criteria for treatment included age, marital status, sex, number of dependents, educational level, future potential, and emotional stability (Edge & Groves, 1994). It is interesting to note that the “committees’ choices favored males, Caucasians, and the middle class or above” (Edge & Groves, p. 175). Choices for dialysis therapy are now based on medical need and medical utility. The use of social utility to justify triage decisions requires extreme circumstances, clear guidelines, and compelling evidence to support that those benefiting will, in turn, fulfill their obligation to enhance the social good.

Professional Liability

All health care professionals, including nurses, are subject to civil liability for providing substandard health care. Malpractice liability is generally a matter of state law, although the law of malpractice liability is very similar in all of the states. A nurse may be held liable, that is, have to pay monetary damages, for providing professional care that is below the standard followed by the profession. Absent special legislation, liability for medical professionals continues, even when they are performing medical care in an emergency situation.

Some states have enacted special legislation, often called Good Samaritan laws, which may provide immunity from civil liability for persons when they render care in emergency situations (Annotaion, 1989). For example, a Florida statute limits the liability of a nurse (or other medical professional) for emergency care or treatment rendered gratuitously (that is, without compensation) either at the scene of an emergency outside of a hospital or in response to a situation arising out of a declared state of emergency. Some other states have similar laws, although they may be limited to care rendered at the scene of an accident. Other states do not limit the liability for nurses rendering emergency care.

The MSEHPA only partly addresses this problem. It provides that the liability of out-of-state emergency health care providers is limited (MSEHPA, 2002, §§ 608(b)(3) and 804, 2002). It does not directly address the liability of emergency health care providers working in their own state, who apparently would be covered by the existing liability rules, including any Good Samaritan laws that might exist. (For more information, see liability and public health checklists prepared by the Center for Law & the Public’s Health, accessible via the Web site at www.publichealthlaw.net.)

Provision of Adequate Care

Case Example: The local television news carries a story that a rash of human-to-human transmission cases of avian flu has occurred in the region, resulting in five deaths to date. Nurses and other staff begin calling in “sick.” When contacted by supervisors, the nurses admit they are afraid to come in to work because of fears of a possible pandemic and the danger of spreading flu to their families (as health care workers they received vaccinations, but their families were not similarly protected). What legal recourse does a hospital have if staff refuses to work during a public health crisis? What liability does the institution face if it operates in the absence of adequate staff? What ethical issues does calling in sick raise for the nurse and the institution?

The relationship between nurses and hospitals legally is the same as between any employer and employee. Absent one of the exceptions discussed in the following, the relationship is viewed as an at-will contract. This means that the hospital can set the terms and conditions of employment and is free to dismiss an
employee for any reason (except as this right is mod-
ified by state or federal statutes, such as laws against racial discrimination). Likewise, the employee, here the nurse, is free to leave the employment to go elsewhere for any reason, and technically without even giving not-
tice, although custom usually prevails here.

This at-will relationship can be modified in two dif-
erent ways. One is by statute, which will be discussed in detail later, and the other is by private contract between the hospital and the nurse. Although it is probably a rare practice in the field, hospitals and nurses can sign employment contracts that spell out the duties and re-

ponsibilities of the two parties, and which modify the typical at-will relationship. No doubt more common are contracts negotiated between unions representing the nurses and the hospital itself. Such contracts often spell out the terms and conditions of the job, including hours of work, limits on required overtime work, and disci-

plinary procedures to be followed if an employee fails to comply with the conditions in the contract.

Both the traditional at-will relationship and a con-
tractual relationship can be modified by statute. As was pointed out earlier, state and federal statutes prohibiting racial discrimination in employment trump the gener-
ally unfettered right of the employer to dismiss an em-
ployee with or without cause. The same is true of other statutes prohibiting employment discrimination on the basis of gender and disability. State statutes could, in theory, limit the number of hours that a nurse works, as well as requiring a nurse to come into work in the event of an emergency. For example, New York State has, by regulation, limited the hours that medical residents can work (10 NYCCR § 405.4).

The MSEHPA contains a provision that would give the state the authority to mandate that health care providers assist "in the performance of vaccination, treatment, examination, or testing of any individual as a condition of licensure, authorization, or the ability to continue to function as a health care provider" in the state (MSEHPA, § 608(a), 2002). The model act also contains a general provision that would give the pub-
lic health authority the power to set rules and regu-
lations necessary to implement the provisions of the act (MSEHPA, § 802, 2002), and it is possible that this would allow the state to enact further rules con-

cerning the duty of health care workers to report for work in a crisis through its regulatory power (MSEHPA, 2002).

In dealing with staffing requirements during a pub-
lic health crisis, nurses and nurse administrators will need to seek advice about the exact legal nature of the relationship between the nurses and the hospital or other employing agency. Employee policies regarding hours of work and refusal to work should be reviewed, and this is particularly critical if there is a contract (ei-

ther individual or a collective union contract) governing the conditions of employment. In addition, legal advice will be needed concerning any state requirements about mandatory work and the hours of employment.

A second legal issue surrounding staffing is liability for failing to maintain adequate nursing staff during a public health crisis. Generally, all hospitals may be held civilly liable if they fail to maintain adequate staffing and an individual is injured as a result of the inadequate staffing (Pozgar, 1999, p. 265). There is no hard-and-

fast standard as to what constitutes adequate staffing, and the courts are likely to allow hospitals a large de-

gree of discretion in determining whether staffing is ad-

equate, particularly in the event of a public health crisis. Nonetheless, if at some point sufficient nursing staff fails to report for work, administrators will need to consider whether the staffing is so insufficient that the quality of care will suffer.

Specifically relating to pandemic flu, the federal government has developed a plan to confront an epi-

demic (Homeland Security Council, 2005). Its three pil-

lars address preparedness and communication, surveil-

lance and detection, and response and containment, and they would have an impact on health care profession-

als’ response. This plan will undoubtedly undergo fre-

quent revision, and, thus, its implementation should be monitored.

Selected Ethical Issues

Historically, nurses have responded quickly during pub-
lic health emergencies. The events following 9/11 pro-

vide a case in point. Hospitals in and around New York City mobilized disaster teams, ready to receive casu-

alities. In New York City, nurses saw the World Trade Center collapse and immediately reported to work (New York State Nurses Association, 2002). Around the state and in neighboring states nurses mobilized to receive casualties. This response was, in part, the routine dis-

aster plan of every hospital in the New York City region, but above and beyond disaster plans, nurses went to work. Within hours the New York State Nurses Associ-

ation was fielding calls from nurses across the country volunteering to help out in any way they could.

Under other conditions, nurses responding to a dis-

aster may face great personal risk. Do nurses have an obligation to care for patients with highly communica-

ble diseases when that care will put nurses at risk for contracting the disease? In conflict are two competing sets of values, professional values that may urge treat-

ing the patient and personal values that urge care of the self. The first provision in the code of ethics states that “[]he nurse, in all professional relationships, prac-
tices with compassion and respect for the inherent dig-

nity, worth and uniqueness of every individual, unre-

stricted by considerations of social or economic status, personal attributes, or the nature of health problems”
The legal and ethical issues related to disaster response are complex, rapidly changing, and occurring at a time of great transition in our society. In this chapter we reviewed the basic legal and ethical issues related to disaster response.

Nurses have a privileged position of trust in society. In the event of a disaster or terrorist attack nurses are and will continue to be in the forefront of the effort to mitigate victims’ suffering with skill and compassion. It is their obligation to stay informed about the rapidly changing legal and ethical issues associated with emergency and disaster preparedness and response. Keeping current will help nurses to act efficiently and effectively under conditions of duress.

Early on in the AIDS epidemic when the risks and mechanisms for transmission were unknown, some physicians and nurses were reluctant or refused to care for patients with AIDS (Bormann & Kelly, 1999; Levine, 1991). One practical solution was to rely on volunteers who would care for patients with AIDS. Now that the mechanism of transmission is known and the risk of contagion from occupational exposure is extremely small the immediate issue seems to have resolved. Relying on volunteers may provide an immediate solution in a disaster situation, but it does not resolve the greater dilemma of limits to nurses’ professional obligations to care for patients.

Nurses also have obligations to employers, and employers have obligations to nurses. U.S. workers, especially those in health care, face potential hazards in the workplace associated with airborne chemical, biological, or radiological terrorism (National Institute for Occupational Safety, 2004). Health care institutions have an ethical obligation to protect the safety and health of those who work in the institution. Following the events of 9/11, the National Institute for Occupational Safety and Health (NIOSH) developed specific recommendations for the assessment and improvement of building safety (NIOSH, 2002). These included guidelines to address such issues as physical security, ventilation and filtration, maintenance, administration, and training. These recommendations were designed to decrease the likelihood of or mitigate the harms caused by a terrorism attack. In 2004, NIOSH issued “Protecting Emergency Responders: Safety Management in Disaster and Terrorism Response” in order to provide more detailed guidelines for the protection of health care providers and emergency responders from injury, disability, and death resulting from disasters (NIOSH, 2004).

SUMMARY

STUDY QUESTIONS

(1) Describe the three levels of government and their anticipated roles in a public health crisis. What problems can be anticipated given the different roles of each level of government? What might be potential benefits?

(2) How does the protection of private health information differ depending on whether it is being used for public health purposes or other purposes?

(3) In the event of a bioterrorist attack and a resulting public health crisis, how might the legal rules governing nurses change, and what government official(s) would be most likely to make these changes?

(4) What is the difference between screening and testing? Is this distinction important in public health laws governing mandatory screening or testing?

(5) In the event of a public health emergency, could nurses legally practice in a state where they are not licensed?

(6) What is the connection between a nurse’s legal obligations and a nurse’s ethical obligations? Give two examples where the legal and ethical obligations might not be identical. How can a nurse resolve such a conflict?

(7) How might the notion of social utility become useful in emergency response triage? What are the dangers of introducing social utility into emergency responses?

(8) If a nurse feels that responding to a disaster would put himself or herself at personal risk, is that nurse ethically obligated to respond? Explain and justify your answer. How might a nurse administrator legally compel a nurse to respond?
(9) Describe two provisions from the ANA Code of Ethics that may be in conflict when a nurse is asked to quarantine a patient.

(10) When may it be ethically justifiable for a nurse to act outside her or his scope of practice?

REFERENCES


New York Education Law, § 5191(b) (2002).


CASE STUDY

6.1 Dark Winter: An Excerpt From “Shining Light on Dark Winter”

NSC Meeting #1: December 9, 2002
The 12 members of the NSC are given the news that a smallpox outbreak is occurring in the United States. In Oklahoma, 20 cases have been confirmed by the CDC, with 14 more suspected. There are also reports of suspected cases in Georgia and Pennsylvania. These cases are not yet confirmed. The initial exposure is presumed to have occurred on or about December 1, given the 9- to 17-day incubation period for smallpox. The Deputies Committee advises the NSC members on possible disease-containment strategies, including isolation of patients, identification and vaccination of patient contacts, and minimization of public gatherings (e.g., closing schools in affected states). In addition, the Deputies Committee provides the NSC members with three vaccine distribution policy options. With only 12 million doses of vaccine available, what is the best strategy to contain the outbreak? Should there be a national or a state vaccination policy? Is ring vaccination or mass immunization the best policy? How much vaccine, if any, should be held for the Department of Defense? Should health care workers, public safety officials, and elected officials be given priority for vaccination? What about their families?

NSC Meeting #2: December 15, 2002 (6 days into the epidemic)
A total of 2,000 smallpox cases have been reported in 15 states, with 300 deaths. The epidemic is now international, with isolated cases in Canada, Mexico, and the United Kingdom. Both Canada and Mexico request that the United States provide them with vaccine. All of the cases appear to be related to the three initial outbreaks in Oklahoma, Georgia, and Pennsylvania. The public health investigation points to three shopping malls as the initial sites of exposure. Only 1.25 million doses of vaccine remain, and public unrest grows as the vaccine supply dwindles. Vaccine distribution efforts vary from state to state, are often chaotic, and lead to violence in some areas. In affected states, the epidemic has overwhelmed the health care systems, and care suffers. Several international borders are closed to U.S. trade and travelers. Food shortages emerge in affected states as a result of travel problems and store closings. The government response to the epidemic has been criticized. The media continues its 24-hour news coverage of the crisis. Misinformation regarding the smallpox outbreak begins to appear on the Internet and in the media, including false reports of cures for smallpox. Schools are closed nationwide. Public gatherings are limited in affected states. Some states limit travel and nonessential gatherings.

NSC Meeting #3: December 22, 2002 (13 days into the epidemic)
A total of 16,000 smallpox cases have been reported in 25 states (14,000 within the past 24 hours). One thousand people have died. Ten other countries report cases of smallpox believed to have been caused by international travelers from the United States. Vaccine supplies are depleted, and new vaccine will not be ready for at least 4 weeks. States have restricted nonessential travel. Food shortages are growing in some places, and the national economy is suffering. Residents have fled and are fleeing cities where new cases emerge. Canada and Mexico have closed their borders to the United States. The public demands mandatory isolation of smallpox victims and their contacts, but identifying contacts has become logistically impossible.

Although speculative, the predictions are extremely grim: An additional 17,000 cases of smallpox are expected to emerge during the next 12 days, bringing the total number of second-generation cases to 30,000. Of these infected persons, approximately one-third, or 10,000, are expected to die. NSC members are advised that in worst-case conditions, the third generation of cases could comprise 300,000 new cases of smallpox and lead to 100,000 deaths, and that the fourth generation of cases could conceivably comprise as many as 3 million cases of smallpox and lead to as many as 1 million deaths.

Lessons of Dark Winter
O’Toole, Mair, and Inglesby (2002) report a series of valuable lessons from the Dark Winter exercise:

(1) Leaders are unfamiliar with the character of bioterrorist attacks, available policy options, and their consequences.
(2) After a bioterrorist attack, leaders’ decisions would depend on data and expertise from the medical and public health sectors.

(3) The lack of sufficient vaccine or drugs to prevent the spread of disease severely limited management options.

(4) The U.S. health care system lacks the surge capacity to deal with mass casualties.

(5) To end a disease outbreak after a bioterrorist attack, decision makers will require ongoing expert advice from senior public health and medical leaders.

(6) Federal and state priorities may be unclear, may differ, or may conflict; authorities may be uncertain, and constitutional issues may arise.

(7) The individual actions of U.S. citizens will be critical to ending the spread of contagious disease; leaders must gain the trust and sustained cooperation of the American people.

O’Toole, Mair, and Inglesby (2002), state that in conducting the Dark Winter exercise, the intention was to inform the debate on the threat posed by biological weapons and to provoke a deeper understanding of the numerous issues that a covert act of bioterrorism with a contagious agent would present to senior-level policy makers and elected officials. The Dark Winter exercise highlights the legal and ethical challenges this type of event will create. It offers instructive insights and lessons for those with responsibility for bioterrorism preparedness in the medical, public health, policy, and national security communities and, accordingly, helps shine light on possible paths forward.

Key Messages

- Communication is critical in all phases of a disaster.
- Emergency responders and the news media need each other: Those dealing with a major disaster need to calm and reassure a frightened populace, and the media needs breaking news for the sake of ratings and circulation.
- Terrorists need publicity and thus have divergent objectives with controlling the media than do disaster responders.
- In the face of major disasters, reporters and others in the news media tend to cooperate with emergency responders. This offers leaders ample opportunity to communicate messages to the public that will be helpful in managing the crisis.
- Every member of the response community, whether the heads of public agencies or private organizations, and nurses in particular, should have rudimentary knowledge in how to respond to reporters’ inquiries.
- The Internet offers the opportunity to circumvent the gatekeepers of the old media and communicate directly with the major sectors of the public.
- Public health messages in a crisis must be simple, timely, accurate, relevant, credible, and consistent.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the central role of the mass media in disaster management.
2. Understand the need for nurses and all other emergency responders to cooperate with the media.
3. Discuss whether the U.S. Constitution guarantees journalists access to emergency sites without exceptions.
4. Speak to the importance of media monitors during crises.
5. Weigh the importance of showing “a human face” to victims and their families at times of acute emergencies.
6. Appreciate the Internet as a vehicle for communicating directly with the public and with fellow emergency responders.
Crisis Communication: The Role of the Media
Brigitte L. Nacos

CHAPTER OVERVIEW

In today’s mass society, mass-mediated emergency response must be an integral part of effective disaster management—especially in the face of bioterrorism, emerging infectious diseases, or other public health crises. Although each emergency situation has its own unique features and requires different approaches for dealing with public information and media relations, this chapter provides a list of general media guidelines for nurses as crisis managers or emergency responders in the public and private sectors. Instead of concentrating solely on utilizing the traditional and new media during emergencies, prudent preparedness measures include public education and information before disasters strike.

INTRODUCTION

When crisis strikes, most people look to the news media for information about the extent and details of the threats or disasters at hand, for blow-by-blow accounts of important developments, and, depending on the nature of the calamity, for instructions of what to do and what not to do. This attention offers crisis managers and response professionals the opportunity to communicate information and messages to the directly affected communities and to the larger national, sometimes even international, audience as well. Indeed, as soon as citizens become aware of impending or actual disasters, such as devastating hurricanes or floods, they tend to turn first to radio, television, and, more recently, to the Internet for the latest crisis reports and, as an emergency unfolds, to newspapers and newsmagazines as well. The more severe a crisis happens to be, the greater the public’s thirst for information and, just as important, the greater the need of crisis response personnel to communicate with, lead, and guide the public.

It was the reporting of the anthrax cases following the 9/11 terrorism that reminded some leaders in the health field how crucial the mass media tend to be as a means to inform the public during such crises. Dr. Peggy Hamburg, for example, noted that the anthrax cases had taught “ample lessons about the importance of this [communication] issue and the challenges
Inherent in it” (Hamburg, 2002). Actually, the news media’s capacity for disseminating both fact-based information and sensational speculations was just as obvious before the first actual anthrax case became known as it was thereafter. Soon after the terror attacks in New York and Washington were reported around the clock by television, radio, and on Internet Web sites for several days, most news organizations turned their attention to the possibility, even likelihood, of far more devastating terror strikes, namely, by the release of biological and chemical agents or the deployment of nuclear weapons. Although New Yorkers, Washingtonians, and U.S. citizens elsewhere were traumatized enough, most news organizations seemed eager to present their audiences with doomsday scenarios. As all kinds of experts filled the air waves, some anchors and hosts showed their preference for those guests who were most gloomy in their forecasts. At times it seemed as if people in the newsrooms and their preferred sources and consultants waited for the other shoe to drop as they pointed out that the public health system and other crisis response circles were ill prepared to deal with bioterrorism or other weapons of mass destruction.

When the news broke that a man in Florida had inhaled anthrax spores and subsequently died, when more anthrax letters arrived via mail in offices in New York and Washington, DC, this new form of terror-fare moved up even higher on the media agenda. To the extent that the press reported the breaking news and informed the public fully of the unfolding events, how to cope, and how to take protective measures, this was good journalism and justified reporting. But much of the coverage was unnecessarily hyped—especially on the part of an army of talking heads in the electronic media that beat the topic to death. This and the specter of public officials who were unable to hide their own confusion as they talked to the press, made for a general climate of uncertainty. In this situation, the perpetrator(s) of the anthrax attacks got a degree of attention that was disproportionate to the scope of the actual damage inflicted. In the climate of growing fear, there were endless mass-mediated discussions about whether to buy gas masks, take precautionary antibiotics, open mail, avoid public places; there were endless speculations over the next form of bioterror—with smallpox high on the media’s list. Not surprisingly, many people became concerned enough to call their physicians to inquire about or ask for antidotes—just in case they became the victims of anthrax or other biological or chemical agents. There is no doubt that these reactions were magnified by the extraordinary amount of news reporting. From the discovery of the first anthrax case on October 4, 2001, to the end of that month, television and radio news, as well as the leading print media, published hundreds of stories about the actual cases and the potential for similar, or worse, threats. The problem was, as one observer noted, that

[journalists had no precedent, no strategy to deal with rapid-fire breaking news of infection by killer germs, no ready-made pool of experts. Hoaxes, false alarms and conflicting information mushroomed as reporters scoured the nation in search of elusive facts and informed advice. As the bioterrorism frenzy took hold, factual information was the first casualty. (Ricchiardi, 2001)]

Whether one agrees with the critics or defenders of the news media, for crisis responders the lessons of the 9/11 horror and the anthrax case are compelling: Although response professionals must focus primarily on preparedness measures in their specialized fields, they also need to establish chains of command with knowledgeable and articulate spokespersons designed to deal with the equally important tasks of public information and press relations. This lesson was further reinforced following Hurricane Katrina’s impact on the Gulf Coast.

**EFFECTS OF MEDIA COVERAGE**

**PERCEPTIONS OF PREPAREDNESS**

In February 2003, the New York City Police Department ordered officers to look out for “improvised weapons” that might be used to release cyanide into the city’s subway system. Fortunately, the chemical attack did not materialize, reportedly because al-Qaeda’s second in command, Ayman al-Zaqaq, called the operation off for fear that it might not cause as much damage, or more, than the 9/11 strikes.

When the incident was revealed more than 3 years later (Suskind, 2006), it was also reported that at the time of the alert “city hospitals were wrestling with the issue of how to treat anyone exposed to cyanide” and sought to “increase their stocks of medical antidotes to cyanide and other toxic substances, preparing for any potential mass triage” (Baker & Rashbaum, 2006). In other words, when federal and local authorities feared a chemical attack in New York City, the news media did not get wind of it and, as a result, New Yorkers were neither aware of the threat nor of the health community’s rush to prepare for the worst.

Had the broadcast and print media reported at the time about a possible cyanide attack by al-Qaeda, they would have alarmed people in New York City, the greater metropolitan area, and beyond. After all, Americans believe that the country is ill prepared for biological, chemical, or nuclear terror strikes. In September 2005, for example, three of four Americans believed that the United States “is not adequately prepared for
a nuclear, biological, or chemical attack.” (The NBC News/Wall Street Journal poll was conducted September 9–12, 2005. 75% of the respondents said the United States is not adequately prepared, 19% believed the country is adequately prepared, and 6% said they were not sure.) But although news reports about the chemical attack warnings would have fueled the public’s fears, they wouldn’t have informed and educated Americans about personal preparedness for these types of disasters. According to one expert, disaster/terrorism coverage boils down to just-breaking news, dramatic pictures, Americans at risk, situations that can be distilled down to uncomplicated controversy (he said, she said) or uncomplicated violence (such as that caused by natural disasters), quick and/or resolvable denouements and human anecdotes. (Moeller, 2006, p. 191)

Eager to attract news consumers by highlighting the most shocking and dramatic aspects of emergencies and threats thereof, news organizations shortchange coverage that would inform citizens about more complex public affairs matters—including how individuals, families, and organizations can and should prepare for possible natural and man-made disasters.

But it is also true that media coverage of actual disasters reveals a great deal about the strengths and weaknesses of public sector preparedness. In the case of Hurricane Katrina, severe flaws in federal, state, and local preparations for emergency response measures overshadowed some heroics by rescuers, especially by members of the Coast Guard. Although the media did report on both aspects, they were right to highlight the tremendous problems and scrutinize those responsible for them. Because pundits and reporters spoke frequently about emergency preparedness for weather-related disasters and terrorist attacks, the Katrina experience affected public attitudes about their personal and their governments’ degree of preparedness for both types of emergencies:

First, the experience of Hurricane Katrina did not have a ten Americans’ personal willingness to prepare for natural calamities. When asked whether they had an emergency preparedness plan in case of natural disasters that all family members knew about, 43% said yes before and 45% after Katrina devastated the Gulf Coast. The increase was within the margin of error and thus meaningless. Whites were significantly more prepared than African Americans and even more so than Latinos (the before-and-after Katrina polls were conducted by The National Center for Disaster Preparedness at Columbia University’s Mailman School of Public Health and the Marist College Institute for Public Opinion July 15–22, 2005 and October 12–17, 2005).

Second, 4 years after 9/11 a majority of Americans (59% before and 53% after Katrina) believed that they were prepared for a natural disaster in their own communities but only about one-third (36% before and 35% after Katrina) said they were prepared for a terror attack in their community. Third, the American people’s confidence in the U.S. government’s preparedness to deal with future terrorist attacks was significantly weakened by the flaws in the disaster responses by federal, state, and local governments before, during, and after Hurricane Katrina made landfall. Thus, whereas in July 2005, before the hurricane disaster, 39% of the public believed that the United States was “not very prepared” or “not prepared at all” to deal with future terror attacks, 3 months later and after the Katrina experience, 55% thought so.

DIVERGENT OBJECTIVES OF TERRORISTS

The media plays a significant role in what can be called the “calculus of political violence” or the “calculus of terrorism.” Years ago Margaret Thatcher, then Great Britain’s prime minister, made the point that “publicity is the oxygen of terrorism.” Indeed, terrorism without publicity can be compared to the proverbial tree that falls in the forest without the press being there to report. This would be as if the tree did not fall or, applying it to terrorism, as if a violent act did not happen. In today’s mass societies, terrorists rely on the news media to report their deeds and thereby get the attention of the public and of government officials in their target countries. In the process, they manage to spread public fear and anxiety and intimidate whole nations. Although media attention and the intimidation of citizens are means to larger ends, namely, the advancement of political goals, terrorists understand the central role the press plays in their scheme, and they act accordingly. Thus, one reason why Timothy McVeigh chose the Alfred P. Murrah Federal Office Building in Oklahoma as a target for his devastating terror attack in 1995 was the fact that the building complex had “plenty of open space around it, to allow for the best possible news photos and television footage. He wanted to create a stark, horrifying image that would make anyone who saw it stop and take notice” (Michel & Herbeck, 2001, pp. 168–169). Similarly, Osama bin Laden’s al-Qaeda organization used a training manual in its camps in Afghanistan that instructed followers to select as their terrorism targets “sentimental landmarks,” such as the Eiffel Tower in Paris, Big Ben in London, and the Statue of Liberty in New York City.
because this would “generate intense publicity” (Hen- 
dawi, 2002). Just as important, after the attacks on the 
World Trade Center and the Pentagon, Osama bin Laden 
observed with obvious satisfaction, “There is America, 
full of fear from north to south, from west to east. Thank 
God for that” (bin Laden statement, 2002).

Given terrorists’ focus on the news media as a con-
duit of their psychological warfare, the crisis response 
community competes with the perpetrators of violence 
for media and public attention. In this respect, a terror-
ist event is very different from other disasters—whether 
an explosion in a chemical or nuclear plant, hurricanes, 
floods, or other natural catastrophes.

Moreover, regardless of what type of emergency 
arises, reporters and others in the news media have 
different priorities and interests than do nurses, other 
emergency response professionals, and public officials. 
In the words of one terrorism expert, the 

mass media aim to “scoop” their rivals with news 
stories that will grip and sustain the public’s atten-
tion and hence increase their ratings and revenue.
The police (and one can add other emergency re-
sponse professionals, such as Emergency Medical 
Services, public health officials, physicians, nurses, 
and other health workers), on the other hand, are 
first and foremost concerned with the protection of 
life. (Wilkinson, 2001, p. 181)

Although the notion of divergent objectives of the two 
sides is obvious, the relationship between news media 
and the emergency response community is not one di-
mensional but complex and multifaceted.

Each disaster situation and each terrorist incident 
has its own characteristics and calls for particular re-
sponses with respect to public information and me-
dia relations. There is, however, consistency in what 
questions the public wants answered and what in-
formation the media will want access to (see Figure 
7.1). The Crisis and Emergency Risk Communication 
Handbook (Centers for Disease Control and Preven-
tion, 2006) recommends the use of the STARCC prin-
cipal as a guideline for all disaster communications.
The STARCC principle states that all public messages 
in a crisis must be: simple, timely, accurate, relevant, 
credible, and consistent. There are some fundamental 
rules of thumb drawn from experience and observation 
that are helpful in informing media and public relations 
in the face of major disasters, especially those of the 
terrorist variety. Thus, the following observations, tips, 
and caveats are meant to help nurses and other disas-
ter responders, and especially members of the public 
and private health care sectors to prepare for their com-
munication needs and media liaison in case of major 
disasters.

I. CRISIS AND EMERGENCY RISK 
COMMUNICATION: FEEDING THE MEDIA

Seasoned reporters as well as outside observers of the 
press have compared the modern news media to a 
“beast” that demands regular feedings. As one long-time 
press secretary in Washington put it, “Reporters would 
gleefully lick the hand that fed them, but if you ran out 
of treats or news . . . the press would devour your arm or 
more” (Walsh, 1996, p. 9). This appetite on the part of 
the press is never greater than in cases of major disas-
ter. Therefore, those involved in crisis response efforts 
must provide information to the media or will other-
wise risk hostility on the part of the media that could 
harm their effectiveness as crisis responders. Moreover, 
if the media are deprived of food in the form of informa-
tion, they may rely on sources that lack the professional 
background and judgment that the members of emer-
gency medical services, physicians, nurses, or other re-
sponders possess. Often the result is that half-truths and 
rumors rather than facts are reported. It is always im-
portant to remember that the media are not the enemy.

Although they can be difficult and aggressive, they can 
become a tremendous asset in crisis situations, and so it is 
best to approach them with an open mind (L. Barrett, 
personal communication, June 29, 2006).

Whenever they release statements to the press or are 
interviewed by journalists, crisis managers and disaster 
response professionals in general must be sure that the 
information they provide is accurate and the split-second 
judgments they make are sound, otherwise they confuse, 
frustrate, and alarm an already traumatized public. For 
example, U.S. Secretary of Health and Human Services 
Tommy Thompson told Americans that the first lethal 
anthrax case in Florida was “an isolated case” with no 

This was a rush to judgment that hereversed after sev-
eral more anthrax infections when he admitted that the 
United States had “never experienced this type of ter-
orism” (Ricchardi, 2001).

There is no doubt that reporters will question all 
kinds of sources regardless of their proximity to the cri-
sis and regardless of their expertise. If crisis managers 
and response professionals cooperate with the press, 
however, especially by providing information and find-
ning answers to reporters’ questions, they are in an excel-
lent position to help shape the news and the predom-
inant story lines. With this in mind, crisis responders 
can and should prepare their media/public information 
approaches for the worst-case scenario. Just as public 
and private actors in the area of health care and other re-
sponders plan for their particular roles during all kinds 
of disasters ahead of time, just as they participate in 
drills to improve their readiness, they should prepare 
for interacting with journalists and others in the news
Emergency Risk Communication Principles

- Don’t overreassure
- Acknowledge that there is a process in place
- Express wishes
- Give people things to do
- Ask more of people

What the Public Will Ask First

What does this mean to me?
- Are my family and I safe?
- What have you found that may affect me?
- What can I do to protect myself and my family?
- Who caused this?
- Can you fix it?

What the Media Will Ask First

- What happened?
- Who is in charge?
- Has this been contained?
- Are victims being helped?
- What can we expect?
- What should we do?
- Why did this happen?
- Did you have forewarning?

Judging the Message

- Speed counts – marker for preparedness
- Facts – consistency is vital
- Trusted source – can’t fake these

5 Key Elements To Build Trust

1. Expressed empathy
2. Competence
3. Honesty
4. Commitment
5. Accountability

Figure 7.1 Emergency Risk Communication Principles. Crisis and Emergency Risk Communication Handbook, CDC, 2006. Available at: http://www.cdc.gov/communication/emergency/erc_overview.htm
media in times of crisis. To be sure, in cases of major disasters highly placed elected officials step in as crisis managers and are likely to interact with the news media and communicate with the public. But response organizations, such as police and fire departments, the Federal Emergency Management Agency (FEMA) and the National Guard, public health agencies, and the medical community in general must also be prepared for public information tasks and press liaison. Even if a disaster shakes up the whole nation, as did the events of September 11, 2001, and Hurricane Katrina, literally all of such incidents affect local communities and regions first and foremost. As a result, local responders are compelled to handle the initial and the bulk of the ongoing crisis response work even though federal agencies, such as FEMA or the Centers for Disease Control and Prevention (CDC), eventually step into leading roles. Whether on the federal, state, or local level, public and private organizations that will be involved in emergency response activities need to designate (and if needed specifically train) persons that prepare for and deal with public information and media relations. Public health officials and medical personnel in hospitals and other health organizations are also well advised to designate in advance a pool of highly qualified, articulate, and media-savvy professionals who will be available to the press as experts in the event of major crises. Not every leader in the public health sector, nor every star in the medical community, however stellar his or her professional qualifications, is an effective spokesperson under pressure.

All of this is not to suggest that reporters and others in the media are content to deal with official spokespersons and experts. On the contrary, members of the working press will question anyone at or near emergency sites, or at places where victims are treated and their families are waiting and worrying. For this reason, it is not sufficient for public officials and leading representatives of the medical community to be available to the press as spokespersons or experts; ideally every one, including nurses, who are likely to be activated for emergency response duty should have some rudimentary knowledge in what to do and not to do, when approached and pressured by reporters, photographers, producers, and other members of the press. In most incidents, the men and women that rescue and treat victims (members of Emergency Medical Services at the site or emergency department physicians and nurses) have firsthand information and experiences that crisis managers and spokespersons usually cannot provide and reporters want to hear about. However, the revelation of some information can, at times, hamper the management of a terrorist crisis (especially when hostages have been taken), provide valuable hints to the perpetrators of terror, or heighten the anxieties and fears of the public. Interactions with the press during a disaster event can also interrupt and tie up critical health care providers and have an impact on the ability of the emergency department and hospitals to respond to patients.

Local response personnel in towns and counties that are far removed from the major media markets, such as New York City, Los Angeles, or Chicago, can be particularly vulnerable, when, as a result of a major emergency, they are faced with an aggressive national and perhaps international press corps on the hunt for breaking news. As one terrorism expert wrote more than 2 decades ago:

\[\text{[the lights, the cameras, the media’s competitiveness, the pressure of deadlines, and other demands of a hurried press corps can overwhelm untrained police officers attempting to deal with the media and can feed easily into the unfolding situation at hand. (Miller, 1982, p. 81]}\]

Today, in a far more competitive media landscape, small-town police personnel, public health officials, or hospital staffs are no longer the only ones likely to be intimidated, but their colleagues in the largest cities will be as well. All of this points to the necessity to include the rank-and-file members of emergency response organizations in some type of media relations training. Drawing from lessons learned from the anthrax crisis, as well as best practices from the fields of both risk and crisis communication, the CDC has developed a series of risk communication courses in preparing for, responding to, and recovering from the threat of bioterrorism and emergent diseases, as part of a comprehensive training program. (see http://www.cdc.gov/communication/emergency/erc_overview.htm for information on courses, curriculum, and tools).

When it comes to biological terrorism, there seems a particular need to provide an even larger group of people with a rudimentary understanding of how to respond to situations they do not usually find themselves in. As Dr. Peggy Hamburg, a leading public health expert, has observed:

\[\text{[A] biological terrorism attack will first be recognized when cases of unusual disease or inexplicable symptoms start to appear in doctor’s offices, emergency rooms, intensive care units, whatever, and I think that we need to also recognize that in this context, the first responders will be people that have historically not been part of our first responder networks, in terms of training or support for the tools necessary to serve in the role of first responder. (Hamburg, 2002)}\]

Thus, in the age of terrorism and emerging infectious diseases, it is most important to assure that medical providers become familiar with the symptoms of infectious diseases that they are not accustomed to seeing. At the same time, however, the medical community should also be included in preparing for other challenges involved in disaster response— including public
information and media relations. The best places to provide media education in this context would be through CDC-sponsored programs or at institutions of higher learning that train future physicians, nurses, technicians, and others in the medical and health care community.

II. RADIO, TV, AND PRINT PRESS AS PLATFORMS TO “GO PUBLIC”

Crisis managers and emergency responders must act with courage, decisiveness, and resolve. They must also utilize the mass media to project the image of competent leaders. This is a difficult undertaking under normal circumstances, and during major crises, presidents, governors, mayors, Secretaries of Health and Human Services, city health commissioners, or experts on infectious diseases at the Centers for Disease Control and Prevention have more pressing tasks than appearing before the press. Yet, crisis managers must “go public” as soon and as often as possible in order to inform the public of vital news and demonstrate that leaders and response specialists are on top of the emergency, and that they are doing whatever is humanly possible to deal with the calamity at hand. As soon as people become aware of an emergency, they turn to radio, television, and, more recently, to the Internet for information. As one media scholar put it:

> Information about crisis, even if it is bad news, relieves disquieting uncertainty and calms people. This more activeWatching or listening to familiar reporters and commentators reassures people and keeps them occupied. It gives them a sense of vicarious participation, of “doing something...” News stories serve to reassure people that their grief and fears are shared. After seeing the same pictures and listening to the same broadcasts, people can discuss a crisis with their neighbors, friends, and coworkers and experience feelings of mutual support. (Graber, 2002, pp. 144-145)

At no other time are radio and television audiences larger than during and after major disasters; at no other time are Internet sites with updated news hit more often than during crises. Yet, although it is certainly true that people are able to cope with horrific emergencies simply because they keep themselves informed, ultimately they will not be reassured by receiving the news from familiar reporters and experienced news anchors. The sooner crisis managers utilize the news media—first of all television and radio—the greater is their chance to demonstrate their competent leadership and thereby reassure and calm an upset, fearful, and grieving public.

The behavior of Rudy Giuliani as the mayor of New York City in the aftermath of the terrorist attack on the World Trade Center provides an excellent example for crisis managing leaders. Giuliani performed convincingly, even brilliantly, in his interactions with and use of the media following the disaster. While centrally involved in managing the unthinkable crisis, Giuliani sensed immediately that he needed to address the people in the metropolitan area and assure them that he and the response communities were dealing competently with a horrendous catastrophe. Two hours after the first plane rammed into the Trade Center’s North Tower, Giuliani was live on New York 1, a cable station, urging everyone to remain calm and assuring his fellow citizens that local, state, and federal authorities were in control of the situation and were doing everything possible to protect the city and the country from further harm. Just as important, Giuliani did not try to sugarcoat the disaster. On the contrary, he spoke with frankness and emotion when he described the “horrible, horrible situation” at the World Trade Center site and acknowledged that “the end result is going to be some horrendous number of lives lost. I don’t think we know yet, but just now we have to focus on saving as many people as possible.” In his live televised news conference a few hours later, the first of many in the aftermath of 9/11, the mayor renewed his assurance that all efforts were concentrated on rescuing lives. At the same time, he enlisted patriotism, when he spoke of sending “a message that the City of New York and the United States of America is much stronger than any group of barbaric terrorists” (Kirtzman, 2001).

Many of those involved in responding to the disaster in downtown Manhattan followed Giuliani’s example of using the media to keep the public informed without minimizing or maximizing the scope of the catastrophe. One example of a health expert who effectively communicated with the public was the District of Columbia’s chief health officer Dr. Ivan Walks. He spoke in a sure-footed and candid manner and became one of the most frequent faces on television at the height of the anthrax scare. He did not pretend that the medical profession knew everything about anthrax, but he left the impression that he handled the situation in Washington, DC, as competently as possible under trying circumstances. Thus, during an appearance on CNN’s Daybreak program, Walks spoke about the anthrax symptoms people should watch out for, but he also admitted freely that the medical profession was learning as the crisis moved along. At one point, he said:

> I think as we continue to learn more about not only the science, but also the clinical presentation, we can address people’s needs better. But I think that we shouldn’t make assumptions. We shouldn’t continue to say everything is fine...
This public health professional who was in the midst of dealing with the anthrax crisis in the Washington, DC, area, struck the right balance between ranking the health threat as very serious and putting it into a comparative perspective (earthquakes, tornadoes, hurricanes) that took the danger out of the doomsday realm.

To be sure, each disaster, whether natural or man-made, poses different problems for the response community with respect to mass-mediated public information. All crisis situations, though, call for steadfast leadership that needs to be projected by those who communicate with the public. Studying a shining example from past disasters, for instance, Rudy Giuliani’s in New York City, may be a good way to prepare for future crisis situations.

III. MASS-MEDIATED EMERGENCY RESPONSE EFFORTS

In all disasters, emergency responders need to use the media for mass communication to tell the public what to do and what not to do. Although crisis managers and response professionals can be most effective on this count when they give live TV addresses or hold news conferences, they can also communicate indirectly with the affected communities by relaying the press to alert the public to specific announcements and directions. In the wake of the Oklahoma City bombing and the destruction of the World Trade Center in New York, emergency responders used the local and national media for direct and indirect public announcements that were crucial to managing those situations. In both cases residents were told, for example, what areas were off-limits for car traffic, who to contact for information about possible victims, where to donate blood, what blood groups were needed most, or where to deliver blankets and all kinds of goods. The news media publicized many calls for volunteers to come forward with precise directions as to who should contact what organization. Television and radio broadcast these and other public announcements and requests many times and proved once again that during severe crises public officials can depend on the news media to provide public officials and the whole response community with literally unlimited access and assistance. Based on this cooperation, one media expert has concluded, in times of crisis: [The media, particularly radio and television, become vital arms of public and private crisis-control organizations. As with other events, journalists select, shape, and report the news. But in addition, they provide crisis workers quick access to the public by allowing them to use media channels to deliver their messages personally or through media personnel. These messages keep endangered communities in touch with essential information and instructions. (Graber, 2002, p. 137)

Typically the responses to such appeals are overwhelmingly positive. In the face of major disaster, many people who are not affected by the emergency react generously to appeals for assistance. This was certainly true in the hours, days, and weeks after the Oklahoma City bombing in 1995 as it was after the devastation of the World Trade Center in New York City, the partial destruction of the Pentagon outside of Washington, DC, and Hurricanes Katrina and Rita.

Biological terrorism is very different from other disasters and other types of terrorism in that there is not a distinct, dramatic event like a bombing that instantly kills and injures people. Instead, after symptoms appear, it may take some time before the medical community will be able to diagnose the agents that cause the health emergency. The more people fall sick, the greater will be the need for emergency responders—especially public health officials and the medical community in general—to provide information, for example, about the symptoms and the likely scope of infections. However gloomy the news may be, emergency responders should be forthright but avoid causing or participating in a feeding frenzy that could result in unrest and panic. Moreover, in case of a germ attack, it will be particularly important to tell victims where to seek what treatment over, in case of a germ attack, it will be particularly important to tell victims where to seek what treatment.

In all cases (biological, chemical, nuclear, radiological, and explosive), the media, particularly radio and television, become vital arms of public and private crisis-control organizations. As with other events, journalists select, shape, and report the news. But in addition, they provide crisis workers quick access to the public by allowing them to use media channels to deliver their messages personally or through media personnel. These messages keep endangered communities in touch with essential information and instructions. (Graber, 2002, p. 137)

Typically the responses to such appeals are overwhelmingly positive. In the face of major disaster, many people who are not affected by the emergency react generously to appeals for assistance. This was certainly true in the hours, days, and weeks after the Oklahoma City bombing in 1995 as it was after the devastation of the World Trade Center in New York City, the partial destruction of the Pentagon outside of Washington, DC, and Hurricanes Katrina and Rita.

Biological terrorism is very different from other disasters and other types of terrorism in that there is not a distinct, dramatic event like a bombing that instantly kills and injures people. Instead, after symptoms appear, it may take some time before the medical community will be able to diagnose the agents that cause the health emergency. The more people fall sick, the greater will be the need for emergency responders—especially public health officials and the medical community in general—to provide information, for example, about the symptoms and the likely scope of infections. However gloomy the news may be, emergency responders should be forthright but avoid causing or participating in a feeding frenzy that could result in unrest and panic. Moreover, in case of a germ attack, it will be particularly important to tell victims where to seek what treatment.

In all cases (biological, chemical, nuclear, radiological, and explosive), the media, particularly radio and television, become vital arms of public and private crisis-control organizations. As with other events, journalists select, shape, and report the news. But in addition, they provide crisis workers quick access to the public by allowing them to use media channels to deliver their messages personally or through media personnel. These messages keep endangered communities in touch with essential information and instructions. (Graber, 2002, p. 137)

Typically the responses to such appeals are overwhelmingly positive. In the face of major disaster, many people who are not affected by the emergency react generously to appeals for assistance. This was certainly true in the hours, days, and weeks after the Oklahoma City bombing in 1995 as it was after the devastation of the World Trade Center in New York City, the partial destruction of the Pentagon outside of Washington, DC, and Hurricanes Katrina and Rita.

Biological terrorism is very different from other disasters and other types of terrorism in that there is not a distinct, dramatic event like a bombing that instantly kills and injures people. Instead, after symptoms appear, it may take some time before the medical community will be able to diagnose the agents that cause the health emergency. The more people fall sick, the greater will be the need for emergency responders—especially public health officials and the medical community in general—to provide information, for example, about the symptoms and the likely scope of infections. However gloomy the news may be, emergency responders should be forthright but avoid causing or participating in a feeding frenzy that could result in unrest and panic. Moreover, in case of a germ attack, it will be particularly important to tell victims where to seek what treatment.
For people in the emergency response field, it is important to remember that cooperation is better than confrontation when it comes to their dealings with the press. When relations are good, when reporters and emergency responders can trust each other, people in distress are likely to benefit. There are times when emergency responders will ask the media to directly assist in managing and solving a crisis. In the past, this scenario unfolded repeatedly, when terrorists demanded that news organizations publicize their manifestos or statements in exchange for the release of hostages or the suspension of further lethal terror strikes. Although official U.S. policy states that the government and its officials will not give in to terrorist demands, public officials and emergency responders have frequently acted against such guidelines. The so-called Unabomber case is perhaps the best remembered of such incidents. After killing three people and injuring many others via letter bombs, Theodore Kaczynsky demanded in his communications with the New York Times and Washington Post that they publish his lengthy manifesto, threatening more letter bombs if they refused. Encouraged by federal agencies, the newspapers published the 35,000-word tract. Upon reading this, Kaczynsky’s own brother and consumerism and tipped off the FBI about the identity of the Unabomber.

It is conceivable that similar situations arise in the context of biological or chemical terrorism. Assume for a moment that unknown terrorists threaten anthrax or smallpox attacks against the population of a specified city unless prominent news organizations publicize their manifesto. Assume that the group provides information about the authenticity of their threat and that the deadline to comply with their demands is terribly tight. Assume finally that public health officials are rushed to evaluate the seriousness of the threat and that, once they confirm its seriousness, they have little time to meet the terrorists’ demands or risk disaster. If the emergency responders decide to ask news organizations to comply with the terrorists’ demands, beginning with good media relations will help them to enlist cooperation. Whatever the scenario and the final decision in such cases, though, decision makers in the response community must never forget that giving in to terrorists could well encourage the same or different individuals and groups to political violence for the sake of realizing their publicity goals.

VI. REPORTERS ARE NOT ALWAYS ENTITLED TO ACCESS

On August 4, 2002, the Beth Israel Medical Center in Brooklyn, a 200-bed community hospital, was closed down for fear that a man, who sought help in the
emergency room, exhibited symptoms of smallpox. Several hours later, once public health officials and physicians in the hospital had determined that the patient did not have smallpox, all emergency measures were canceled. By then, the hospital had quarantined the man with smallpox-like symptoms, asked visitors to leave the premises, and diverted ambulances to other health facilities. According to the city’s emergency response officials, “the incident was a good exercise in readiness for a true catalyism” (Baker, 2002, p. B3).

If one imagines for a moment that this was not a false alarm, there would have been an onslaught of the local and national press and efforts by some members of the media to get closer to the hospital than emergency responders would have allowed. Or imagine a major smallpox outbreak and public health officials quarantining infected and possibly infected people. In these kinds of situations, albeit to a lesser degree than in emergencies without infectious threats to the working press, the response community must not be intimidated by media representatives who insist on access in the name of the First Amendment’s guarantee of press freedom. To be sure, denying the press access should always be a decision of last resort. But response professionals must also be aware that the U.S. Supreme Court and its lower courts have not backed the working press’s absolute right of access. In Bransburg v. Hayes (1972), the highest court ruled that the U.S. Constitution does not guarantee the press a right to access, when the same is denied to the public at large. In an earlier decision, a unanimous Supreme Court held that the constitutional freedom to speak and publish does not include the uninhibited right to gather information. Providing an excellent example, the justices wrote that denial of unrestricted entry to the White House inhibits the ability of citizens to gather valuable information about the way their government functions, but that this “does not make entry into the White House a First Amendment right” (Zemel v. Rusk, 1965). The Appeals Court of California ruled:

Restrictions on the right of access to particular places at particular times are consistent with other reasonable restrictions on liberty based upon the police power, and these restrictions remain valid even though the ability of the press to gather news and express views on a particular subject may be incidentally hampered (Los Angeles Free Press, Inc. v. City of Los Angeles, 1970).

Again, all of this is not to say that those who deal with major emergencies should be denied access automatically or readily. This would breed resentment and ill will on the part of the news media and perhaps cost response professionals the generous access to the print press and the electronic media in times when they do need news organizations to constantly communicate with the public. When the presence of reporters interferes with the effective and prudent management of a major disaster, however, emergency responders have the right and perhaps the responsibility to deny or restrict nonemergency personnel access to the sites or areas in question.

In certain situations, it may be possible and practical to allow a few journalists to enter otherwise closed areas, and the best criteria would be to make exceptions for beat reporters, meaning those representatives of the media who cover the crime, the public health, or terrorism beat on a regular basis. Because these reporters tend to develop expertise in those particular areas, emergency responders would rather deal with small numbers of regulars than with many general reporters who have no particular knowledge of emergency requirements. Indeed, a Federal Appeals Court in California permitted selected access along the lines described here, when it ruled, “Regular coverage of police and fire news provides a reasonable basis for classification of persons who seek the privilege of crossing police lines” (Los Angeles Free Press Inc. v. City of Los Angeles, 1970).

The exclusion of general reporters and anchors, among them perhaps locally, regionally, or nationally well-known media stars, is not an easy decision to make. Indeed, although professional emergency responders may be willing to go this route in exceptional cases, political leaders in a given jurisdiction are likely to resent such exclusions if only for the sake of not upsetting prominent members of the media.

The development of clear and detailed guidelines ahead of time is the best way to prepare for these kinds of situations (see Figure 7.2). Whether it involves public agencies, such as police, fire, health departments, or private institutions like hospitals, once such rules have been developed, they should be discussed with representatives of news organizations in cities, counties, and perhaps even states before an emergency occurs and issues about media access arise. Whereas the establishment of rules with input from the media may not necessarily prevent clashes during emergencies, these sorts of preparations do increase the chance for cooperation in the face of serious crises.

If access is denied, it should be clearly explained as to why (e.g. public health risks, interference with caring for the sick and injured, safety issues, and so forth) and a plan to provide ongoing communication to media outside inaccessible areas made where possible. In that manner, denying physical access doesn’t mean denying access to information (L. Barrett, personal communication, 2006). Evidence strongly suggests that media coverage is more factual when reporters have more information (Centers for Disease Control and Prevention, 2006).
Chapter 7  Crisis Communication: The Role of the Media

How to work with reporters

__ Reporters want a front seat to the action and all information NOW.
__ Preparation will save relationships.
__ If you don’t have the facts, tell them the process.
__ Reality Check: 70,000 media outlets in U.S.
   Media cover the news 24/7.

Information sought by media

__ Casualty numbers, condition, treatment
__ Property damage
__ Response and relief activities
__ Resulting effects (anxiety, stress)
__ Questions are predictable

What is news?

__ Change or controversy
__ Black or white, not gray
__ Crises or opportunities
__ Entertain versus inform
__ Individual versus group/officials

Media and crisis coverage

__ Evidence strongly suggests that coverage is more factual when reporters have more information. They become more interpretative when they have less information.
__ What should we conclude?

Media availability or press conferences “in person” tips

__ Determine in advance who will answer questions about specific subject matters.
__ Assume that every mike is “alive” the entire time
__ Sitting or standing?

Note: Whenever possible approach media interviews with clear key messages: the information that you want the audience to hear and remember!

Available at: http://www.cdc.gov/communication/emergency/erc_overview.htm

Figure 7.2 Guidelines for working with the media.
Crisis and Emergency Risk Communication Handbook, CDC (2006). Available at:
http://www.cdc.gov/communication/emergency/erc_overview.htm

VII. THE INTERNET AS ALTERNATIVE MEDIA

So far, this chapter has focused on the traditional news media—television, radio, newspapers, and newsmagazines—as these media remain for now the dominant modes for disseminating the news and, in the context of major disasters, the most effective vehicles for the emergency response community to communicate with, inform, and educate the public. But as most Americans move toward getting more information from the Internet, crisis managers and emergency responders should also utilize the new mass media for their purposes. The great advantage here is that officials in the public and private health field, just as in other agencies and institutions, have complete control over the information they want to get out to the public without dealing with the gatekeepers of the traditional news media.

Most public and private organizations that are involved in emergency preparedness planning and drills
have set up their Web sites in order to be prepared before disaster strikes. In the case of emergencies, the public affairs specialists in emergency management centers, health departments, or hospitals must constantly post the latest public information on these sites. It is of utmost importance that the posted messages, instructions, and warnings are organized and written in ways that are easily accessible and understood by the vast majority of the public. In areas with large concentrations of newcomers from non-English speaking countries, for example, Asians or Latinos, the information should be posted not only in English but in other languages as well.

Web sites can make a real difference in case of a major emergency when the public is aware of this resource before a disaster occurs. Therefore, agencies and institutions must inform the public through mailings, flyers, newspaper ads, or, better yet, through news stories in the traditional news media. If people have such information handy, chances are they will log on to sites that promise to have emergency news at times of acute crisis. Shortly after the first anthrax cases became known in October of 2001, for example, the District of Columbia’s Department of Health posted useful information about anthrax on its Web site. Part of these explanations were general under the headlines “What is Anthrax?,” “The Symptoms,” “The Risk,” “Biological Weapon,” and “Treatment”; part were targeted at postal workers whose facilities in and around Washington, DC, had been especially hard hit by the anthrax attack. Eventually, health departments, hospitals, and groups of health facilities followed suit. For example, the New Jersey Hospital Association posted information such as “Anthrax Facts: Ten Things Every Person Should Know” or “Conquering Fear With Common Sense” in a way that citizens could easily understand. It is always prudent to provide this sort of information and educational material on Internet sites before catastrophic disasters or other forms of catastrophic terrorism occur.

Last, but not least, the Internet is an ideal method for emergency responders to communicate with each other—most of all via e-mail—during a crisis situation. In addition, visiting the Web sites of other emergency response agencies and participating in electronic discussion groups are means to learn from each other—before times of emergencies. Electronic message boards provide forums for emergency response professionals in the health field to exchange disaster preparedness ideas.

VIII. THE HUMAN FACE OF EMERGENCY RESPONDERS

The media reported extensively about the heroic efforts of members of the police and fire departments and other rescue workers who responded to the destruction of the World Trade Center. Americans and people around the globe were impressed by the professionalism and courage of the emergency community and saddened when several hundred perished as the Twin Towers crumbled into a heap of rubble. The visuals of exhausted emergency workers digging for victims, the pictures of grief-stricken rescuers carrying yet another body from the scene of terror, the caring words of emergency room physicians or nurses—all of these news sketches provided a mass-mediated composite of a response community with a human face.

Crisis managers and everyone involved in responding to major emergencies must be rational, cool under pressure, and detached enough from the human suffering they witness so that they are able to effectively act in highly professional ways. Simply learning from news accounts that the emergency responders involved are well equipped with these qualities, will comfort a community affected by a disaster or major public health emergency.

Admiration and gratitude for crisis managers, rescue workers, and other emergency responders are far from automatic, however; it must be earned by the way the response community acts under pressure and interacts with the community. Families, friends, and neighbors of victims are especially in need of understanding and compassion as they worry about their loved ones or mourn the victims. These people expect and appreciate a kind word and a departure from standard operating procedures; they will resent emergency responders whom they deem insensitive and uncooperative. If perceived as speaking and acting without showing a human face, emergency responders will be judged harshly—first by the families and friends of victims and eventually by the media and the larger community as well. For example, after the terrorist bombing of Pan American Flight 103 over Lockerbie, Scotland, the struck airline and the U.S. State Department were harshly criticized by the victims’ families for not providing timely information to those waiting at John F. Kennedy Airport in New York or assistance to those who wanted to fly to the crash site. Even years after the incident, the victims’ families were unhappy about what they perceived as insensitivity on the part of State Department personnel they dealt with. Belatedly, the State Department recognized the necessity to improve in this area by “sensitizing our people to dealing with such tragedies . . . we can never forget that we are participating in a life-shattering event for these families, and that we must proceed with utmost care” (Report of the President’s Commission on Aviation Security and Terrorism, 1990).

Whether working for public or private institutions or organizations, involvement in emergencies demands both professional excellence and sensitivity for the human tragedies that are the result of crises. If they survive, the victims of disaster as well as their families will be
grateful for encountering skillful and compassionate response professionals. Moreover, it is helpful, when crisis managers and others who speak for response agencies in public, project this sensitivity to human suffering to the public as well. Showing their human face in the midst of emergencies will help members of the response community to rally the public behind their efforts in particular crises—and in their future preparedness needs and activities.

**SUMMARY: MASS-MEDIATED EMERGENCY RESPONSE**

Disaster managers and the network of agencies and institutions involved in handling crises must strive for mass-mediated emergency response. As described in this chapter, emergency responders must communicate with the public in order to inform, educate, and direct the affected population. Today, the opportunities to “go public” are greater than ever before, spanning from the local newspaper to the Internet, from the hometown television stations to the global TV networks. Most media organizations grant crisis managers and other actors involved in handling an acute emergency generous access, but to utilize such opportunities for the benefit of responding most effectively, both the leaders and the rank-and-file members of the response community are well advised to prepare well, and well in advance, for their public information and media liaison tasks. Finally, when institutions and organizations provide the public with good and easily accessible information before an actual disaster happens (for example, on well-publicized Internet sites), chances are that they will be heard and read by many more members of the public in the face of an emergency.

**STUDY QUESTIONS**

1. Why do terrorists need the mass media to further their goals?
2. Evaluate the news about the bioterrorist threat after 9/11 and before the first anthrax case became known in early October 2001.
3. The author argues that every nurse and all other response professionals should have a rudimentary knowledge in handling reporters and other members of the press corps. Why?
4. New York’s ex-mayor Rudy Giuliani during the 9/11 emergency, and the District of Columbia’s chief health officer Dr. Ivan Walks, at the height of the anthrax threat, communicated very effectively with the general public. Describe and evaluate their “going public” performances.
5. Describe the media’s portrayal of federal leadership following Hurricane Katrina. How did this influence the nation’s perception of preparedness?
6. In what ways do most reporters and media organizations cooperate with emergency responders in the face of serious disasters? Why are nurses and other response professionals well advised to seek cooperation with the media and avoid confrontation?
7. Why is it important to monitor news content during serious health crises?
8. The First Amendment guarantees freedom of the press. Does this also mean that reporters must be granted access to all sites during a major crisis regardless of the circumstances?
9. Describe the usefulness of the Internet as a vehicle for public information before and during health emergencies.

**REFERENCES**


CASE STUDY

Crisis and Emergency Risk Communication

Crisis and emergency risk communication is the attempt by science or public health professionals to provide information that allows an individual, stakeholders, or an entire community to make the best possible decisions during a crisis emergency about their well-being. Often this communication must be done within nearly impossible time constraints and requires public acceptance of the imperfect nature of the available choices for action. Successful crisis and emergency risk communication is achieved through the skillful use of risk communication theory and techniques.

Crisis communication, as it is normally defined, and risk communication as it is normally accepted, doesn’t fit entirely the situation we trying to deal with—that emergency, that urgent situation where people have to make up their mind. So what we’ve done is actually broken some ground, according to the academics that we’ve been talking to on this subject. We have created an actual new area of study for communication called Emergency Risk Communication that combines some of the crisis elements and some of the risk elements but puts it within the context of an urgent situation.

Understanding People in a Crisis

Effective communication is a resource multiplier during a crisis, disaster, or emergency. For example, during a crisis you may find yourself overwhelmed with requests for information from the media and the public and managing misinformation and conflicting messages being sent by other agencies. Use of effective communication techniques allows you to avoid resource over-utilization or misuse by managing or eliminating as many of these issues as possible.

Each crisis will carry its own psychological baggage. The practitioner must anticipate the mental stresses that the population will be experiencing and apply appropriate risk communication strategies to attempt to manage these stresses.

Risk communication is a reasoned and mature communication approach to the selection of message, messenger, and method of delivery for intended audiences. It is quite helpful in communicating during a crisis to be familiar with the different ways that people may react in an emergency or crisis.

Psychological Reactions

In crisis, people often manifest the following psychological reactions:

- Vicarious rehearsal—The communication age allows some people—who are frequently farther away (by distance or relationship) from the threat—to participate vicariously in a crisis that they have no danger of experiencing and to “try on” the courses of action presented to them. In the most troublesome form, these “worried well” will heavily tax the recovery and response.
- Denial—Some of the ways people will experience denial are by avoiding getting the warnings or action recommendations.
- Agitation or confusion—People may become agitated or confused by the warning.
- Disbelief—People may not believe that the threat is real.
- Personal disbelief—People may not believe that the threat applies to them.
- Stigmatization—Sometimes victims may be stigmatized by their communities and refuse services or public access. The fear and isolation of a group perceived to be contaminated or at risk will hamper community recovery and affect evacuation and relocation efforts.
- Fear and avoidance—The fear of the unknown or of uncertainty may be the most debilitating of the psychological responses to disaster. With fear at the core, an individual may act in extreme, and sometimes irrational, ways to avoid the perceived or real threat.
- Withdrawal, hopelessness, and helplessness—Some people can accept that the threat is real, but the threat looms so large that they feel that the situation is hopeless. They feel helpless to protect themselves and so, instead, they withdraw.
Prioritize Messages and Remember Audience Profile

Prioritize the messages for each audience based on the level of the audience’s involvement. Audience segmentation and demographics are still relevant during a crisis. Remember the basics of your audience profile when creating your messages:

- Education
- Current subject knowledge and experience
- Age
- Language spoken/read
- Cultural norms
- Geographic location
- Audiences judge the effectiveness of messages on several levels:
  - Speed of communication
  - Content
  - Trust and credibility

PART II

Disaster Management
Key Messages

■ Planning is an essential element of any disaster management system.
■ Effective disaster management requires system capacities, a competent staff, and a clearly defined, executable, and practiced disaster response plan.
■ External disasters can quickly become internal disasters for the organization.
■ Incident Command System (ICS) is a management model that assists in achieving command and control during disaster response.
■ After each disaster, an evaluation of the response must be made, strengths and problems identified, and the plan should be changed accordingly.
■ The needs and concerns of staff must be ascertained and addressed in order to facilitate health care workers’ ability and willingness to report to duty during catastrophic events.
■ Interagency cooperation and coordination is essential for effective disaster response.
■ During catastrophic events, the standard of care may need to be altered.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the three types of disaster planning.
2. Explain the difference between an internal and external disaster.
3. Describe how an external disaster can create an internal disaster in a hospital.
4. Explain the different styles of disaster leadership.
5. Identify the appropriate timing for the different styles of disaster leadership.
6. List and describe the five phases of disaster management.
7. Explain the incident command system used in hospitals.
8. Discuss the importance of interagency coordination and collaboration during disaster planning and response.
9. Discuss the notion of an altered standard of care during catastrophic events.
The purpose of disaster management in any health care facility is to maintain a safe environment and continue to provide essential services to the patients during times of disaster. Disaster management includes preparedness/risk assessment, prevention, mitigation, response, recovery, and evaluation activities. Effective planning is the most important element of disaster management. Disasters at any level can be the result of events internal to the institution, external to the facility, or a combination of both. Regardless of the type of disaster, strong leadership is required to mobilize and focus the organization’s energy.

The essential elements for successful disaster management are appropriate system capacities to support the delivery of services; staff that is competent in their disaster response roles; a clearly defined, executable, and practiced disaster plan; and strong preexisting partnerships with collaborating organizations and agencies.

In the United States, as per the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), all hospitals now must utilize an incident command structure on which to model their disaster plan. The most commonly utilized system for this is the Hospital Incident Command System. This system delineates a clear chain of command and authority and assigns specific disaster functional roles for staff members. After each disaster response, an evaluation must be done for the purpose of identifying what worked and what requires improvement. Afterward, follow-through activities must ensure that identified changes are implemented.

Disaster management is akin to a feedback loop—it starts with planning, moves to prevention, mitigation and response, and then moves to evaluation and identification of areas for improvement, and planning again to implement the required changes. Not every disaster can be prevented; however, strong leadership and sound disaster management can serve to mitigate the results of almost any disaster.

The possibility exists that in the event of a catastrophic disaster, the standard of care in the hospital setting may have to be altered. Advance planning for such a situation can serve to save the most lives.
INTRODUCTION

Disaster management of the 21st century goes beyond incident response and postevent activities. It includes risk assessment, prevention, mitigation, response, and recovery activities. In fact, the hospital manager should spend more time on disaster preparedness planning and evaluation, rather than on actual disaster response events. In the hospital setting, the primary purpose for an emergency management plan is to maintain a safe environment so that patient care can continue to be delivered effectively and staff are not exposed to undue risks during times of emergency or disaster response. The most important aspect of disaster management is planning in advance. Disaster planning requires the cooperation of the hospital, community agencies, and local government officials (Waeckerle, 1991). Cuny (1998) describes three types of advanced planning activities:

1. Strategic planning—These are planning activities that focus on preparing the organization for any type of threat. This is commonly referred to as the all-hazards approach.

2. Contingency planning—These are planning activities related to a site-specific threat that may occur at any time. An example of this in the hospital setting would be planning activities for a facility that is in close proximity to a nuclear power plant or an airport.

3. Forward planning—These are planning activities for a known imminent disaster, for example, a pending snowstorm, hurricane or major rock concert.

Each of these different types of planning activities is temporally ordered. Strategic planning is done to prepare the hospital for any type of emergency or disaster. Contingency planning is done after a risk assessment has been completed and the vulnerabilities of the organization are identified. Geographic location, geological features, industries in the community, demographics of the population served, and age and condition of the facility are some of the factors to be considered when performing such an assessment. Contingency planning is sometimes done in the form of appendices to the strategic (or all hazards approach) plan. Forward planning is performed in response to an anticipated disaster or event. It focuses on plans for activation of the existing strategic and possibly the contingency plans.

Despite the fact that planning is usually considered the most important step in disaster preparedness and response, it is frequently the step that receives the least attention. Auf der Heide (1989) attributes this to the “apathy factor.” He reports that because disasters are low-probability events, disaster preparedness tends to get lost among the day-to-day events of our lives and in the workplace, community, and home settings. The public in general tends to be poorly informed about disaster preparedness and frequently either underestimates the risk for events or adopts an attitude of denial or fatalism. The government is more likely to earmark resources for programs that have a strong constituency, and frequently emergency preparedness planning is not on the priority list. Finally, in the United States, disaster planning and response is a cross-jurisdictional, interagency endeavor with poorly defined lines of authority and accountability. It is, therefore, difficult for a healthcare agency to make plans for interagency interface and coordination when the partners are difficult to identify.

However, after the terrorism events on U.S. soil during 2001, a series of serious natural disasters such as Hurricanes Katrina and Rita during 2005, and the new threat of emerging infectious diseases such as SARS and avian influenza, there is a heightened interest in the topic in the United States and the rest of the world. The value in planning is in its ability to anticipate problems that are likely to be encountered in a disaster and to develop practical, realistic, and cost-effective measures for response (Auf der Heide, 2002). The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) environment of care standards require that all hospitals perform a hazard risk assessment for both internal and external disasters and have an emergency management plan that includes the ability to use an incident command system for joint response with other agencies.

Considerations Related to Internal Versus External Disasters

Internal Disaster

An internal disaster occurs when there is an event within the facility that poses a threat to disrupt the environment of care. Such events are commonly related to the physical plant (e.g., loss of utilities or fire), but can arise from availability of personnel (e.g., a labor strike). Regardless of the cause, the management goal is to maintain a safe environment for the patients, continue to provide essential services, ameliorate the problem, and restore normal services.

External Disaster

An external disaster becomes a problem for a facility when the consequences of the event create a demand for services that tax or exceed the usual available resources (e.g., arrival of a large number of trauma patients or victims of a chemical HAZMAT incident).
Combined External/Internal Disaster

External disasters can trigger internal disasters for an organization. A severe weather condition like a snowstorm or a geological event like an earthquake can create both conditions for a hospital. During severe weather events, staff may not be able to commute to work, but trauma cases may increase, and this results in a situation where there is short staffing with a simultaneous increase in demand for services. An earthquake may cause structural damage to the hospital, destroy roads and highways, and cause mass casualties in the community. Such a hospital would be faced with simultaneous internal and external disasters.

Goolsby and Kulkarni (2006) further classify disasters according to the magnitude of the disaster in relation to the ability of the agency or community to respond. Disasters are classified by the following levels:

Level I: If the organization, agency, or community is able to contain the event and respond effectively utilizing its own resources.

Level II: If the disaster requires assistance from external sources, but these can be obtained from nearby agencies.

Level III: If the disaster is of a magnitude that exceeds the capacity of the local community or region and requires assistance from state-level or even federal assets.

Considerations Related to Levels of Disasters

Level I

The agency must assure that each of its own employees are competent in basic emergency preparedness, and there is adequate surge capacity within its own organization to be prepared to respond to routine emergencies, some of which can be expected, such as power outages, weather events, or other limited events.

Level II

The agency must assure that it has adequate linkages with other organizations and agencies in the surrounding community so when needed, required local support and assets can be readily procured.

Level III

The agency must assure that it has adequate linkages with state- and federal-level organizations, have the ability to know when to request a higher level of assistance, and know the communication chain of command for requesting state and or federal assets.

The most effective way for an organization to prepare for any type of disaster, whether it be a Level I, II, or III or internal, external, or combined internal/external, is to have a solid plan in place for the most likely events, establish relationships with public agencies (e.g., EMS, fire and police departments), utility companies (telecommunications, electric, and water), and enter into mutual aid agreements with similar types of facilities (e.g., the hospital in the next community). During the disaster is not the time for senior management of the hospital to be first meeting leaders of public agencies, utilities, and neighboring health care facilities. In addition, disaster managers may need to interface with governmental agencies in the local community or on the state or federal level. This is usually done through the local- or state-level Office of Emergency Management (OEM). Hospital disaster managers should be familiar with the staff and procedures of the OEM that their organization is likely to interface with during an internal or external disaster at any of the levels. Commitment to disaster preparedness by the Chief Executive Officer and others in hospital leadership is critical to the success of the endeavor (Auf der Heide, 2002). Figure 8.1 illustrates the federal, state, and local level agencies involved in disaster response typical communication flow.
facility. These types of activities can be accomplished rapidly only if preexisting relationships and plans exist.

Currently, the most common model for disaster response in the hospital sector is the Incident Command System (ICS) model (Federal Emergency Management Agency [FEMA], 2001). In 1992 the Hospital Emergency Incident Command System (HEICS) was first developed by the California Emergency Medical Services Authority and the San Mateo County Health Services Agency. It is important to remember that HEICS is not a disaster plan, but rather a model on which a plan can be developed. In 2006 the model was updated and it is now known as the Hospital Incident Command System (HICS). The newer model of incident command for hospitals includes:

- A new name (HICS).
- A streamlined organizational chart that is consistent with the National Incident Management System (NIMS), which includes nine key positions: incident commander; public information officer; safety officer; liaison officer; section chiefs for operations, finance/administration, planning, and logistics; and a medical/technical specialist.
- Modification of the operations section to include provisions for daily operations. (This is consistent with the notion that one needs to maintain a safe environment and provide effective care to all patients, including the current population as well as the disaster victims.)
- The addition of planning tools for specific internal and external emergency scenarios that could affect the hospital. These tools target probable events and assist with integration with community agencies as well. The tools include checklists, forms, and so forth.

The original basic concepts of HEICS remain in the HICS 2006 version.

DISASTER MANAGEMENT PROGRAMS

There are five basic phases to a disaster management program (Kim & Proctor, 2002), and each phase has specific activities associated with it.

- Preparedness/Risk Assessment: Evaluate the facility’s vulnerabilities or propensity for disasters. Issues to consider include: weather patterns; geographic location; expectations related to public events and gatherings; age, condition, and location of the facility; and industries in close proximity to the hospital (e.g., nuclear power plant or chemical factory).
- Mitigation: These are steps that are taken to lessen the impact of a disaster should one occur and can be considered as prevention measures. Examples of mitigation activities include installing and maintaining backup generator power to mitigate the effects of a power failure or cross training staff to perform other tasks to maintain services during a staffing crisis that is due to a weather emergency.
- Response: The response phase is the actual implementation of the disaster plan. The best response plans use an incident command system, are relatively simple, are routinely practiced, and are modified when improvements are needed. Response activities need to be continually monitored and adjusted to the changing situation.
- Recovery: Once the incident is over, the organization and staff need to recover. Invariably, services have been disrupted and it takes time to return to routines. Recovery is usually easier if, during the response, some of the staff have been assigned to maintain essential services while others were assigned to the disaster response.
- Evaluation: Often this phase of disaster planning and response receives the least attention. After a disaster, employees and the community are anxious to return to usual operations. It is essential that a formal evaluation be done to determine what went well (what really worked) and what problems were identified. A specific individual should be charged with the evaluation and follow-through activities.

LEADERSHIP STYLES FOR DISASTER MANAGEMENT OPERATIONS

Most managers have a particular leadership style, which serves them well during times of non-disaster operations. Such styles usually span a spectrum of varying degrees of control—directive, supportive, participative, or achievement-oriented. To be effective, disaster managers need to be able to match the management style with the phase of disaster operations (Cuny, 2000).

During the non-crisis phase, participative and achievement-oriented management styles work best for disaster management. Involvement of the staff during disaster planning activities serves several functions. The staff usually knows what will work and what will not work in terms of a plan and can readily identify vulnerabilities during risk assessment activities. In addition, staff who are involved in the planning have a vested interest in seeing it succeed and are more likely to follow the plan and cooperate during times of crisis; whereas those plans that are developed without the involvement of the staff have a lower likelihood of being successful. Such plans end up being merely compilations of procedures, which are poorly understood by the staff and not likely to be followed.
During the response phase of a disaster, a more directive style of leadership is required. At this time the leader must act quickly and decisively, and there is usually little time for extended consultation. For this reason, the most experienced manager should be sought for the task. Staff members who have been involved in the planning process from the beginning will usually understand the need for this type of management during this time and follow orders and direction. During the acute phase of a disaster, use of an incident command structure will assist the manager with directing disaster operations.

As the disaster winds down and transitions to the recovery and evaluation phases, the leader can become less directive and more supportive. Staff may have been traumatized by the event and require support from the leader.

Figure 8.2 illustrates the degree of directiveness of the leader during the phases of disaster planning and management. The ability to toggle back and forth between different leadership styles requires practice and experience. Staging drills between times of disaster response offers the opportunity to practice.

It is also important to note that disasters occur during all times of the day and all days of the week. Health care staff members who work during evening, night, and weekend hours also need to be proficient in disaster management. They need to be able to switch their leadership style to suit the situation. This can only be achieved through participation in the planning and evaluation activities and preparation through practice and drills.

PHASES OF DISASTER MANAGEMENT

Risk Assessment

The disaster manager needs to consider what types of disasters are most likely to be encountered by the organization. All types of events need to be considered, including deliberate human-caused, technological, and natural events. Table 8.1 describes the most common types of disasters that are included in disaster management plans. The best disaster management plans are developed for an all-hazards approach and then have specific appendices for the events that are most likely to occur in the area. The appendix will address procedures that are unique for that incident. For instance, for a radiation incident, the appendix would include reporting procedures, how to notify the Radiation Safety Officer, as well as procedures for decontamination of the patient and disposal of contaminated clothing. The new HICS document contains numerous sample appendices that can be utilized for different types of scenarios. These are available from the California Emergency Medical Services Authority Web site (2007).

The disaster manager needs to also perform a risk assessment in the area of staffing. Depending on the nature and extent of the disaster and the demographics of the workforce, there may be variation in the employee’s ability and/or willingness to report to work. The staffing issue has been examined by several researchers. Shapira et al. (1991) found that child care responsibilities and...
### 8.1 Examples of Likely Events and Effect on the Hospital's Environment of Care

<table>
<thead>
<tr>
<th>TYPE OF EVENT</th>
<th>EXAMPLES</th>
<th>POTENTIAL EFFECT ON THE ORGANIZATION’S ENVIRONMENT OF CARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidents</td>
<td>Transportation, Industrial plant, Nuclear</td>
<td>■ Patient census exceeding facility capacity</td>
</tr>
<tr>
<td></td>
<td>Biohazard</td>
<td>■ Patient census exceeding facility capacity</td>
</tr>
<tr>
<td></td>
<td>Bioterrorism</td>
<td>■ Staff safety issue related to contamination</td>
</tr>
<tr>
<td>Biological</td>
<td>Epidemic (influenza)</td>
<td>■ Staffing problems due to increase in sick time or fear</td>
</tr>
<tr>
<td>Civil</td>
<td>Riots</td>
<td>■ Staffing problems due to fear</td>
</tr>
<tr>
<td>Facility Failure</td>
<td>Water</td>
<td>■ Staffing problems due to fear</td>
</tr>
<tr>
<td></td>
<td>Electricity</td>
<td>■ Staffing problems due to fear</td>
</tr>
<tr>
<td></td>
<td>Heating, ventilation, air conditioning (HVAC)</td>
<td>■ Staffing problems due to disruption of transportation system</td>
</tr>
<tr>
<td></td>
<td>Geographical</td>
<td>■ Staffing problems due to disruption of transportation system</td>
</tr>
<tr>
<td>Geological</td>
<td>Earthquakes</td>
<td>■ Staffing problems due to disruption of transportation system</td>
</tr>
<tr>
<td></td>
<td>Volcanic eruption</td>
<td>■ Increased in trauma volume that exceeds capacity of the facility</td>
</tr>
<tr>
<td></td>
<td>Tsunamis</td>
<td>■ Increased in trauma volume that exceeds capacity of the facility</td>
</tr>
<tr>
<td>Warfare/terrorist attack</td>
<td>Mass casualty incidents</td>
<td>■ Staffing problems due to fear or disruption in transportation system</td>
</tr>
<tr>
<td>Weather</td>
<td>Snowstorm</td>
<td>■ Staffing problems due to disruption in transportation system</td>
</tr>
<tr>
<td></td>
<td>Heat emergency</td>
<td>■ Increased patient census that exceeds facility capacity</td>
</tr>
<tr>
<td></td>
<td>Hurricanes</td>
<td>■ Increased patient census that exceeds facility capacity</td>
</tr>
<tr>
<td></td>
<td>Tornadoes</td>
<td>■ Increased patient census that exceeds facility capacity</td>
</tr>
<tr>
<td></td>
<td>Floods</td>
<td>■ Increased patient census that exceeds facility capacity</td>
</tr>
</tbody>
</table>

Concern for one's own safety were the most likely factors that would influence an employee's decision to not report to work during a catastrophic disaster such as a chemical or biological attack. Qureshi, Merrill, Gereshon, and Calero-Breckheimer (2002) found that in a pilot study of emergency preparedness for New York City school health nurses, 49 out of 50 of the participants reported at least one barrier that would impede their ability to report to work during an emergency situation. The most common barriers identified were related to child, elder, and pet care issues. In a larger study of more than 6,000 health care workers, Qureshi, Gereshon, Gebbie, Straub and Morse (2005) also found that where an employee has more of a potential to become ill or injured while working during a disaster, they are less likely to be willing to report to work. Barriers to willingness included fear and concern for family and self and personal health problems. The findings were consistent for all types of facilities. Lanzilotti, Galanis, Leoni, and Craig (2002) found that health professionals’ willingness to work in a field hospital during a mass casualty event as a result of a weapon of mass destruction (WMD) was influenced by their perceived ability to provide adequate care to the victim. Based on the findings from these researchers, a disaster manager needs to understand what factors influence their employees’ ability and willingness to report to duty, and then address the identified issues. For example, the employer could make plans to open a child care center for employees’ children, make arrangements for pet care through a local animal volunteer group, assure the ready availability of personal protective equipment, provide adequate safety training, and educate staff about WMD to improve employee willingness to report during an event. Both ability and willingness of the workforce need to be evaluated and prepared for in each organization before the incident occurs.
Hazard vulnerability risk assessments need to be reviewed at least on an annual basis. A new industry may have located to the area, or events of the world may have changed. For example, the threat of bioterrorism, emerging infectious diseases, or civil strife may become part of our reality. The emergency management plan may have to be revised, and an appendix may have to be added for newly identified risks. This process then leads to the next phase of disaster management—mitigation.

Mitigation

Mitigation lessens the severity and impact of the disaster through appropriate planning and practice. The best ways to mitigate the results of a disaster are to perform a thorough hazard vulnerability risk assessment and be sure that your plan includes provisions for each of the likely events; develop a plan that maintains the least variation from normal routines as possible, and develop backup plans in the event the first response actions are not successful. Plans for staffing can be used as an example. All disaster management plans need to include provisions to achieve adequate staffing to meet the needs of the existing as well as incoming patients. Usually a telephone notification tree protocol is put into place, and additional staff are called in as needed. However, what if the disaster disables the telephone system? Having a backup plan such as use of cell phones or relocation of the staffing office to another facility would mitigate the effects of the failed telephone system. Not all disasters can be prevented. But mitigation would mitigate the effects of the failed telephone system. Having a backup plan such as use of cell phones or relocation of the staffing office to another facility would mitigate the effects of the failed telephone system.

ESSENTIAL ELEMENTS FOR HOSPITAL DISASTER MANAGEMENT

The essential elements for any disaster management system include the following:

- An appropriate infrastructure to support the disaster response, which includes maintaining services for preexisting patients as well as the new arrivals.
- An appropriately trained staff who are competent to perform their disaster response functional roles and willing to report to work during any sort of disaster.
- A clearly defined, executable, practiced emergency response plan.
- A strong foundation of preexisting relationships with partnering organizations and agencies that can be called on to provide mutual aid and support when needed.

Infrastructure

During response for an external disaster, two types of operations need to take place simultaneously. Current patients need to be cared for at the same time as the new arrivals. It is the disaster manager’s responsibility to ensure that this is done. One method is to assign one individual with the specific responsibility for directing the care to the preexisting patients and ensuring for their safety. The HICS incorporates a framework for guiding this objective. This requires a certain degree of surge capacity that should be determined during the risk assessment and planning process. Organizations that utilize just-in-time processes for staffing or supply management need to take into account the possible sudden increases in demand imposed by an emergency or disaster. Making provisions for rapid procurement during these times can help to improve the disaster response.

During an internal disaster situation, staff need to be sure that the environment of care remains safe and essential services are provided to all patients. The physical plant, utilities, staffing, supplies, and equipment must remain available and functional.

Competency of the Staff

Another crucial element of disaster management is assuring that all levels of staff are competent to perform during disaster response. Emergency preparedness competencies refer to the ability of the staff to actually perform their functional roles for emergency response. Competencies are usually complex actions; therefore, the best method to evaluate competence is direct observation. This can be accomplished through drills or during actual response activities.

Emergency preparedness core competencies have been developed for public health (Gebbie & Merrill, 2002), nurses (Gebbie & Qureshi, 2002), and all hospital workers and leaders (Gebbie & Merrill, 2002). Table 8.2 summarizes these core competencies for hospital workers. These emergency preparedness competencies are cross cutting knowledge, skills, and abilities that all hospital workers must be able to demonstrate, and there are additional competencies for hospital leaders.

The Disaster Plan

The staff in any health care organization should be fully conversant with the agency’s emergency response plan. During the emergency response is not the time to begin to teach staff about the elements of the plan. Employees should know their emergency response functional roles, and these should have been practiced beforehand.

Each agency needs to have an emergency response plan that is specific to that agency, and consistent with
Core Competencies for ALL Hospital Staff

1. Locate and use the section of the hospital emergency plan that applies to your position.
2. Describe your emergency response functional role and be able to demonstrate it during drills or actual emergencies.
3. Demonstrate the use of any equipment (such as personal protective equipment or special communication equipment) required by your emergency response role.
4. Describe your responsibilities for communicating with or referring requests for information from other employees, patients and families, media, general public or your own family and demonstrate these responsibilities during drills or actual exercises.
5. Demonstrate the ability to seek assistance through the chain of command during emergency situations or drills.
6. Demonstrate the ability to solve problems that arise from carrying out your role during emergency situations or drills.

Core Competencies for Hospital LEADERS

1. Describe the mission of the hospital during response to emergencies of all kinds, including the disaster response chain of command and emergency management system (e.g., Hospital Emergency Incident Command System, Incident Command System) used in your hospital.
2. Demonstrate the ability to review, write, and revise as needed those portions of the hospital emergency plan applicable to your management responsibilities and participate in the hospital’s hazard vulnerability analysis on a regular basis.
3. Manage and implement the hospital’s emergency response plan during drills or actual emergencies within your assigned functional role and chain of command.
4. Describe the collaborative relationship of your hospital to other facilities or agencies in the local emergency response system and follow the planned system during drills and emergencies.
5. Describe the key elements of your hospital’s emergency preparedness and response roles and policies to other agencies and community partners.
6. Initiate and maintain communication with other emergency response activities as appropriate to your management responsibilities.
7. Demonstrate your responsibilities for communicating with other employees, patients and families, media, general public, or your own family and demonstrate them during drills or actual emergencies.
8. Demonstrate the use of any equipment (such as personal protective equipment or special communication equipment) required by your agency response.
9. Demonstrate flexible thinking and use of resources in responding to problems that arise carrying out your functional role during emergency situations or drills.
10. Evaluate the effectiveness of the response within your area of management responsibility in drills or actual emergencies and identify improvements needed.


Preexisting Relationships and Partnerships

The geopolitical climate today makes it likely that the emergencies and disasters that any hospital can expect to encounter are likely to be more complex and of a higher magnitude of severity. With the decreased surge capacity of most hospitals (i.e., fewer staffed beds, little or no extra staff, and so forth) the need to establish mutual aid agreements, plans to share resources, and ability and willingness to provide and receive support from local agencies is of paramount importance. Perhaps the best method to establish such emergency response relationships is to plan and drill/exercise with other organizations and agencies. During such endeavors, managers and staff across the organizations get to know and trust one another, tend to develop plans that synchronize the partnering agencies, and during a crisis are better able to work together. Every disaster manager needs to remember that all disasters are local. Each hospital or health care facility must have a plan in place that provides for procurement of local assistance or mutual aid, before reaching out to the state or federal agencies.
8.3 Essential Features of a Hospital Disaster Plan

- Definition of a disaster (determines point of activation)
- Plan activation protocol
- Notification
- Chain of command
- Phase
- Command center
- Emergency operations center (EOC)
- Reporting center (for staff)
- Traffic flow
- Triage
- Decontamination
- Treatment areas
- Specialized areas
- Family
- Volunteers
- Media
- Morgue
- Individual departmental plans
- Internal disaster plans
- Individual disasters (utility failure, strike plan)
- Evacuation of the facility


Response

Even though disaster managers spend the least amount of time in the response phase, it is this phase that most employees remember. It is at this point that the disaster manager must change leadership styles. During disaster response, group decision making/consensus style management is replaced with structured and focused direction style. Staff who have been involved in the planning process will recognize the need for this style of leadership and will cooperate. The most common framework to achieve this in the hospital setting is the Hospital Incident Command System (HICS).

HOSPITAL INCIDENT COMMAND SYSTEM (HICS)

Introduction to HICS

HICS is an emergency management system that is comprised of specific disaster response functional role positions within a hierarchical organization chart. Figure 8.3 illustrates the basic HICS table of organization. Each position has a job action sheet (JAS) that clearly defines the functional role and the tasks required to fulfill that role. The use of incident command reduces staff freelancing and provides management with the level of control required to manage the disaster.

The California Emergency Medical Services Authority and the San Mateo County Emergency Medical Services Agency originally developed this system (previously referred to as “HEICS,” the hospital emergency incident command system). The HICS template, as well as all supporting documents, can be obtained free of charge from the Internet at http://www.emsa.ca.gov/hics/hics.asp. HICS is not a disaster plan, but rather a disaster management model for emergency response.

The HICS document reflects the same basic principles of command and control, chain of command, predefined positions, established reporting and communication relationships, use of common nomenclature, expandability and contractility of the scale of the operation, and span of control, as did its predecessor HEICS.

History of HICS (HEICS)

During the 1980s, as a response to poor coordination of operations while fighting wildfires in California, an interagency (federal, state, and local) cooperative effort was established to develop a common inter- and intra-agency organizational system. The original cooperative plan was called FIRESCOPE and produced a standard operating system for firefighting agencies known as the Incident Command System (ICS). ICS was deemed to be successful and hospitals began to look for a system that could be used to bring order to the usual chaos that was experienced during emergency response. With funding from the State of California Emergency Medical Services Authority, the Orange County Emergency Medical Services agency worked with the hospital sector, and in 1991 the first edition of HEICS was published. A second edition was published in 1993, and the third was released in 1998. In 2006 HICS was released, which supplanted HEICS III.
Part II

Disaster Management

Figure 8.4 HICS incident management team chain of command.

Key Features of Incident Command and HICS

- **Predictable, responsibility-oriented chain of command**: In the HICS system there is ONE incident commander. This individual has overall responsibility for the management of the incident, and employees know who reports to them and to whom they report. Direction, requests for resources and all information flow in a prescribed fashion up or down the chain of command. Figure 8.4 illustrates the hierarchy of the chain of command in HICS.

- **Use of common nomenclature**: All agencies utilizing ICS use the same titles and functional roles for the command staff positions. Use of common terminology assists different agencies with communicating with each other.

- **Modular, flexible organization**: Only those portions of the system that are needed for the response are activated. It can be expanded or scaled back according to the situation. This is efficient, conserves resources, and makes it applicable to both large and small events.

- **Unified command structure**: This allows all agencies involved in the response to coordinate efforts by establishing a unified set of incident objectives and strategies.

- **Incident Action Plan (IAP)**: This is a plan that is developed when multiple agencies are involved in the disaster response. It ensures that all agencies are working toward the same goal. It is what is developed when the unified command structure is used.

- **Facility Action Plan (FAP)**: A FAP describes the purpose, goals, and objectives for the hospital’s response. All responders in the hospital then work toward the same goals and objectives.

- **Unity of command**: Each person reports to only one individual.

- **Manageable span of control**: Each manager controls a defined amount of resources, which is limited to what can realistically be managed. The ideal range is 5–7 people per supervisor, however where tasks are relatively simple, the personnel possess a high level of expertise or the management team is in close proximity to those being supervised, this number of persons supervised can be higher than 7.

- **Use of JAS**: Job action sheets define for the staff what their specific functional role is during the disaster response. They also facilitate improved documentation for better financial recovery after the event.

HICS Structure

HICS achieves command and control during disaster response through its chain of command, incident action plans, defined functional roles for each individual, and extensive use of incident response tracking forms. At the top of the organization tree are the command positions: Incident Commander, Safety, Liaison, and Public Information Officers. Under the command positions are the staff positions that include the section chiefs and their reporting staff. As the disaster response evolves, sections are activated or deactivated. The only position that is always required for incident command is the Incident Commander. Figure 8.5 illustrates a full HICS table of organization; Figure 8.6 illustrates an example of the type of positions in a hospital that would fill each of these incident command positions. Only those portions of the ICS tree that are required for the response are activated, and the tree will expand and contract as needed.

Each position in HICS has a specific functional role that is described on a JAS. Each JAS includes functional role title; what role title that position reports to; the mission of the position; and immediate, intermediate, and extended tasks. Figure 8.7 provides examples of functional role JAS. When developing a hospital disaster plan based on HICS, the manager should review established HICS JASs and adapt them to the organization.

Specific HICS Functional Roles

Although HICS has many different functional roles, the roles on the top of the organization tree will be similar across a variety of types of organizations. The positions at the base of the tree are more generic to the hospital setting.

**Command Positions**

These are the positions at the top of the ICS organizational tree. They are the same in HICS as well as ICS for the uniformed services.
Figure 8.5 Potential candidates for HICS positions.
Available at: http://www.emsa.ca.gov/hics/appendixes.pdf
Figure 8.6 HICS incident command team organizational chart.

Available at: http://www.emsa.ca.gov/hics/appendices.pdf
Incident Commander (IC): The mission of the IC is to organize and direct the operations of the incident. The highest-ranking executive in the organization appoints the IC, and from that point the IC directs the disaster response. In the best disaster management system, the IC is selected based on experience in disaster management, knowledge of the organization, and the nature of the incident. The IC immediately appoints the other required command staff (e.g., safety, liaison, and public information officers) and activates the required sections (planning, operations, logistics, and finance). The IC establishes an emergency operations center (EOC) and then initiates a meeting to develop the initial incident action plan (IAP). It is important that the IC acts more as a director than as a participant and manages on a macro level rather than a micro level. At periodic intervals, the IAP is reviewed and updated as necessary. For instance, during a fire, the IAP may start out aiming to evacuate one floor of a hospital to the emergency department, but then change to evacuate the entire hospital to other facilities.

Safety and Security Officer: The mission of the safety officer is to ensure for the safety of the staff, facility, and the environment during the disaster operation. The safety officer has the final authority to make decisions as they relate to safety and hazardous conditions. With the threat of bioterrorism and chemical warfare, the role of the safety officer has taken on added importance.

Liaison Officer: The mission of the liaison officer is to function as a contact for external agencies. During times of disaster, the hospital is likely to interface with multiple local, state, or federal agencies. The liaison officer serves as a conduit for these agencies and serves to prevent the IC from becoming overloaded with information and requests. Likewise, all communication from the hospital to these external agencies should go through the liaison officer to prevent duplicate requests or conflicting information. This can be difficult for departments in the hospital that have a preexisting working relationship with an external agency. If, during an event, an external agency decides to station staff at the facility, the liaison officer coordinates the activities of the interagency staff.

Public Information Officer: The position is responsible for providing information to the news media. Disaster managers must be aware that the news media can make or break the public’s perception of the hospital’s response to a disaster. When the media are handled appropriately, they can be an asset to the disaster response. The public information officer is key to this process, and this position should be activated for any response that has the potential to involve the media.

Medical/Technical Specialists: These positions provide guidance on a variety of special situations. Positions may include specialists in biological and infectious diseases, legal affairs, chemical, radiological, risk management, medical staff, pediatric care, clinic administration, hospital administration, and medical ethics.

Staff Positions
The lower portion of the ICS tree contains the staff positions. Staff positions all fall under one of four sections and are headed by a chief.

Planning Section Chief: The mission of the planning section chief is to collect and distribute information within the organization that is required for planning and the development of an IAP. The planning section chief assures that the appropriate reports are being generated, and that the facility IAP is communicated to the other section chiefs. This position also directs the planning activities for staffing and manages the labor resource pools.

Operations Section Chief: The mission of the operations section chief is to direct the actual activities related to the patient care activities during disaster response. Typically, in a hospital setting this is the largest of the sections and engages the most personnel. This section includes clinical (medical and nursing) and ancillary services.

Logistics Section Chief: The logistics section chief has a mission to ensure that all resources and support required by the other sections are readily available. Responsibilities include maintenance of the environment and procurement of supplies, equipment, and food. Logistics ensures that the operations staff can focus on delivering services.

Finance/Administrative Section Chief: The mission of the finance section chief is to monitor the utilization of assets and authorize the acquisition of resources essential for the emergency response. This position is also frequently charged with ensuring that human resources policy and procedure consultation is available to the IC.

Operations Section Branches
Major divisions under the operations section will be divided into branches. For instance, there may be an ongoing care branch that will be responsible for assuring continuity of care for existing patients in the hospital, and there may be an emergency medical response branch that will be responsible for delivery of care to incoming victims.

Unit Leaders, Supervisors, and Directors
Unit leaders are responsible for a major division or service within the disaster response. Some of these services
or divisions would correspond to a department in a hospital (e.g., laboratory or pharmacy units); whereas others are specific to the disaster response (e.g., labor pool unit). If the number of staff warrant a further division, then subunits are created that are directed by a supervisor or director, who, in turn, reports to the section chief. The goal of incident command is to manage the span of control so that effective command and control can be maintained. All direction, information, and requests flow up or down, through the chain of command.

COMMUNICATION

The most frequently cited failures in disaster response systems are in the areas of decision making and communication (Ingelsby, Grossman, & O’Toole, 2001). Use of incident command assists with decision making and maintaining order. However, in any type of agency, communication needs to be addressed on multiple levels: within the agency, between agencies, with the media and public, and for staff members and their families as well.

Incident command addresses interagency communication through the role of the liaison officer. Communication with the media and public is addressed through the public information officer. Disaster managers need to remember that the public’s perception of how an agency performs during a disaster is largely influenced by media reports. Therefore, all incidents require the participation of the organization’s media affairs staff, and all staff needs to know what the policy is regarding release of information to any group—media, general public, or other responding agencies.

Additionally, during emergency response activities, staff needs to be provided with a method to communicate with their families. It is most difficult for staff to concentrate on an emergency response functional role while worrying about the safety of their family. Making provisions for family communication will result in a more focused workforce for response activities.

The organization needs to be sure that there is a mechanism (and a backup procedure) for contacting staff in the event a disaster response is activated. Each department head in the organization needs to be able to contact their staff members, and where telephone numbers are used, they must be kept up to date.

Communication can make or break the operation of a disaster response. This is an important area that the disaster manager must focus on.

ALTERED STANDARDS OF CARE

Another important issue to consider is the fact that in the event of a catastrophic disaster (such as Hurricane Katrina or a large-scale WMD event) or a large-scale epidemic, the standard of care provided to all patients in a hospital may need to be altered. Although this may seem to be inconceivable to some, the reality exists, and the hospital disaster manager must plan for such events. The first step in this process is to acknowledge this as a potential reality, and inform staff of such. The Agency for Healthcare Research and Quality (AHRQ, 2005) has identified four levels of medical standards and provided guidelines that may be utilized by disaster managers when formulating such plans. The four levels include normal medical standards; near-normal medical standards (where the focus will be on an expanded scope of practice for some practitioners, use of alternate sites of care, and use of atypical devices, such as reusing disposable equipment); key lifesaving care (many will receive only key lifesaving care and nonessential services will be delayed or eliminated); and, finally, total systems/standards alteration (severe rationing of care, and some persons will not be treated at all).

The guidelines are based on the following five principles:

1. During disaster planning the goal should be to keep the system functioning to deliver the highest level of care possible to save as many lives as possible.
2. The planning must be comprehensive, community-based, include all types of agencies, and coordinated at the regional level.
3. There must be an adequate legal framework for providing care during a catastrophic event that has many casualties.
4. The rights of patients must be protected to the extent possible considering the circumstances.
5. Clear, effective communication with all is essential during all phases of a disaster, including before, during, and after an event.

The full set of guidelines may be obtained from the AHRQ Web site at http://www.ahrq.gov/research/altstand/index.html.

RECOVERY

During the recovery phase the disaster is over, and the facility attempts to return to usual operations. During this period of time, the disaster manager must be attuned to not only the operations of the organization, but to the staff as well. Plans should be in place to provide critical incident stress debriefing for those staff members who may have been exposed to traumatic experiences or worked for protracted periods of time and may be simply exhausted. It is during the recovery phase that
Chapter 8  Disaster Management

Incident Commander

Mission: Organize and direct the Hospital Command Center (HCC). Give overall strategic direction for hospital incident management and support activities, including emergency response and recovery. Authorize total facility evacuation if warranted.

Date: __________ Start: __________ End: __________ Position Assigned to: ___________________________

Signature: __________________________________________ Initial: ______________

Hospital Command Center (HCC) Location: ____________________ Telephone: __________________
Fax: __________________ Other Contact Info: __________________ Radio Title: ______________

Immediate (Operational Period 0-2 Hours)

Assume role of Incident Commander and activate the Hospital Incident Command System (HICS).

Read this entire Job Action Sheet and put on position identification.

Notify your usual supervisor and the hospital CEO, or designee, of the incident, activation of HICS and your HICS assignment.

Initiate the Incident Briefing Form (HICS Form 201) and include the following information:

• Nature of the problem (incident type, victim count, injury/illness type, etc.)
• Safety of staff, patients and visitors
• Risks to personnel and need for protective equipment
• Risks to the facility
• Need for decontamination
• Estimated duration of incident
• Need for modifying daily operations
• HICS team required to manage the incident
• Need to open up the HCC
• Overall community response actions being taken
• Status of local, county, and state Emergency Operations Centers (EOC)

Contact hospital operator and initiate hospital’s emergency operations plan.

Determine need for and appropriately appoint Command Staff and Section Chiefs, or Branch, Unit, Team Leaders and Medical/Technical Specialists as needed; distribute corresponding Job Action Sheets and position identification. Assign or complete the Branch Assignment List (HICS Form 204), as appropriate.

Brief all appointed staff of the nature of the problem, immediate critical issues and initial plan of action. Designate time for next briefing.

Assign one or more clerical personnel from current staffing or make a request for staff to the Labor Pool and Credentialing Unit Leader, if activated, to function as the HCC recorder(s).

Distribute the Section Personnel Time Sheet (HICS Form 252) to Command Staff and Medical/Technical Specialist assigned to Command, and ensure time is recorded appropriately. Submit the Section Personnel Time Sheet to the Finance/Administration Section’s Timesheet Leader at the completion of a shift or at the end of each operational period.

Initiate the Incident Action Plan Safety Analyses (HICS Form 253) to document hazards and define mitigation.

Figure 8.7 Selected HICS job action sheets.

### Immediate (Operational Period 0-2 Hours) Time Initial

- Receive status reports from and develop an Incident Action Plan with Section Chiefs and Command Staff to determine appropriate response and recovery levels. During initial briefing/status reports, discover the following:
  - If applicable, receive initial facility damage survey report from Logistics Section Chief and evaluate the need for evacuation.
  - If applicable, obtain patient census and status from Planning Section Chief, and request a hospital-wide projection report for 4, 8, 12, 24 & 48 hours from time of incident onset.
  - Identify the operational period and HCC shift change.
  - If additional beds are needed, authorize a patient prioritization assessment for the purposes of designating appropriate early discharges.
  - Ensure that appropriate contact with outside agencies has been established and facility status and resource information provided through the Liaison Officer.
  - Seek information from Section Chiefs regarding current "on-hand" resources of medical equipment, supplies, medications, food, and water as indicated by the incident.
  - Review security and facility surge capacity and capability plans as appropriate.

- Document all key activities, actions, and decisions in an Operational Log (HICS Form 214) on a continual basis.

- Document all communications (internal and external) on an Incident Message Form (HICS Form 213). Provide a copy of the Incident Message Form to the Documentation Unit.

### Intermediate (Operational Period 2-12 Hours) Time Initial

- Designate regular briefings with Command Staff/Section Chiefs to identify and plan for:
  - Update of current situation/response and status of other area hospitals, emergency management; local emergency operation centers, and public health officials and other community response agencies
  - Deploying a Liaison Officer to local EOC
  - Deploying a PIO to the local Joint Information Center
  - Critical facility and patient care issues
  - Hospital operational support issues
  - Risk communication and situation update to staff
  - Implementation of hospital surge capacity and capability plans
  - Ensure patient tracking system established and linked with appropriate outside agencies and/or local EOC
  - Family Support Center operations
  - Public information, risk communication and education needs
  - Appropriate use and activation of safety practices and procedures
  - Enhanced staff protection measures as appropriate
  - Public information and education needs
  - Media relations and briefings
  - Staff and family support
  - Development, review, and revision of the Incident Action Plan.

- Oversee and approve revision of the Incident Action Plan developed by the Planning Section Chief. Ensure that the approved plan is communicated to all Command Staff and Section Chiefs.

- Communicate facility and incident status and the Incident Action Plan to CEO or designee, or to other executives and/or Board of Directors members on a need-to-know basis.
Extended (Operational Period Beyond 12 Hours) Time Initial
Ensure staff, patient, and media briefings are being conducted regularly.
Review and revise the Incident Action Plan Safety Analysis (HICS Form 261) and implement correction or mitigation strategies.
Evaluate/evaluate need for deploying a Liaison Officer to the local EOC.
Evaluate/evaluate need for deploying a PIO to the local Joint Information Center.
Ensure incident action planning for each operational period and a reporting of the Incident Action Plan at each shift change and briefing.
Evaluate overall hospital operational states, and ensure critical issues are addressed.
Review/review the Incident Action Plan with the Planning Section Chief for each operational period.
Ensure continued communications with local, regional, and state response coordination centers and other HCCs through the Liaison Officer and others.
Ensure all staff and volunteers for signs of stress and inappropriate behavior. Report concerns to the Employee Health & Well-Being Unit Leader.
Upon shift change, brief your replacement on the status of all ongoing operations, critical issues, relevant incident information and Incident Action Plan for the next operational period.

Demobilization/System Recovery Time Initial
Assess the plan developed by the Demobilization Unit Leader and approved by the Planning Section Chief for the gradual demobilization of the HCC, and emergency operations according to the progression of the incident and facility/hospital status.
Demobilize positions in the HCC and return personnel to their normal jobs as appropriate until the incident is resolved and there is a return to normal operations.
• Briefing staff, administration, and Board of Directors
• Agrees announcement of "ALL CLEAR" when incident is no longer a critical safety threat or can be managed using normal hospital operations
• Ensure outside agencies are aware of status change
• Declare hospital/facility safety

Ensure the HCC and restocking of supplies, as appropriate including:
• Return of borrowed equipment to appropriate location
• Replacement of broken or lost items
• Cleaning of HCC and facility
• Restock of HCC supplies and equipment;
• Environmental clean-up as sustained

Ensure that after-action activities are coordinated and completed including:
• Collection of all HCC documentation by the Planning Section Chief
• Coordination and submission of response and recovery costs, and reimbursement documentation by the Finance/Administration and Planning Section Chiefs
• Conduct of staff debriefings to identify accomplishments, response and improvement issues
• Identify needed revisions to the Emergency Management Plan, Emergency Operations Plan, Job Action Sheets, operational procedures, records, and/or other related items
• Writing the facility/hospital After Action Report and Improvement Plan
• Participation in formal (community and governmental) meetings and other post incident discussions and after-action activities
• Post-incident media briefings and facility/hospital status updates
• Post-incident public education and information
• Stress management activities and services for staff

Documents/Tools
• Incident Action Plan
• HICS Form 201 – Incident Briefing Form
• HICS Form 204 – Branch Assignment List
• HICS Form 207 – Incident Management Team Chart
• HICS Form 213 – Incident Message Form
• HICS Form 214 – Operational Log
• HICS Form 252 – Section Personnel Time Sheet
• HICS Form 261 – Incident Action Plan Safety Analysis
• Hospital emergency operations plan and other plans as cited in the JAS
• Hospital organization chart
• Hospital telephone directory
• Radio/satellite phones

Figure 8.7 Continued
LIAISON OFFICER

Mission: Function as the incident contact person in the Hospital Command Center for representatives from other agencies.

Date: ________   Start: ______ _   End: ______ _   Position Assigned to: _______________   Initial: _____ _
Position Reports to: Incident Commander (Signature: ___________________ Initial: ___________ _)
Hospital Command Center (HCC) Location: ___________________ Telephone: ___________________
Fax: ___________________ Other Contact Info: _______________ _ Radio Title: ___________________

Immediate (Operational Period 0-2 Hours)

Read this entire Job Action Sheet and review incident management team chart (HICS Form 207). Put on position identification.
Notify your immediate supervisor of your HCC assignment.
Appoint Liaison team members and complete the Branch Assignment List (HICS Form 204).
Brief Liaison team members on current situation and incident objectives, develop response strategy and tactics; outline action plan and designate time for next briefing.
Establish contact with the Communications Unit Leader, and confirm your contact information.
Establish contact with local, county and/or state emergency organization agencies to ascertain current status, appropriate contacts and message routing.
Consider need to deploy a Liaison Officer to local EOC; make recommendation to the Incident Commander.
Communicate information obtained and coordinate with Public Information Officer.
Obtain initial status and information from the Planning Section Chief to provide as appropriate to the inter-hospital emergency communication network and local and/or county EDC, upon request:
- Patient Care Capacity – The number of “immediate (red),” “delayed (yellow),” and “minor (green)” patients that can be received and treated immediately, and current census.
- Hospital’s Overall Status – Current condition of hospital structure, security, and utilities.
- Any current or anticipated shortage critical resources including personnel, equipment, supplies, medications, etc.
- Number of patients and mode of transportation for patients requiring transfer to other hospitals, if applicable.
- Any resources that are requested by other facilities (e.g., personnel, equipment, supplies, medications, etc.).
- Media relations efforts being initiated, in conjunction with the PIO.
Establish communication with other hospitals, local Emergency Operations Center (EOC), and/or local response agencies (e.g., public health). Report current hospital status.
Establish contact with liaison counterparts of each assisting and cooperating agency (e.g., local EOC, Red Cross), keeping governmental Liaison Officers updated on changes in...
Immediate (Operational Period 0-2 Hours)  

- Facility/hospital status, initial hospital response to incident, critical issues and resource needs.
- Request one or more recorders as needed from the Labor Pool and Credentialing Unit Leader, if activated, to perform all necessary documentation.
- Document all key activities, actions, and decisions in an Operational Log (HICS Form 214) on a continual basis.
- Document all communications (internal and external) on an Incident Message Form (HICS Form 213). Provide a copy of the Incident Message Form to the Documentation Unit.

Intermediate (Operational Period 2-12 Hours)  

- Attend all command briefings and Incident Action Planning meetings to gather and share incident and hospital/facility information. Contribute inter-hospital information and community response activities and provide Liaison goals to the Incident Action Plan.
- Request assistance and information as needed through the inter-hospital emergency communication network or from the local and/or regional EOC.
- Consider need to deploy a Liaison Officer to the local EOC; make this recommendation to the Incident Commander.
- Obtain Hospital Casualty/Fatality Report (HICS Form 259) from the Public Information Officer and Planning Section Chief and report to appropriate authorities the following minimum data:
  - Number of casualties received and types of injuries treated.
  - Current patient capacity (census)
  - Number of patients hospitalized, discharged home, or transferred to other facilities
  - Number dead
  - Individual casualty data: name or physical description, sex, age, address, seriousness of injury or condition
- Respond to requests and issues from incident management team members regarding inter-organization (e.g., other hospitals, governmental entities, response partners) problems.
- Assist the Labor Pool & Credentialing Team Leader with problems encountered in the volunteer credentialing process.
- Report any special information obtained (e.g., identification of toxic chemical, decontamination or any special emergency condition) to appropriate personnel in the receiving area of the hospital (e.g., emergency department), HCC and/or other receiving facilities.
- Continue to document all actions and observations on the Operational Log (HICS Form 214) on a continual basis.

Extended (Operational Period Beyond 12 Hours)  

- In coordination with the Labor Pool & Credentialing Unit Leader and the local EOC, request physicians and other hospital staff willing to volunteer as Disaster Service Workers outside the hospital, when appropriate.
- Communicate with Logistics Section Chief on status of supplies, equipment and other resources that could be mobilized to other facilities, if needed or requested.
- Consider need to deploy/maintain a Liaison Officer to local EOC; make the

Figure 8.7 Continued
Part II Disaster Management

Figure 8.7 Continued

<table>
<thead>
<tr>
<th>Job Action Sheet</th>
<th>Time</th>
<th>Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended (Operational Period Beyond 12 Hours)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>recommendation to the Incident Commander</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepare and maintain records and reports as appropriate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure your physical readiness through proper nutrition, water intake, rest, and stress management techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observe all staff and volunteers for signs of stress and inappropriate behavior. Report concerns to the Employee Health &amp; Well-Being Unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upon shift change, brief your replacement on the status of all ongoing operations, issues, and other relevant incident information</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Demobilization/System Recovery | Time | Initial |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>As needs for Liaison team staff decrease, return staff to their normal jobs and combine or deactivate positions in a phased manner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure return/retrieval of equipment and supplies and return all assigned incident command equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upon deactivation of your position, brief the Incident Commander on current problems, outstanding issues, and follow-up requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upon deactivation of your position, submit Operational Logs (HICS Form 214) and all completed documentation to the Planning Section Chief</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in after action debriefings and document observations and recommendations for improvements for possible inclusion in the After-Action Report. Topics include:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Accomplishments and issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Review of pertinent position descriptions and operational checklists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Recommendations for procedure changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in stress management and after-action debriefings. Participate in other briefings and meetings as required.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Documents/Tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Incident Action Plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HICS Form 207 – Incident Management Team Chart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HICS Form 213 – Incident Message Form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HICS Form 214 – Operational Log</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HICS Form 259 – Hospital Casualty/Fatality Report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Hospital emergency operations plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Hospital organization chart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Hospital telephone directory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Radio/satellite phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Municipal organization chart and contact numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• County organization chart and contact numbers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A tally is made of the resources expended during the disaster response. This is important when attempting to recover some of the costs, justifying budget, and future planning for the future. Organizations that do a hazard risk assessment and predict that the community usually experiences three weather emergencies per year can use historical disaster response costs for forward budgeting.

Usually the largest disaster response expenses to an organization are related to employee overtime costs. Tracking these costs as well as other additional expenses is essential as it can assist in recouping funds to aid in the financial recovery of the institution.

EVALUATION AND FOLLOW-THROUGH

Every time an organization engages in a disaster response an evaluation needs to be done. It is best if one person is designated to coordinate this effort. It should be performed in a formal way and include not only staff, but also those agencies that the health facility interfaced with during the response. Each unit or division should examine its own performance, making a list of what went well and what proved to be problematic. Afterward there should be an organization-wide evaluation that includes representatives from each of the units or divisions, as well as senior management.
As a final step, the organization should convene an evaluation meeting with all of the collaborating agencies to evaluate interagency performance. At each of these meetings there should be a recorder. A detailed list of recommendations for changes to the emergency response plan should be compiled. The documentation from each of these meetings should then be forwarded to the organization’s emergency response committee as well as to the executive office. The emergency response committee should then review all documentation and compile a report that will describe the scenario, response activities, who participated, what went well and what posed a problem. Finally a list of recommendations for change needs to be developed. This list should include specifics including the who, what, and when as well as what resources are required to implement the changes. Although an individual should be assigned to follow the progress toward making the changes, ultimately the executive office of the organization needs to approve the resources needed to change the plan. Additionally, a final report should be developed and distributed to the general staff. Staff can become emotionally vested in emergency responses, and a final report assists with closure and moving forward. Following through with the changes identified demonstrates to the staff that emergency preparedness is valued and important.

**SUMMARY**

The ability of a health care organization to respond to emergencies or disasters is often reflective of the organization as a whole and the quality of its leadership. When provided with good disaster management leadership, staff will rise to the challenge and perform above and beyond the call of duty during disaster response. The best way to ensure this is to engage the staff in the planning process, provide decisive direction during the crisis, and then thoroughly evaluate the performance, following through to make required changes. Establishing relationships with agencies and other organizations in the community is essential for effective disaster management. The nature and complexity of disaster events require disaster managers to plan for the event where standards of care may need to be altered. Advance planning for such a catastrophic situation could serve to save lives.

As the events of today’s world unfold, health care organizations will face many new challenges, including the need to engage in disaster management on a more frequent basis. All disasters are local; therefore, the challenges and responsibilities for local hospital disaster managers are significant. However, these challenges can be met with adequate disaster planning and management.

**STUDY REVIEW QUESTIONS**

1. What are the different styles of disaster leadership, and can you explain when and why it would be appropriate to use each style?
2. What are the phases of disaster management, and why is the planning phase so important?
3. What are the different levels of disasters, and how does planning differ for each level?
4. How can an external disaster contribute to the development of an internal disaster in a health care organization?
5. What do the terms *system capacity* and *employee emergency preparedness competency* mean? How are they different?
6. What are the basic principles of the Hospital Incident Command System?
7. What is meant by the term *disaster response functional role*? Can you identify some disaster response functional roles for nursing staff in your health care agency?
8. Why is postdisaster response evaluation and follow-through so important?
9. Why do disaster plans have to be continually reevaluated and updated?
10. Discuss when and how the standards of care might have to be altered in a hospital. What challenges would that likely pose for the staff?

**USEFUL LINKS / INTERNET-BASED ACTIVITIES**

American Hospital Association: Disaster Readiness [http://www.hospitalconnect.com/aha/key_issues/disaster_readiness/resources/HospitalReady.html](http://www.hospitalconnect.com/aha/key_issues/disaster_readiness/resources/HospitalReady.html)

American Red Cross [http://www.redcross.org/services/nursing/](http://www.redcross.org/services/nursing/)

Center for the Study of Bioterrorism [http://bioterrorism.slu.edu/](http://bioterrorism.slu.edu/)

Center for Disaster Management [http://www.cendim.boun.edu.tr/](http://www.cendim.boun.edu.tr/)


Emergency Nurses Association
http://www.enau.org/
Federal Emergency Management Agency
http://www.fema.gov/homepage.html
Hospital Emergency Incident Command System
http://www.emsa.ca.gov/dms2/download.htm
Nursing Emergency Preparedness Education Coalition (NEPEC), formerly the International Nursing Coalition for Mass Casualty Incidents
http://www.mc.vanderbilt.edu/nursing/coalitions/INM/C2e/overview.html
Internet Disaster Information Network
http://www.disaster.net/index.html
Joint Commission on Accreditation of Healthcare Organizations
http://www.jacho.org/standard/faq/hos.html
Natural Hazards Research and Applications Information Center
http://www.colorado.edu/hazards/

REFERENCES


ADDITIONAL READINGS

Dynes, R. R., & Quarantelli, E. L. (1977). Organizational communications and decision making in crisis. Disaster Research...


Key Messages

- Triage is the cornerstone of good disaster resource management.
- The performance of accurate triage provides nurses and other responders with the opportunity to do the greatest good for the greatest number of casualties.
- Disaster triage is employed when the type or amount of resources that are required are unavailable to provide immediate care on a timely basis to all victims needing such care.
- Performing triage under disaster conditions requires a paradigm shift on the part of disaster response nurses and other first responders, and its success may be highly dependent on compliance with disaster triage protocols.
- There are several models available for disaster/mass casualty triage, and nurses need to be aware of them and the appropriate indications for their use.
- Special condition triage is used when additional factors are present in a population of victims (such as incidents involving weapons of mass destruction [WMD] with radiation, biological, or chemical contaminants or during epidemics).
- The physiological makeup of children (and the need to administer rescue breaths) suggests the need for special consideration during triage in a mass casualty event.

Learning Objectives

When this chapter is completed, readers will be able to

1. Define triage.
2. Describe the differences among daily hospital triage, mass casualty incident triage, disaster triage, tactical/military triage, and special conditions (hazmat) triage.
3. Understand the situations in which each model of disaster triage is used.
4. List and describe the features of a field triage tag.
5. Explain the criteria for each of the basic disaster triage levels.
6. Discuss the special situations presented during epidemic triage.
7. Differentiate between the START, JUMPSTART and START–SAVE disaster triage systems and describe the indications for each model.
8. Identify the three key elements of the START triage system.
9. Describe the state of the science that supports the use of current triage systems.
This chapter presents the fundamental concepts of disaster triage. Triage is the first action in any disaster response, and decisions made at this time will have a significant impact on the health outcomes of the affected population. Disaster triage is a difficult and intimidating task. The presentation of large numbers of traumatic casualties or persons infected during an epidemic can quickly overwhelm the health system and the health care personnel who must respond. In a large-scale disaster, mass casualty incident, or epidemic, in all likelihood many health care providers will be called on to perform triage at the scene or in the hospital—including those without previous triage experience. Whether in the hospital or at the scene, the triage nurse must accurately decide which patients need care, where they should receive it, in what order they should receive care, and in situations of severely constrained resources, who should not receive care at all. In situations involving acute chemical exposures and hazardous materials incidents, special conditions triage must be employed. Decontamination should be performed whenever known or suspected contamination has occurred with a hazardous substance.

CHAPTER OVERVIEW

PRINCIPLES OF DISASTER TRIAGE

“Triage is a process which places the right patient in the right place at the right time to receive the right level of care” (Rice & Abel, 1992). The word triage is derived from the French word trier, which means, “to sort out or choose.” The Baron Dominique Jean Larrey, who was the Chief Surgeon for Napoleon, is credited with organizing the first triage system (Robertson-Steele, 2006). Triage is the process of prioritizing which patients are to be treated first and is the cornerstone of good disaster management in terms of judicious use of resources (Auf der Heide, 2000). Accurate triage allows disaster nurses to do the greatest good for the greatest number of afflicted. Although the basic fundamentals of triage remain consistent wherever it is conducted, performing triage during a disaster situation presents unique challenges, and its success will be highly
Part II Disaster Management

dependent on the competence and experience of the nurse.

Triage dates back in history to the French military, which used the word to designate a “clearing hospital” for wounded soldiers. The U.S. military used triage to describe a sorting station where injured soldiers were distributed from the battlefield to distant support hospitals. Following World War II, triage came to mean the process used to identify those most likely to return to the battle after medical intervention. This process facilitated the provision of medical care to soldiers who could fight again. During the Korean and Vietnam conflicts, triage was further refined to resemble the process that is still used today.

Disaster triage will always be a difficult and daunting task. The triage nurse must accurately decide which patients need care, the location of the care, in what order they should receive care, and in situations of severely constrained resources, who should not receive care at all. Previous triage experience in an emergency department is excellent preparation for disaster triage. In a large-scale disaster, mass casualty incident, or epidemic, in all likelihood many health care providers will be called on to perform triage at the scene of the event, in a community setting or in the hospital. Burkle (1984) identified a variety of personal abilities that are essential to be an effective triage officer during a disaster:

- Clinically experienced
- Good judgment and leadership
- Calm and cool under stress
- Decisive
- Knowledgeable of available resources
- Sense of humor
- Creative problem solver
- Available
- Experienced and knowledgeable regarding anticipated casualties

There are many approaches to triage found in the literature and in clinical practice (Cone & MacMillan, 2005). Triage methodologies are focused on the proper sorting and distribution of patients, either in the prehospital (field or community) or hospital (emergency department) settings. One model for understanding triage divides the process into five conceptual categories: daily triage, incident triage, disaster triage, tactical-military triage, and special condition triage (Hogan & Laiert, 2002). Although all types of triage assign a priority to the order for being cared for, the determinants for priority of care differ.

Nurses perform daily triage on a routine basis every day in the emergency department. The goal is to identify the sickest patients in order to assess and provide treatment to them first, before providing treatment to others who are less ill. The highest intensity of care is provided to the most seriously ill patients, even if those patients have a low probability of survival.

Incident triage occurs when the emergency department is stressed by a large number of patients but is still able to provide care to all victims utilizing existing agency resources. Additional resources (on-call staff) are used, but disaster plans do not have to be activated. The highest intensity of care is still provided to the most critically ill patients. Emergency department delays may be longer than normal, but eventually everyone who presents themselves for care is attended to.

Disaster triage is employed when local emergency services are overwhelmed to the point that immediate care cannot be provided to everyone who needs it. There is a paradigm shift in the fundamental philosophic foundation from “rapid, high tech care to the most unstable or acutely ill” to “doing the greatest good for the greatest number” (Auf der Heide, 2000). Resource availability and management becomes a focal driving point for the provision of care. The goal of triage now shifts to identifying injured or ill patients who have a good chance of survival with immediate care that does not require extraordinary resources (Auf der Heide, 2000). During disaster triage where there are many casualties, patients are usually sorted into one of the following categories:

- Critical casualties are those that are life threatening, but likely to be amenable to rapid intervention that does not require an inordinate amount of resources. Examples may include upper airway obstruction, rapidly progressing allergic reaction, or complicated delivery. Urgent casualties are those conditions that are serious and, if not treated in a timely manner, are likely to deteriorate to become critical. Examples may include compound fracture of a long bone, cervical spine injury that has been immobilized, or severe bleeding that is controlled with a pressure dressing. Urgent cases are referred to a hospital setting, but these cases will be treated after the critical cases are attended to. Casualties are classified as minor when the care required can be provided in a low-tech setting and a delay in treatment would unlikely contribute to a significant deterioration in the victims’ condition. Examples of minor casualties may include minor laceration that requires suturing, first-degree burns, and emotional reaction to the event. Minor casualties are frequently referred to an alternate site for care, such as a community health center or to community-based clinicians.

Last, there may be catastrophic casualties. This classification is used for conditions that have either a very grave prognosis or would require an amount of resources that are so large they would divert care from others with a much better prognosis. Examples of catastrophic casualties would include cardiac arrest, penetrating trauma to the head with loss of consciousness, and major burns over more than 50% of the body.
During a disaster situation, catastrophic casualties will not be treated until the critical and urgent cases are attended to. For most clinicians, assigning a victim a triage category of this class is difficult. However, it is essential to remember that during a catastrophic disaster, the aim of triage is different and the clinician will be working under extraordinary circumstances. The initial goal of disaster triage is to sort out patients who are lightly injured and can safely wait for care without risk of negative outcomes and those who are so grievously injured that death is imminent. Once this is accomplished, the patients with serious and critical injuries can be further assessed and triaged for transportation based on their level of injuries and the available resources (Burkle, 2002).

**Tactical-military triage** is similar to disaster triage, only military mission objectives rather than traditional civilian guidelines drive the triage and transport decisions.

Special conditions triage is used when patients present from incidents involving WMD, such as radiation, biological, or chemical contaminants. These triage situations mandate personal protective equipment for all health care personnel and decontamination capabilities at the facility (Hogan & Lairet, 2002). During any disaster response triage event, the triage officers must assure that they themselves do not become a victim. One only enters the scene for field triage when scene safety has been assured (see chapter 26, Mass Casualty Decontamination, for further information).

**Triage during an epidemic**—to date, the predominant disaster triage model used in the United States is based on mass casualty trauma situation scenarios. However, emerging infectious diseases such as SARS or avian influenza, or the threat of another bioterrorist event such as the deliberate dissemination of anthrax in 2001, serve to highlight our inadequacies of our current disaster triage system for handling large-scale biological events. Burkle (2002) defines "bioevent" as any large-scale biologically induced disaster whether it be naturally occurring or deliberate. The manner in which it is managed with outbreak investigation and control is similar. Indeed, SARS, monkey pox, and West Nile fever were all thought to be terrorist events for the first week or two. These are population-based disasters in that everyone in the population requires some intervention, ranging from timely and accurate health information to the triaged use of ventilators. The entire population shares the same concerns...either you are exposed and are possibly infectious or unexposed and remain susceptible. The goal of triage in an epidemic is to prevent secondary transmission. Burkle also argues that trauma-directed mass casualty incident (MCI) triage is based on severity of presentation and universally uses START (Simple Triage and Rapid Treatment) and SAVE (Secondary Assessment of Victim Endpoint) methodologies.

Unfortunately, these point-of-contact conventional triage methods have limited application to bioevents where triage decisions are based on infectiousness and duration of illness. Indeed, depending on their severity, lethality, and known health profiles, bioevents can potentially be more serious than MCIs, leading to aggressive transmission to susceptible but unexposed populations. Therefore, disease containment strategies, such as social distancing, shelter-in-place, isolation, and quarantine are the first line of management under state public health law. In this model, everyone in the population falls into one of five population-based triage categories (SEIRV classification), each one requiring both generic and disease-specific interventions:

1. **Susceptible individuals**—those unexposed but susceptible.
2. **Exposed individuals**—susceptible individuals who have been in contact with the disease and may be infected, incubating but still non-contagious.
3. **Infectious individuals**—persons who are symptomatic and contagious.
4. **Removed individuals**—persons who no longer can pass the disease to others because they have survived and developed immunity or died from the illness.
5. **Vaccinated or on prophylactic antibiotics**—persons in this group are a critical resource for the essential workforce.

In such a situation many people are being triaged simultaneously at multiple sites—triage and information centers, vaccination clinics, emergency departments, or hospitals. The triage nurse has a vital role in this process (whether triage is performed face to face or over hotlines) classifying citizens and assigning them to levels and locations of care based on disease susceptibility, vulnerability, co-morbid disease, symptoms, infectiousness, or exposure. For example, the Toronto Health system utilized their 1-800-telehealth hotline, which went from 2,000 callers in the pre-SARS period to more than 20,000 calls during the SARS outbreak, and served as the major triage element with capability of determining the probable infected from those not infected making triage decisions that prevented further mixing of patients, preventing unnecessary secondary cases. Those who are susceptible may be triaged to a vaccination area; those who are ill may be triaged to an acute care, alternate level of care, or maybe even the home care setting. Those who are ill also may be triaged to isolation, whereas those who are exposed but not yet ill may need to be triaged to quarantine.

Because there is such a large spectrum of communicability and treatment patterns for the numerous infectious diseases that could rise to epidemic proportions, no one triage algorithm has been yet developed.
Part II Disaster Management

9.1 Comparison of Military and Disaster Priority Categories

<table>
<thead>
<tr>
<th>PRIORITY</th>
<th>MILITARY</th>
<th>DISASTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Immediate Care</td>
<td>Class I (emergent) Red</td>
</tr>
<tr>
<td></td>
<td>Shock, airway problems, chest injury, crush injury, amputation, open fracture</td>
<td>Critical; life threatening—compromised airway, shock, hemorrhage</td>
</tr>
<tr>
<td>2</td>
<td>Minimal Care</td>
<td>Class II (urgent) Yellow</td>
</tr>
<tr>
<td></td>
<td>Little or no treatment needed</td>
<td>Major illness or injury; requires treatment within 20 minutes to 2 hours—open fracture, chest wound</td>
</tr>
<tr>
<td>3</td>
<td>Delayed Care</td>
<td>Class III (nonurgent) Green</td>
</tr>
<tr>
<td></td>
<td>Treatment may be postponed without loss of life; noncritical—simple fracture, nonbleeding laceration</td>
<td>Care may be delayed 2 hours or more; minor injuries; walking wounded—closed fracture, sprain, strain</td>
</tr>
<tr>
<td>4</td>
<td>Expectant Care</td>
<td>Class IV (expectant) Black</td>
</tr>
<tr>
<td></td>
<td>No treatment until immediate and delayed priority patients cared for; requires considerable time, effort, and supplies</td>
<td>Dead or expected to die—massive head injury, extensive full-thickness burns</td>
</tr>
</tbody>
</table>

However, it is essential that the triage nurse be prepared to utilize an infectious disease triage model algorithm when triaging during an infectious disease disaster. Should such a situation occur, the algorithm to be used will likely be issued by the state or territorial department of health in concert with the U.S. Centers for Disease Control and Prevention.

Basic Differences Between Daily and Disaster Triage

Generally, two basic types of triage are used: civilian and military. Although both assign a priority to the order of treatment, the determinants for priority of care differ between the two. During civilian triage the most fragile patients are identified and treated first; whereas during military triage, fragile patients who have a good likelihood of survival and do not require an extraordinary number of resources are treated first; those who have a low probability of survival or require a large number of resources are not treated.

The civilian triage system can be further divided into two types: usual, hospital daily triage and disaster situation triage. Disaster triage is similar to tactical-military triage in that the goal is the greatest good for the greatest number of injured. The primary difference between disaster triage and tactical-military triage relates to patient transport. Table 9.1 compares the priority categories used for tactical-military and disaster triage.

Usual hospital daily triage is what is done every day during ordinary circumstances. Basic information is obtained that allows the triage nurse to make a judgment regarding the actual or potential severity of the problem and the degree of urgency for further evaluation and treatment. Table 9.2 lists the typical types of data that are gathered during hospital triage evaluation. Large volume emergency departments, which frequently have longer delays for treatment, tend to collect more information at the point of triage, and some may utilize the information gathered at triage to initiate testing before a treatment provider sees the patient. Other emergency departments, which rarely experience large volumes of...
Basic Steps for Disaster Triage in a Hospital Setting

Airway, breathing circulation
Skin vitals (color, moisture, temperature)
V/S: pulse, respiration
Visual inspection for gross deformities, bruising, or lacerations
Level of consciousness

patients or delays in treatment, tend to collect fewer elements at the point of triage, as the patients are seen rapidly, and this information is collected during initiation of treatment. In the hospital setting, during a disaster situation, where a large number of patients arrive within a short time, the number of data elements usually collected during the initial triage encounter may be reduced. Table 9.3 illustrates a shorter list of triage elements, which would be typically collected during disaster triage in a hospital. This list represents those elements that are essential to identify emergent cases. Depending on the nature and extent of the disaster, however, the staff may have the time and resources to do a more complete assessment during the triage process and include additional elements from Table 9.2.

Daily Triage in the Hospital Setting

If emergency departments were able to handle each case as it arrived to the hospital, there would be no need for triage. Each patient would be treated upon arrival to the emergency department. Currently, however, there are over 114 million emergency department visits each year in the United States, and frequently, the demand for services exceeds the capacity of the system at the given moment (Centers for Disease Control and Prevention, 2006). Therefore, a triage system has evolved in which the sickest patients are given priority. In the event of a MCI, when a hospital receives a large number of cases, additional staff and resources are brought to the emergency department and activated in the hospital, and hospital triage would still be used. If a hospital’s capacity is likely to be overwhelmed, patients are diverted to other institutions. It is only when the number and severity of casualties are greater than the hospital or available system can handle that disaster triage is initiated in a hospital.

The main purpose of in-hospital triage (usual or disaster) is to identify those patients who have the highest degree of compromise for the purpose of providing rapid care to the sickest patients first. Therefore, in this type of triage, patients with an airway, breathing, or circulation emergency are assigned the highest degree of urgency and receive care first. Individuals in extremis, even if they are expected to die or require an extraordinary amount of resources for their care, are provided with immediate treatment.

IN-HOSPITAL TRIAGE SYSTEMS

Most hospitals utilize a triage system that has between three and five categories. The three main categories are emergent, urgent, and nonurgent (Lanros & Barber, 1997). Where four or five levels are used, subcategories are added to either end of the spectrum. Table 9.4 illustrates the typical categories in three-, four-, and five-tier systems.

In a three-tier system, emergent signifies a condition that requires treatment immediately or within 15 to 30 minutes. Examples include cardiac arrest, airway obstruction, seizure, asthma, acute bleeding or acute pain, or depressed level of consciousness. The urgent category is utilized for serious illness or injury that must be attended to, but a wait of up to 2 hours would not add to the morbidity or mortality of the patient. Examples would include a complex long bone fracture, bleeding controlled with a pressure dressing, acute psychiatric problem (where the patient is in a safe environment), or high fever with other vital signs stable. Nonurgent in this type of simple system is any condition that can
wait more than 2 hours to be seen without the likelihood of deterioration. This includes problems or conditions such as simple fracture, minor laceration, rash, or medication refill requests.

In a four-tier system, usually the emergent category is subcategorized to identify those conditions that must be treated immediately (stat or 1A) versus rapidly (within a few minutes or 1B). Stat conditions would be classified as 1A problems and would include conditions such as cardiac arrest, airway obstruction, or hemorrhage with shock, whereas 1B problems would include asthma, cardiac dysrhythmia with stable blood pressure, or heavy bleeding but no tachycardia.

In a five-tier system, in addition to the emergent category, the nonurgent category is subcategorized. Conditions that are nonacute, but require the technology of the emergency department (ED) to either diagnose or treat are categorized as nonurgent-ED. This would include conditions such as a minor laceration, which requires sutures, or a minor joint trauma, which requires an X-ray for diagnosis. These types of conditions are frequently treated in an emergency department because there is a lack of access to these services on an emergency basis in the primary care setting. Nonurgent-ambulatory care is used to classify those conditions that are nonurgent in nature and can routinely be provided in the ambulatory care setting. Examples of problems in this group are requests for medication refills or chronic conditions that are stable such as a preexisting skin rash.

Usually, emergency departments that routinely experience significant overcrowding problems and long treatment delay situations will utilize a five-tier system, whereas those that rarely have delays will use a three-tier system. Emergency departments that usually use a three-tier system should be able to switch to a more complex system during times of disaster to accommodate a larger volume of patients.

Disaster Triage in the Hospital Setting

What is deemed to be a disaster for one facility may be routine operations for another facility. For example, a large emergency department with an annual volume of more than 100,000 patients per year may not commence disaster operations for the arrival of 10 trauma victims. However, such a number may be overwhelming and require disaster resources for the same number of victims in a smaller facility. Regardless of the size of the facility, each must have in place a system to recognize when the existing resources are likely to be exceeded and be able to implement disaster triage and operations at a moment’s notice.

During times of a community disaster, hospitals and their emergency departments usually activate their resources and prepare to receive an additional influx of patients. Hospital staff frequently report that the time required to enter the disaster victim into the system may delay care (because of the fact that, for most institutions, diagnostic tests cannot be ordered and results cannot be received without a medical record number). To eliminate this delay premade disaster or stat charts should be prepared ahead of time, so that as each patient enters the emergency department a medical record number can be immediately assigned. These stat charts contain a sequential stat number in the patient name section of the chart along with a predesignated medical record number. Stat packets are then assembled that contain the stat chart, along with a preprinted stat number, identification band, and lab and X-ray requisition slips. Table 9.5 lists a typical stat chart system. These stat chart numbers should then also be entered onto a patient tracking log. As patients arrive to the emergency department triage area, they are issued a STAT pack and entered onto the disaster patient tracking log. Diagnostic testing can be performed without waiting for an actual registration in the hospital information system. When time and resources permit, a personal identifier and other essential medical record information can be appended to this record.

As the patients enter the emergency department, triage team staff should be stationed at the ambulance bay. Table 9.6 provides a list of staff required for a typical disaster triage team and a section of the chart along with a predesignated medical record number. Pre-assigned stat medical record number and stat name number

<table>
<thead>
<tr>
<th>Prestamped:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency department medical record</td>
</tr>
<tr>
<td>Triage slip</td>
</tr>
<tr>
<td>Laboratory slips</td>
</tr>
<tr>
<td>X-ray requisitions</td>
</tr>
<tr>
<td>Labels for blood tubes</td>
</tr>
<tr>
<td>Patient I.D. band</td>
</tr>
<tr>
<td>Disaster casualty cross-reference list</td>
</tr>
</tbody>
</table>

Log form that contains pre-entered state medical record and stat name that can be used to track patients through the system.
9.6 Staff Complement of a Typical Disaster Triage Team

<table>
<thead>
<tr>
<th>STAFF</th>
<th>FUNCTIONAL ROLE IN TRIAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Physician**</td>
<td>Triage Officer</td>
</tr>
<tr>
<td>Emergency Nurse (1)</td>
<td>Evaluates patient and reports findings to officer, supervises</td>
</tr>
<tr>
<td></td>
<td>clerk, nursing aid, and transporters</td>
</tr>
<tr>
<td>Emergency Nurse (2)</td>
<td>Records all assessments</td>
</tr>
<tr>
<td>Nurse Aide</td>
<td>Applies prenumbered I.D. band</td>
</tr>
<tr>
<td>Transporter</td>
<td>Moves patient from triage area to assigned area in the emergency department</td>
</tr>
</tbody>
</table>

Notes: **Depending on the size and nature of the disaster; and available staff, several triage teams may be assembled or different levels of staff may be used to perform these functional roles.  
***In some facilities, a senior level emergency department registered nurse may be designated as the Triage Officer.

disposition is entered on the tracking log. If the patient name is not available at the time of triage, evaluation and treatment is initiated using the stat medical record number and name.

After the rapid assessment, the patient is triaged to a treatment location and team in the emergency department (or other designated area in the facility), where a more thorough evaluation and assessment will take place. It is also important to remember that during a disaster situation, nondisaster patients will continue to arrive at the emergency department. Provisions need to be made for these patients as well, as there is a risk of this group slipping between the cracks or being ignored in the fray.

PREHOSPITAL AND DISASTER TRIAGE PROCESS

During times of catastrophic disaster, where the resources of all available systems are overwhelmed, there is a defined system that some have termed tactical-military or disaster triage. The goal of this type of triage is to meet the needs of the largest number of victims possible, by delaying care to selected patients who have little hope of survival or who would consume too many resources (Johnson, 1997). The idea that a patient in extremis may not receive care is a difficult one for a health care provider to accept. It must be remembered that this type of triage would be utilized only in the most catastrophic circumstances, when resources are overwhelmed, and when providing care to a select few would result in harm to many others. In most instances these types of decisions would be made in each prehospital care arena; however, nursing staff must be familiar with the system in order to effectively function during times of acute disaster.

Emergency Medical Service (EMS) providers are normally the first responders to the scene of a disaster and are very experienced in triage. These providers have received specialized training and encounter situations on a daily basis where triage decisions must be made and patients transported for care (see chapter 3, Emergency Health Services, for further information). The first action is to establish a clear area for triage and treatment. With this type of triage, rapid evaluation of the victims is made in the field, and many EMS providers use the Simple Triage and Rapid Treatment (START) system for prehospital triage (Super, 1994) or one of the disaster triage systems listed in the following.

DISASTER TRIAGE SYSTEMS

Examples of three well-known disaster triage systems are the following:

- Simple Triage and Rapid Treatment (START) system (for triaging adults)
- JumpSTART system (for triaging pediatric patients)
- Start/Save (when the triage process must be over an extended period of time)

Simple Triage and Rapid Treatment (START) System

A common algorithm that is used with adult prehospital triage is the Simple Triage and Rapid Treatment (START). START was developed by the Newport Beach, California, Fire and Marine Department and Hoag Hospital. Emergency Medical Service (EMS) providers are very experienced in the use of the START system. The START system is easy to learn and simple to use. It is based on the person’s ability to respond verbally and ambulate and their respirations, perfusion, and mental status (RPM). The system works as follows:

1. All patients who can walk (walking wounded) are categorized as Delayed (GREEN) and are asked to move away from the incident area to a specific location.
2. The next group of patients is assessed quickly (30–60 seconds per patient) by evaluating RPM:
   - Respiration (position upper airway or determine respiratory rate)
Using RPM to Classify Patients

<table>
<thead>
<tr>
<th>CATEGORY (COLOR)</th>
<th>RPM INDICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical (RED)</td>
<td>R = Respiratory rate &gt; 30; P = Capillary refill &gt; 2 seconds; M = Doesn’t obey commands</td>
</tr>
<tr>
<td>Urgent (YELLOW)</td>
<td>R = Respiratory rate &lt; 30; P = &lt; 2 seconds; M = Obeys commands</td>
</tr>
<tr>
<td>Expectant: dead or dying (BLACK)</td>
<td>R = not breathing</td>
</tr>
</tbody>
</table>

- Perfusion/blood circulation (check capillary refill time)
- Mental status (determine patient’s ability to obey commands)

The RPM components are assessed in order. For example, if the victim is not breathing, CPR is not performed—the patient is categorized as Expectant (BLACK) and the assessor moves on to the next victim. Table 9.7 summarizes the classifications based on the patient’s RPM findings. Table 9.8 illustrates the criteria and transport priority for each level of this type of triage.

JumpSTART

Because the physiological indicators used in START are not appropriate when assessing young pediatric patients, the JumpSTART system was originally created to meet the unique needs of assessing children less than 8 years of age (Romig, 2002b). Because it may be difficult to determine actual age during a disaster event, JumpSTART should be used if the victim “looks like a child” and START should be used whenever the victim “looks like a young adult or older” (Romig, 2006, personal communication).

The JumpSTART Pediatric MCI Triage Tool is the first objective tool developed specifically for the triage of children in the multicasualty/disaster setting. JumpSTART was developed in 1995 and modified in 2001 by Dr. Lou Romig, an emergency medicine expert in pediatric disaster preparedness and response, to parallel the structure of the START system, the adult MCI triage tool most commonly used in the United States and adopted in many countries around the world (Romig, 2002a).

JumpSTART’s objectives are the following:

1. To optimize the primary triage of injured children in the MCI setting.
2. To enhance the effectiveness of resource allocation for all MCI victims.
3. To reduce the emotional burden on triage personnel who may have to make rapid life-or-death decisions about injured children in chaotic circumstances.

JumpSTART provides an objective framework that helps to assure that injured children are triaged by responders using their heads instead of their hearts, thus reducing overtriage that might siphon resources from other patients who need them more and result in physical and emotional trauma to children from unnecessary painful procedures and separation from loved ones. Undertriage is addressed by recognizing the key differences between adult and pediatric physiology and using appropriate pediatric physiologic parameters at decision points (Romig, 2002b).

JumpSTART has rapidly gained acceptance by EMS agencies and hospitals throughout the United States and Canada and is being taught in numerous countries internationally. The tool has been recognized for use by groups such as the U.S. National Disaster Medical System’s federal medical response teams and EMS providers in the National Park Service. JumpSTART is referenced in numerous EMS and disaster texts and has been incorporated into courses such as Pediatric Disaster Life Support (PDSL) and Advanced Pediatric Life Support (APLS; Romig, 2002a; 2006, personal communication). Evaluation of JumpSTART as a training tool for EMS providers and school nurses suggests that it...
9.9 Zones for Disaster Triage During Chem/HAZMAT Incidents

<table>
<thead>
<tr>
<th>ZONE</th>
<th>DESCRIPTION OF ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot</td>
<td>Immediately adjacent to the location of the incident</td>
</tr>
<tr>
<td></td>
<td>Minimal triage and medical care: activities are limited to airway and hemorrhage control, administration of antidotes, and identification of expectant cases</td>
</tr>
<tr>
<td></td>
<td>All staff are in protective gear in this zone</td>
</tr>
<tr>
<td>Warm</td>
<td>More than 300 feet from the outer edge of the Hot Zone, and uphill/upwind from the contamination area</td>
</tr>
<tr>
<td></td>
<td>Rapid triage takes place to sort victims into critical, urgent, delayed, or expectant categories</td>
</tr>
<tr>
<td></td>
<td>Priority is to commence decontamination</td>
</tr>
<tr>
<td></td>
<td>All staff must wear the appropriate PPE</td>
</tr>
<tr>
<td>Cold</td>
<td>Adjacent to the Warm Zone, and uphill/upwind from the contamination area</td>
</tr>
<tr>
<td></td>
<td>Decontaminated patients enter this area where a more thorough triage is performed; then patients are directed to treatment areas based on the severity and nature of illness or injury</td>
</tr>
<tr>
<td></td>
<td>Personnel may wear PPE in case the wind changes or victims arrive who have been improperly decontaminated</td>
</tr>
</tbody>
</table>

improves responders’ ability to appropriately categorize children’s need for care (Sanddal, Loyacono, & Sanddal, 2004).

JumpSTART was designed for use in disaster/multicasualty settings, not for daily EMS or hospital triage. The triage philosophies in the two settings are different and require different guidelines. JumpSTART is also intended for the triage of children with acute injuries and may not be appropriate for the primary triage of children with medical illnesses in a disaster setting.

In this triage system a child’s respiratory rate is assessed as “good” if it is between 15 and 45 (~one breath every 2-4 seconds). A child with a rate <15 or >45 would be classified as Critical (RED).

A child’s perfusion is checked by palpating the distal pulses. A child with a weak or nonexistent distal pulse gets classified as Critical (RED).

Assess for mental status using the AVPU system (Alert, responds to Vocal stimuli, responds to Painful stimuli, Unresponsive). A child who is unresponsive or has an inappropriate response to pain would be classified as Critical (RED).

In addition, unlike the START system, in the JumpSTART system, a young child who is not breathing on initial assessment should still be checked for a pulse. If a pulse is found, the child receives a brief (5 breaths) ventilatory trial, which, if not successful results in assigning the patient as Expectant (BLACK). If breathing is restored, the patient is classified as Critical (RED) (Romig, 2002b; see Figure 9.1).

There may be a need for modification of the JumpSTART model for children who can’t walk because of young age or developmental/motor delay. In these patients, triage personnel should use the usual JumpSTART algorithm. If the patient satisfies criteria for the yellow category, the person performing the triage should quickly look for external signs of significant injury, such as large areas of soft tissue avulsions or burns, penetrating injuries, amputations, possible airway burns, distended abdomen, and so forth. Patients with such signs are kept as yellow. Those without significant external signs can be classified green even though they can’t walk (Romig, 2006, personal communication).

The JumpSTART Pediatric MCI Triage Tool algorithm as well as the combined Start/JumpSTART algorithm (see Figure 9.2) and additional information regarding its use, along with resources for pediatric disaster management can be located at the following Web site: http://www.jumpstarttriage.com/.

START/SAVE Triage for Catastrophic Disasters

Some disaster events are of such magnitude and duration that rapid evacuation of the victims is not possible. Occasionally an event occurs that requires that victims be evaluated immediately, but because of the inability to evacuate the patient to a higher source of care, the triage process must be extended.

The Medical Disaster Response (MDR) project was developed to specifically address an event where specially trained, local health care providers evaluate patients immediately after the event but cannot evacuate patients to definitive care (Benson, Koenig, & Schultz, 1996). In this type of scenario, a dynamic triage methodology was developed that permits the triage process to evolve over hours or even days, thereby maximizing patient survival and resulting in a more efficient use
Figure 9.1 JumpSTART triage algorithm.
of resources. This MDR system incorporates a modified version of Simple Triage and Rapid Treatment (START) that substitutes radial pulse for capillary refill, coupled with a system of secondary triage termed, Secondary Assessment of Victim Endpoint (SAVE; Benson et al., 1996).

The SAVE triage was developed to direct limited resources to the subgroup of patients expected to benefit most from their use. The SAVE assesses survivability of patients with various injuries and, on the basis of trauma statistics, uses this information to describe the relationship between expected benefits and resources consumed. Because early transport to an intact medical system is unavailable, this information guides treatment priorities in the field to a level beyond the scope of the START methodology (Benson et al., 1996).

Preexisting disease and age are factored into the triage decisions. An elderly patient with burns to 70% of body surface area who is unsalvageable under austere held conditions and would require the use of significant medical resources—both personnel and equipment—would be triaged to an expectant area. Conversely, a young adult with a Glasgow Coma Scale score of 12 who requires only airway maintenance, would use few resources and would have a reasonable chance for survival with the interventions available in the field, would be triaged to a treatment area. The START and SAVE triage techniques are used in situations in which triage is dynamic, occurs over many hours to days, and only limited, austere, field, advanced life support equipment is readily available (Benson et al., 1996).
Potential Value of START and JumpSTART in the Hospital Setting

When planning for disaster triage in the hospital setting, it is important to note the possible value of using START and JumpSTART as the primary triage tools for patients who present to the ED without being assessed and triaged on scene by EMS. It is quite possible that walk-in victims may outnumber EMS-transported victims if the hospital is anywhere close to the disaster site. In these cases, where there may be tens to hundreds of patients converging on an ED in a short period of time, field-style primary triage may be the best tool to do the first sorting of victims. There would need to be one triage point for EMS-transported patients and at least one more for those who arrive by personal vehicle or on foot. In large events, abbreviated ED-style triage with full vital signs and the type of history listed in Table 9.2 should be done in the secondary triage and treatment area(s) (Romig, 2006, personal communication).

As noted earlier, it is important to remember that when a patient arrives to an emergency department with a prehospital disaster triage tag, the triage team must still triage the patient, as the condition may have changed during transport. After patients are re-triaged they should be systematically tagged to designate the order that they should be cared for in the treatment area. Most of the information about the patient available to emergency department staff will be what is written on the tags. Many different types of tagging systems are available. Tags need to be waterproof and easy to write on, and need to be affixed directly to the patient—not to the patient's clothing. Tags should contain as much information as is available including the patient’s name; a triage number; presenting injury or complaint; any interventions performed; the time, allergy, and medication history if available; and assigned triage category. The tag must be clearly visible and easy to read. Different versions of triage tags are utilized (see Figure 9.4). Some are simple color-coded strips that are folded to the correct color and inserted into a clear plastic envelope, whereas others have color-coded perforated tabs. For these types of tags, the tag is torn at the perforation just below the assigned triage color category (see Figure 9.3). A commonly used tag of this type is the METTAG (www.METTAG.com). The most commonly used color coding scheme in the United States is: red, yellow, green, or black; see Table 9.4.

SUCCESSFUL DISASTER TRIAGE PRINCIPLES

Hogan and Lairot (2002) describe the following principles of successful disaster triage that they have derived from the experiences of emergency medical providers during the Persian Gulf War:

- Never move a casualty backward (against the flow).
- Never hold a critical patient for further care.
- Salvage life over limb.
- Triage providers do not stop to treat patients.
- Never move patients before triage except in cases of:
  - Risks due to bad weather
  - Impending darkness or darkness has fallen
  - A continued risk of injury
  - Medical facilities are immediately available
  - A tactical situation that dictates movement

Empirical Evidence to Support Triage Systems

The reader should note that roughly half a dozen mass casualty triage systems have been developed and are in use around the world for the purpose of sorting and prioritizing care, and most sort patients into the familiar immediate, delayed, minimal, and expectant categories. It is interesting to note that there has been very little research validating or even evaluating these systems. Empirical evidence is lacking whether any of them actually work as intended or have any effect on patient outcome even if used as designed. No MCI triage tool, including START and JumpSTART, has been clinically or scientifically validated at the time of publication of this book (Cone & MacMillian, 2005).

Existing triage methodologies tend to be one-size-fits-all in nature, with some trauma-only methods that are based on decades of previous work but not yet proven (Sacco et al., 2005). Controversy exists among disaster experts regarding the applicability and feasibility of population-targeted triage systems (e.g., for pediatric patients, chemical weapons victims, or biological weapons victims), and a critical review of commonly used systems demonstrates that some triage-system components are likely to fail on the basis of differences in physiological baselines and patient presentations (Cone & Koenig, 2005). Although it remains unclear whether a universal triage system should be pursued, various system components have been tested and been shown to have differential inputs. Additional research on the effectiveness of triage modalities and on triage as it relates to surge capacity is needed, according to the 2006 Academic Emergency Medicine Consensus conference (Rothman, Hsu, Kahn, & Kelen, 2006).

DISASTER TRIAGE FOR CHEMICAL AND HAZARDOUS MATERIAL DISASTERS

Field trauma triage systems currently used by emergency responders at mass casualty incidents and
Figure 9.3 triage tags. Many different types of triage tag systems are available. Tags are designed to be attached to a patient’s arm or leg—not their clothing—and should contain as much information about the patient as is possible (e.g., name, triage number, triage category, decontamination status, presenting injury/complaint, interventions performed, the date/time, allergies, medication history, etc.). Some triage tags have perforated colored tabs for the different triage classifications, so if the patient’s condition changes and deteriorates, the tag may be torn again to the revised triage level/color. Others are all one color (red, yellow, green, or black), and some include contamination or decontamination information. All tags must be waterproof, easy to write on, easy to read, and clearly visible when attached to the patient.
disasters do not adequately account for the possibility of contamination of patients with chemical, biological, radiological, or nuclear material (Cone & Koenig, 2005). Additionally, chemical or hazardous material disasters pose unique challenges in that hospital-based staff have the potential to become victims themselves from actual exposure to the toxins or the physiological affects from wearing and working in the personal protective gear. Victims who are chemically contaminated must be decontaminated before being brought into the clean treatment area (see chapter 26, Mass Casualty Decontamination, for further information). Failure to do so is likely to result in contamination of the staff, other patients, and the environment and can potentially require evacuation and closure of the entire emergency department. Because some prehospital services may transport chemically exposed victims to the hospital prior to decontamination, and because many walking victims will leave the scene before being triaged and decontaminated, each hospital must have a system in place to employ special conditions triage and decontaminate these arrivals.

Triage for chemical incidents will occur in several places:

- **Hot Zone**: This is the area immediately adjacent to the location of the incident. Minimal triage and medical care activities take place and are limited to airway and hemorrhage control, administration of antidotes, and identification of expectant cases (dead or nonsalvageable). All staff are in protective gear in this area.
- **Warm Zone**: This is a distance of at least 300 feet from the outer perimeter of the hot zone and is upwind and uphill from the contaminated area. Rapid triage takes place to sort victims into critical, urgent, delayed, or, if they have deteriorated, expectant categories. As in the hot zone, only a minimal amount of treatment is rendered to provide essential stabilization. The priority is to commence decontamination. Nonambulatory victims go through litter decontamination, whereas ambulatory patients and any personnel wishing to leave the warm zone go through ambulatory decontamination before entering the cold zone. Those victims with the most severe signs/symptoms of contamination are given priority for decontamination. All staff in this area

In the Field (Sidell, William, & Dashiell, 1998)

**Hot Zone**: This is the area immediately adjacent to the location of the incident. Minimal triage and medical care activities take place and are limited to airway and hemorrhage control, administration of antidotes, and identification of expectant cases (dead or nonsalvageable). All staff are in protective gear in this area.

**Warm Zone**: This is a distance of at least 300 feet from the outer perimeter of the hot zone and is upwind and uphill from the contaminated area. Rapid triage takes place to sort victims into critical, urgent, delayed, or, if they have deteriorated, expectant categories. As in the hot zone, only a minimal amount of treatment is rendered to provide essential stabilization. The priority is to commence decontamination. Nonambulatory victims go through litter decontamination, whereas ambulatory patients and any personnel wishing to leave the warm zone go through ambulatory decontamination before entering the cold zone. Those victims with the most severe signs/symptoms of contamination are given priority for decontamination. All staff in this area
must wear the appropriate personal protective equipment.

Cold Zone: This area is adjacent (and uphill and upwind) to the warm zone and is where decontaminated victims enter. As the victims enter this area, a more thorough triage is performed (including evaluation for secondary injuries), and victims are directed to treatment areas based on the severity and nature of illness or injury. Personal protective equipment is maintained in this area in case the wind changes or victims arrive who have been improperly decontaminated.

In the Hospital Setting

Warm Zone: This is an area that is adjacent to the hospital (usually the emergency department), which has a source of water (in cold climates it must be a warm water source) for decontamination and barriers to control entrance and exit from the area. In the hospital setting, the triage station is at the entrance to the warm zone decontamination area. All ambulance and walk-in cases must enter the facility after going through this triage station. Cases who are clearly not contaminated enter the emergency department, and those that require decontamination go through the warm zone decontamination area before entering into the clean zone in the emergency department (or noncontaminated area).

Clean Zone: This is the treatment area inside of the emergency department or hospital where newly arriving patients and victims are sent after having been triaged and decontaminated. Any staff or patients who have entered the warm zone must be decontaminated before entering the clean zone. Another more thorough triage is performed in the clean zone area. Again, it is important to remember that the usual patients treated by the emergency department will continue to arrive for evaluation and treatment. Figure 9.5 illustrates a potential arrangement for triage in warm and clean zones in the hospital setting.

**SUMMARY**

Events may occur where rapid assessment of large numbers of patients is required, and the ability to correctly sort patients will impact health outcomes. Although empirical evidence to support the use of individual triage systems is currently lacking, in general, the use of disaster triage optimizes the allocation of scarce resources. Successful use of a disaster triage system will be a critical component of any hospital’s surge capacity. Triage is the cornerstone of good disaster resource management,
and nurses should be aware of the different types of triage systems and when it is appropriate to use them. Disaster triage requires a significant paradigm shift for the nurse, which may be an emotionally distressing experience. Yet, the performance of accurate triage provides nurses with the opportunity to do the greatest good for the greatest number of casualties.

Note: Special thanks go to Lou Romig, MD, for her generous contribution of material and for her review of this chapter.

STUDY QUESTIONS

1. How are the priorities in usual hospital triage different from military disaster triage?
2. What ethical dilemmas are posed by disaster triage?
3. What are the basic hospital triage system categories? Explain each.
4. Why is there a need for triage in the hospital setting?
5. Describe the basic elements of a disaster triage tag. What do the colors red, yellow, green, and black signify? List types of problems for each category.
6. During triage for mass casualty chemical incidents, what are the differences in the triage activities in the hot, warm, and cold zones?
7. What are the five major cohort triage classifications during epidemic triage? Where would each of these cohorts likely be triaged to and what sort of care would they likely receive?
8. What are the three key elements of the START triage system?
9. Differentiate between the START, JumpSTART, and START/SAVE systems.

REFERENCES


START triage plan for disaster scenarios. (1996). IF Management, 8(9 suppl.), 103-104.


Williams & Wilkins.

In P. Pons & D. A. Cason (Eds.), Paramedic field care (pp. 629-642). St. Louis, MO: Mosby Year Book.

Key Messages

- Populations affected by a disaster experience diminished environmental conditions that put them at risk for negative health outcomes.
- Basic physiologic needs must be met in a timely manner to ensure survival.
- Sanitation issues are the cornerstone of public health response.
- The establishment, implementation, and continuous monitoring of minimum standards for water safety, food safety, sanitation, shelter, personal hygiene, and vector control provide a firm foundation for health promotion.
- Infectious disease outbreaks usually occur in the postimpact and recovery phases of a disaster (not during the acute phase).
- The risks of epidemics increase if drought, famine, and/or large displacements of people are involved.
- The length of time that people spend in temporary shelters is an important determinant of the risk of disease transmission that might lead to major epidemics.
- Successful planning for potential outbreaks demands that nurses be knowledgeable of the diseases endemic to the disaster area.
- Working in conjunction with their public health colleagues and as members of an interdisciplinary disaster response team, nurses must be able to detect environmental changes that can increase the potential for the spread of infectious disease.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the 10 essential functions of public health.
2. Describe the importance of a clean environment as a foundation for good health.
3. Appraise both risks and resources in the environment in order to meet the basic needs (food, water, shelter, and safety) for survival.
4. Discuss the major health risks in a population affected by a disaster and identify and prioritize according to prevention/control of disease, epidemics, and other hazards.
5. Describe rapid environmental assessment (REA) as a methodology for data collection in a disaster-affected community.
6. Discuss the initiation of water safety measures.
7. Discuss the initiation of wastewater management.
8. Discuss options for providing sanitation and solid waste removal.
9. Identify the primary pathogens responsible for foodborne and waterborne disease.
10. Describe the importance of vector control in the postimpact phase of a disaster.
This chapter provides an overview of the basic concepts of health promotion and disease prevention for disaster nursing. The chapter begins by introducing the 10 core functions of public health. Analysis of the fundamental public health functions during nondisaster circumstances provides a foundation for what concepts apply and what services will need to be mobilized should a major event occur. Nurses responding to the needs of populations and communities affected by disasters require an understanding of the basic tenets of environmental health, methods of health promotion, and disease prevention strategies.

Rapid environmental assessment is introduced as a methodology for data collection in postimpact communities. Individuals affected by disasters must have their basic physiologic needs met in a timely manner for survival. A framework for establishing public health priorities and minimum standards for water, food, sanitation and solid waste removal, shelter, and vector control is proposed. Response to public health emergencies such as outbreaks of foodborne illness is presented. The role of the public health nurse in the response and recovery phases of any disaster becomes even more valuable, as these nurses have expertise in disease surveillance and optimization of population health outcomes.

Disasters destroy or disrupt the integrity of the physical environment and the foundations of good health are lost. The consequences of this diminished environment will vary based on the geographic location of the disaster, the biological pathogens present, the susceptibility and health habits of the people living there, and the availability of resources and protective measures to compensate for the losses (Landesman et al., 2001). The Sumatra Asian tsunami (December 26, 2004) and Hurricane Katrina (August 29, 2005), catastrophic events of epic proportion by any measure, provided evidence that regardless of where geographically a disaster may occur, the basic physiologic needs of each affected population will be fundamentally the same (Berger, 2006). Health promotion and disease prevention activities must focus on restoration of services to meet the immediate physiological needs of the affected people and to prevent the spread of infectious disease (Noji, 1996, 2000).
In its 1948 charter, the World Health Organization (WHO) defined health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 2002a). Public health is the profession, discipline, and the system for providing health care to communities. The WHO oversees health throughout the world (see Figure 10.1). Grounded in a multitude of sciences, public health’s primary focus is prevention of illness, injury, and death (Merson, Black, & Mills, 2006). C.E.A. Winslow, frequently regarded as the founder of modern public health in the United States, defined health as:

“The science and art of preventing disease, prolonging life and prompt physical and efficiency through organized community for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will ensure to every individual a standard of living adequate for the maintenance of health; organizing these benefits in such a fashion as to enable every citizen to realize his birthright of health and longevity.” (Winslow, 1920, p. 184)

The public health infrastructure in the United States today is a large, poorly defined, and loosely connected system of agencies and providers working to meet the health care needs in their communities. The fundamental obligation of these agencies responsible for population-based health is to

- Prevent epidemics and the spread of disease.
- Protect against environmental hazards.
- Prevent injuries.
- Promote and encourage healthy behaviors and mental health.
- Respond to disasters and assist communities in recovery.
- Assure the quality and accessibility of health services.

These responsibilities describe and define the function of public health in assuring the availability of quality health services. The unique features of public health were further defined in 1994 by an Essential Public Health Services Working Group of the Core Public Health Functions Steering Committee of the United States Public Health Service (see Case Study 10.1; Turnock, 2004).

Although the essential functions of the public health system provide a frame of reference for nurses and other health care providers responding to a major event (see Case Study 10.1), disasters compound the challenges for public health in numerous ways. The Asian tsunami, Hurricanes Katrina and Rita, and the Pakistan earthquake are recent examples of the devastating effect on health and social well-being resulting from the forces of nature. In the weeks following catastrophic events, the threat of infectious disease outbreaks is high. Nurses responding to the needs of individuals, families,
and communities affected by disasters are called on to provide much more than just postimpact nursing care. Restoration of the environment and its resources to pre-disaster conditions is imperative to promote good health and prevent disease.

HEALTH PROMOTION

Health promotion is the process of enabling people to increase control over, and to improve, their health (WHO, 1986, 2002a). Pender, Murdaugh, and Parsons (2006) describe health promotion as behavior motivated by the desire to increase well-being and actualize human health potential. In health promotion, empowerment is a process through which people gain greater control over decisions and actions affecting their health. Empowerment may be a social, cultural, psychological, or political process through which individuals and social groups are able to express their needs, present their concerns, devise strategies for involvement in decision making, and achieve political, social, and cultural action to meet those needs (WHO, 2002a).

Historically, public health and nursing are the two primary disciplines concerned with the science and art of promoting health, preventing disease, and prolonging life through the organized efforts of society. In disaster situations, the use of organized efforts to eliminate hazards and restore the environment and its inhabitants to their optimal level of health becomes important.

MASLOW’S HIERARCHY OF NEEDS

Abraham Maslow is recognized for establishing a theory of a hierarchy of needs. He writes that human beings are motivated by unsatisfied needs, and certain lower needs need to be satisfied before higher needs can be satisfied. According to Maslow, there are general types of needs (physiological, safety, love, and esteem) that must be satisfied for people to behave unselfishly and to realize their full human potential (Maslow, 1970). Maslow’s hierarchy of needs provides a theoretical foundation for disaster response efforts. Even in circumstances of great upheaval, desolation, and despair, these basic needs must be met for individuals to recover and realize their inherent potential as human beings.

Physiological needs are the very basic needs such as air, water, food, sleep, and so forth. When these needs are not satisfied, as frequently occurs as the result of a disaster’s destruction, individuals become ill and experience pain, suffering, and discomfort. These feelings motivate individuals to correct the imbalances in their environment in order to re-achieve homeostasis. Once these needs are met, individuals become capable of meeting other needs in their life.

Safety needs are concerned with establishing stability and consistency in a chaotic world. These needs are primarily psychological in nature, and again, are frequently disrupted by the effects of a disaster. Individuals who do not feel safe in the environment are incapable of addressing other prevailing life issues.

The nature of the environment has a direct impact on a community’s health and also on the quality of life of its inhabitants. Quality of life is defined as an individual’s perception of his position in life in the context of the culture and value system where he lives and in relation to his goals, expectations, standards, and concerns. It is a broad-ranging concept that incorporates a person’s physical health, psychological state, level of independence, social relationships, personal beliefs, and relationship to salient features of the environment (WHO, 2002a). Natural and human-generated disasters disrupt the sources of meeting physiological needs and the sense of safety that individuals may embrace within their communities. Restoration of these facilities and a collective reduction in fear and uncertainty must be accomplished as soon as possible. Disaster nursing practice is wide ranging and broad in scope and seeks to promote changes in behaviors that will compensate for the disrupted physiological conditions. Health promotion and disease prevention activities must occur simultaneously in the immediate aftermath of a disaster.

The goals for health promotion in disaster nursing are the following:

- To meet the immediate basic survival needs of populations affected by disasters (water, food, shelter, and security).
- To identify the potential for a secondary disaster.
- To appraise both risks and resources in the environment.
- To correct inequalities in access to health care or appropriate resources.
- To empower survivors to participate in and advocate for their own health and well-being.
- To respect cultural, lingual, and religious diversity in individuals and families and to apply this principle in all health promotion activities.
- To promote the highest achievable quality of life for survivors.

To achieve these goals, nurses must have a solid understanding of the basic principles of environmental health, methods of health promotion, and disease prevention strategies. They must also maintain competencies in such relevant skills in order to collaborate with other members of the team who provide health care.

The concept of health promotion in disaster nursing is not new. Nursing has long been aware that a clean environment is the foundation for good health.
Florence Nightingale waged a tireless campaign during the Crimean War to improve the health outcomes of soldiers in her care through the use of fresh air, clean water, fresh bed linens, and a plentiful supply of healthy food. Because of her emphasis on health promotion efforts, Nightingale was able to bring about substantial reform in the living standards of and health services for the armed services. Her work remains a shining example of the impact of applying principles of public health and disaster nursing on improving environmental conditions for affected populations (Nightingale, 1858).

Disasters destroy or destabilize the physical environment in which people work and live. Natural disasters that have a rapid onset and broad impact can produce many factors that work synergistically to increase the risk of illness and deaths resulting from infectious disease (Toole, 1997). The first goal in any disaster response is to reestablish sanitary barriers as quickly as possible. Following this, efforts are made to meet the basic physiologic needs of the population. Strategies to accommodate population-based needs for water, food, waste removal, vector control, shelter, and safety should be planned for in advance whenever possible. Following a disaster, continuous monitoring of the environment will allow potential hazards to be addressed immediately. Disease prevention is an ongoing goal. Generally, the risks of large-scale epidemics are low immediately following acute natural disasters, particularly in developed nations. Infectious disease outbreaks usually occur in the postimpact and recovery phases of the disaster. The risks of epidemics increase when drought, famine, and large displacements of people are involved (Greensough, 2002). Complex emergencies (such as those resulting from civil war) generate refugee movements and place millions of people at risk for infectious disease (Merson et al., 2006). Any disaster that interrupts one or more levels of the public health infrastructure of a community, including the sanitation systems, water supply, food and nutrition sources, vector control programs, and access to primary care (e.g., immunizations) can trigger an infectious disease outbreak. Breaks in the public health infrastructure lead to outbreaks from the increased modes of transmission of infectious diseases, an increased susceptibility to endemic organisms among disaster survivors, and occasionally new organisms introduced to the area by those individuals who travel to the disaster scene to provide relief. Modes of transmission of waterborne, airborne, and vector-borne diseases are enhanced by disaster conditions.

Susceptibility increases in the population because of the migration of large populations, malnutrition, overcrowding in shelters and camps, open wounds, stress, and exposure to extremes of hot and cold temperatures. Diseases that are widespread and have a short incubation period will commonly appear first. Measles, diarrheal disease, and respiratory infections, all of which are preventable diseases, constitute the vast majority of deaths following a disaster (Merson et al., 2006). When a disease appears in a population following a disaster, investigation and full appraisal of the situation (data collection and risk assessment) must occur immediately.

RISK FACTORS FOR INFECTIOUS DISEASE OUTBREAKS FROM DISASTERS

Disasters destroy or destabilize the physical environment in which people work and live. Natural disasters that have a rapid onset and broad impact can produce many factors that work synergistically to increase the risk of illness and deaths resulting from infectious disease (Toole, 1997). The first goal in any disaster response is to reestablish sanitary barriers as quickly as possible. Following this, efforts are made to meet the basic physiologic needs of the population. Strategies to accommodate population-based needs for water, food, waste removal, vector control, shelter, and safety should be planned for in advance whenever possible. Following a disaster, continuous monitoring of the environment will allow potential hazards to be addressed immediately. Disease prevention is an ongoing goal. Generally, the risks of large-scale epidemics are low immediately following acute natural disasters, particularly in developed nations. Infectious disease outbreaks usually occur in the postimpact and recovery phases of the disaster. The risks of epidemics increase when drought, famine, and large displacements of people are involved (Greensough, 2002). Complex emergencies (such as those resulting from civil war) generate refugee movements and place millions of people at risk for infectious disease (Merson et al., 2006). Any disaster that interrupts one or more levels of the public health infrastructure of a community, including the sanitation systems, water supply, food and nutrition sources, vector control programs, and access to primary care (e.g., immunizations) can trigger an infectious disease outbreak. Breaks in the public health infrastructure lead to outbreaks from the increased modes of transmission of infectious diseases, an increased susceptibility to endemic organisms among disaster survivors, and occasionally new organisms introduced to the area by those individuals who travel to the disaster scene to provide relief. Modes of transmission of waterborne, airborne, and vector-borne diseases are enhanced by disaster conditions.

Susceptibility increases in the population because of the migration of large populations, malnutrition, overcrowding in shelters and camps, open wounds, stress, and exposure to extremes of hot and cold temperatures. Diseases that are widespread and have a short incubation period will commonly appear first. Measles, diarrheal disease, and respiratory infections, all of which are preventable diseases, constitute the vast majority of deaths following a disaster (Merson et al., 2006). When a disease appears in a population following a disaster, investigation and full appraisal of the situation (data collection and risk assessment) must occur immediately.

RAPID ASSESSMENT OF POPULATION HEALTH NEEDS

One of the most important public health tasks in the immediate aftermath of a disaster is to conduct a rapid and comprehensive assessment of population health requirements. Responders should conduct a health assessment of the community as soon as possible within the first few days following the event (Connolly, 2005). This is a multifaceted process that consists of several key elements: (1) data collection for assessment of needs, (2) identification of available resources that match to defined needs, (3) prevention of further adverse health effects associated with the event, (4) implementation of disease control strategies, (5) evaluation of the effectiveness of the application of these strategies, and (6) improvement in contingency planning for future disasters.

The initial data collection as part of the rapid assessment should include the following:

1. An assessment of the current circumstances and quality of life of the victims—location, demographic data, routes of access and modes of transportation, communication systems, availability of basic services (water, electricity, communications, sanitation facilities, housing, and shelters), and availability of food.
2. The scope of the damage—determine the number of deaths, the number of persons injured, the number who have disappeared, the number displaced and their location, the status and capacity of health care facilities, urgent needs, and human and material resources in the immediate area (Farmer, Jimenez, Rubinso, & Talmor, 2004).

Other data points for collection include the following:

1. The presence of an ongoing hazard (e.g. persistent toxic smoke or chemicals).
2. The community’s need for immediate outside assistance.
3. The augmentation of existing public health surveillance for ongoing monitoring of health care needs.

A team must be assembled, including public health officials, clinicians, epidemiologists, engineers and local officials, if available. Frequently, members of the American Red Cross will also participate in this initial assessment. If the area affected is large, several teams may be needed to traverse the field site. All team members collecting data should use a standardized format. Advance information on the status of the health care system (available beds, equipment) emergency medical services, and the availability of health care providers to respond is critical to assessing capacity. Accurate detailed maps should be obtained, delineating high-risk areas and the location of vulnerable populations. Collection of baseline data on the population is critical prior to beginning the rapid assessment. The use of pre-impact epidemiologic data on frequencies and distributions of disease (e.g. incidence, prevalence, and mortality) will facilitate the analysis and planning for response (see chapter 20 for further discussion of disease surveillance and the principles of epidemiology; Connolly, 2005; Waring & Brown, 2005).

Successful interventions require rapid assessment by health care providers to determine where the break-down in the public health infrastructure occurred and to identify and prioritize the health needs of the population. All immediate and potential health hazards must be identified. Outbreak management can quickly become disaster management if the number of patients exceeds the capability and resources of the responders (Moralejo, Russell, & Porat, 1997).

The Role of the Public Health Nurse Following a Disaster

Public health nurses have a central function in the public health system and, as such, become invaluable resources both to the community and to other nurses during times of disaster (see chapter 31, The Role and Preparation of the Public Health Nurse for Disaster Response, for further discussion). Public health nurses are expert in population health care and routinely conduct disease surveillance, implement programs in health promotion, and are knowledgeable in healthy standards for food, water, and sanitation. Public health nurses working at the local level are extremely dedicated to serving their communities, routinely form informal partnerships that are essential for disease surveillance, and effectively use informal communication channels to obtain critical surveillance information (Atkins, Williams, Salinas, & Edwards, 2005). Increased surveillance activities for disaster recovery add more responsibilities to the work of public health nurses. In all types of disasters, all responding nurses will be empowered to exercise leadership and discerning judgment in the following:

- Assessing the affected community for the presence (or absence) of the basic fundamentals for health—clean water, safe food, sanitation, and shelter.
- Reestablishing the sanitary barriers that protect communities from environmental hazards.
- Detecting changes in the integrity of the environment and organizing activities designed to eliminate or mitigate existing health hazards.
- Planning for continuous maintenance and monitoring of facilities basic to health regarding proper waste removal, adequate water and food supplies, shelter, and personal safety.
- Responding aggressively to evidence of the transmission of disease to ameliorate the spread of an epidemic throughout the population.
- Respecting and empowering affected individuals by giving them decision-making rights regarding all pertinent public health issues.

MINIMUM STANDARDS FOR PUBLIC HEALTH

In 1997 an international initiative called the Sphere Project was developed. The project published a set of minimum standards in core areas of humanitarian assistance. These standards can serve as a foundation for the disaster nursing prevention strategies previously described. The Sphere Project, a program of the Steering Committee for Humanitarian Response, sought to improve the quality of assistance provided to people around the world who were affected by disasters and to enhance the accountability of the humanitarian system in disaster relief efforts. The cornerstone of the project was the establishment of the Humanitarian Charter. Based on the principles and provisions of international humanitarian law, international human rights law, refugee law, and the Code of Conduct for the International Red Cross and Red Crescent Movement, the Charter describes the core principles that govern humanitarian action and asserts the right of populations to protection and assistance (McConnan, 2004; see chapter 4, American Red Cross Disaster Health Services and Disaster Nursing, for further discussion). In 2004, the Sphere Project published revised and updated standards reflecting recent developments in humanitarian practice in water, sanitation, food, shelter, and health, together with feedback from practitioners in the field, research institutes and cross-cutting experts in protection, gender, children, older people, disabled people, HIV/AIDS, and the environment (McConnan, 2004).
The Charter is concerned with the most basic requirements for sustaining the necessary dignity of those affected by disasters. The following minimum standards aim to quantify these requirements with regard to people’s need for water, sanitation, nutrition, food, shelter, and health care, and protection from hazards in the environment. Although designed to address international relief efforts, the Humanitarian Charter and Minimum Standards provide a useful operational framework for establishing public health priorities and accountability in any disaster response, regardless of location. In the event of a disaster within the geographic borders of the United States, the basic fundamental priorities for the health of a population remain the same.

Water

Water is essential to sustain life and plays a vital role in the proper functioning of the Earth’s ecosystems. Water is needed for drinking, cooking, cleaning, and personal hygiene. Paradoxically, too much or too little water is the foremost cause of most of the world’s disasters. Everyone has the right to water. This right is recognized in international legal instruments and provides for sufficient, safe, acceptable, physically accessible, and affordable water for personal and domestic uses. An adequate amount of safe water is necessary to prevent death from dehydration, to reduce the risk of water-related disease, and to provide for consumption, cooking, and personal and domestic hygiene requirements (Sphere Project, 2004).

The Sphere Project proposes the following minimum standards for the water supply in disaster relief efforts:

1. **Access and water supply.** All people have safe access to a sufficient quantity of water for drinking, cooking, and personal and domestic hygiene. Public water points are sufficiently close to households to allow use of the minimum water requirement.

2. **Water quality.** Water at the point of collection is palatable and potable and can be used for personal and domestic hygiene without causing significant risk to health because of waterborne diseases or chemical or radiological contamination from short-term use.

3. **Water use facilities and goods.** People have adequate facilities and supplies to collect, store, and use sufficient quantities of water for drinking, cooking, and personal hygiene, and to ensure that drinking water remains sufficiently safe until it is consumed (Sphere Project, 2004).

Water Supply

**Water Supply Standard 1: Access and Water Quantity.** All people have safe and equitable access to a sufficient quantity of water for drinking, cooking, and personal and domestic hygiene. Public water points are sufficiently close to households to enable use of the minimum water requirement.

**Key indicators:**

**Average water use for drinking, cooking, and personal hygiene in any household is at least 15 liters per person per day.**

The maximum distance from any household to the nearest water point is 500 meters.

Waiting time at a water source is no more than 15 minutes.

It takes no more than 3 minutes to fill a 20-liter container.

Water sources and systems are maintained such that appropriate quantities of water are available consistently or on a regular basis (Sphere Project, 2004).

Nurses will need to work closely with public health officials and the agencies responsible for monitoring access to and the quantity of the water supply in the postimpact phase of a disaster. The exact quantities of water needed for domestic use will vary according to the climate, religious and cultural habits of the affected population, and the amount of food they cook. Water consumption should be monitored and each family should be provided with their own water receptacle or bucket to reduce the spread of disease. In the immediate aftermath of a disaster, the first priority is to provide an adequate quantity of water, even if its safety cannot be guaranteed, and to protect water sources from contamination. A minimum of 15 liters per person per day should be provided as soon as possible, though in the immediate postimpact period, it may be necessary to limit treated water to a minimum of 7.5 liters per day per person. During emergencies, people may use an untreated water source for laundry, bathing, and so forth. Water-quality improvements can be made over succeeding days or weeks (WHO, 2006a).

A 5- to 6-day supply of water (5 gallons per person) should be stored for food preparation and personal hygiene, as part of essential disaster planning in communities at high risk for a natural disaster. Stored water should be changed every 6 months. Cloudy water or any water with a fetid odor should be discarded immediately.

In disaster situations, there may not be enough water available to meet the physiological needs of the affected population, and sources of potable water must be found. A satisfactory supply must be made available to every individual. Rainwater, surface water, and groundwater are sources of water. Rainwater is sporadic and generally unreliable as a water source. Surface water is found in lakes, ponds, streams, and rivers, and is...
Water Supply Standard 2: Water Quality. Water is generally the only type of water that is accessible and in large enough quantity to provide for a population following a major disaster. Although surface water is easy to collect, it is microbiologically unsafe and requires treatment before use. Attempts to access groundwater may be necessary in the event that surface water is unavailable or insufficient to meet demand. As with surface water, groundwater may harbor contaminants and must be evaluated for quality. Chlorine (“shock chlorination”) can be used to treat sources of ground-water, including wells. Every effort should be made to achieve a drinking water quality as high as possible. Protection of water supplies from contamination is the first and best line of defense, and ongoing monitoring of water quality must be conducted. Once water is collected, its quality will deteriorate over time. Source protection is almost invariably the best method of ensuring safe drinking water and is preferred to treating a contaminated water supply to render it suitable for consumption. Once a potentially hazardous situation has been recognized, however, the risk to health, the availability of alternative sources, and the availability of suitable remedial measures must be considered so that a decision can be made about the acceptability of the supply. A contaminated water source should not be closed to access unless another source has been identified. Providing people with more water is more protective against fecal-oral pathogens than providing people with cleaner water, according to studies conducted in developing countries (Centers for Disease Control and Prevention, 1992; Esrey, Potash, Roberts, & Shiff, 1991).

As far as possible, water sources must be protected from contamination by human and animal waste, which can contain a variety of bacterial, viral, and protozoan pathogens and parasites. Failure to provide adequate protection and effective treatment will expose the community to the risk of outbreaks of intestinal and other infectious diseases. To a great extent, the vulnerability of victims to waterborne illnesses depends on the preexisting levels of personal hygiene and sanitation (WHO, 1979). Those at greatest risk of waterborne disease are infants and young children, people who are debilitated or living under unsanitary conditions, the sick, and the elderly. For these people, infective doses are significantly lower than for the general adult population (WHO, 2006a).

Water Quality

Water Supply Standard 2: Water Quality. Water is palatable, and of sufficient quality to be drunk and used for personal and domestic hygiene without causing significant risk to health.

Key indicators:
A sanitary survey indicates a low risk of fecal contamination.

There are no fecal coliforms per 100 mL at the point of delivery.

People drink water from a protected or treated source in preference to other readily available water sources.

Steps are taken to minimize post-delivery contamination. For piped water supplies, or for all water supplies at times of risk or presence of diarrhea epidemic, water is treated with a disinfectant so that there is a free chlorine residual at the tap of 0.5 mg per liter and turbidity is below 5 NTU.

No negative health effect is detected that is due to short-term use of water contaminated by chemical (including carry-over of treatment chemicals) or radiological sources, and assessment shows no significant probability of such an effect (Sphere Project, 2004).

The pollution of water has a serious impact on all living creatures and can negatively affect the use of water for drinking, household needs, recreation, fishing, transportation, and commerce. The water supply may be compromised as a result of a natural disaster, a chemical, radiological or nuclear attack, or by contamination from excreta that is due to inadequate sanitation facilities. As a result, with this in mind, WHO developed guidelines that represent a scientific assessment of the health risks from biological and chemical constituents of drinking water and of the effectiveness of associated control measures (WHO, 2004). The various WHO guidelines concerned with water (guidelines for drinking water safety; guidelines for the safe use of wastewater and excreta in agriculture; guidelines for safe recreational water environments) are all designed to limit the health hazards derived primarily from contamination with excreta. Water quality is evaluated based on the presence of bacterial measures that indicate the presence of feces. Human feces contain millions of bacteria and even minute amounts of feces in water are often detectable via bacterial monitoring. WHO guidelines consider water with less than 10 fecal coliforms per 100 mL to be reasonably safe, whereas water with 10 or greater fecal coliforms is considered contaminated and unsafe for human consumption.

■ The WHO recommends that social, economic, and environmental factors be taken into account through a risk–benefit approach when adapting the guideline values to international standards or during emergency situations. The WHO (2004) Guidelines for Drinking Water Quality are meant to be the scientific point of departure for the development of standards (including bottled water), and sometimes actual international standards may vary from the Guidelines.

■ In the United States, the Environmental Protection Agency (EPA) enforces federal clean water and safe drinking water laws, provides support for municipal
wastewater treatment plants, and takes part in pollution prevention efforts aimed at protecting watersheds and sources of drinking water. The Agency carries out both regulatory and voluntary programs to fulfill its mission to protect the nation’s waters and has established standards for the microbial quality of water in the United States.

**EPA and the Safe Water Drinking Act (SWDA).** Through the Safe Drinking Water Act (SWDA), the EPA sets legal limits on the amount of contaminants in drinking water and establishes rules for the treatment of contaminated water (EPA, 2006). The SWDA was originally passed by Congress in 1974 to protect public health by regulating the nation’s public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources: rivers, lakes, reservoirs, springs, and groundwater wells. SWDA authorizes the EPA to set national health-based standards for drinking water to protect against both naturally occurring and manmade contaminants that may be found in drinking water. The EPA works in conjunction with the states and water systems to make sure that these standards are met. The SWDA empowers states to set and enforce their own drinking water standards as long as the standards are at least as strong as those of the EPA. Millions of Americans receive high-quality drinking water every day from their public water systems (which may be publicly or privately owned). Nonetheless, drinking water safety cannot be taken for granted. There are a number of threats to drinking water: improperly disposed of chemicals; animal wastes; pesticides; human wastes; wastes injected deep underground; and naturally occurring substances can all contaminate drinking water. Likewise, drinking water that is not properly treated or disinfected, or which travels through an improperly maintained distribution system, may also pose a health risk.

Disaster events disrupt the integrity of water containment and systems, and contamination can occur. Depending on the location of the disaster, nurses should use one or both of the WHO guidelines and the EPA standards to provide a foundation for assessment of risk and risk management for water-related infectious diseases following a disaster or major public health event. Much of this discussion addresses those parts of the world without an adequate infrastructure, whereas in the United States, nurses will most frequently encounter well water contamination from flooding.

**Drinking Water.** Safe water for drinking and cooking includes bottled, boiled, or treated water. If possible, in the aftermath of a disaster, people should only drink bottled, boiled, or treated water until the water supply can be tested for safety. Health education includes warning people not to use contaminated water to brush teeth, wash dishes, wash or cook food, or to make ice. Water used for making edible ice should be subject to the same drinking water standard and should include specific sanitary requirements for equipment for making and storing ice. To kill harmful organisms, all members of the community should be instructed to boil their water in a rapid boil for at least 1 to 2 minutes. Water can also be treated to kill bacteria by adding chlorine or iodine tablets or 1/8 teaspoon of unscented Clorox bleach per gallon of water. The solution must be mixed thoroughly and allowed to sit for at least 30 minutes (EPA, 2002).

**Water Use**

**Water Supply Standard 3: Water Use Facilities and Goods.** People have adequate facilities and supplies to collect, store and use sufficient quantities of water for drinking, cooking, and personal hygiene, and to ensure that drinking water remains safe until it is consumed.

*Key indicators:*

Each household has at least two clean water collecting containers of 10 to 20 liters, plus enough clean water storage containers to ensure there is always water in the household.

Water collection and storage containers have narrow necks and/or covers, or other safe means of storage, drawing, and handling, and are demonstrably used.

There is at least one standard bar of soap available for personal hygiene per person per month.

Where communal bathing facilities are necessary, there are sufficient bathing cubicles available, with separate cubicles for males and females, and they are used appropriately and equitably.

Where communal laundry facilities are necessary, there is at least one washing basin per 100 people, and private laundering areas are available for women to wash and dry undergarments and sanitary clothes.

The participation of all vulnerable groups is actively encouraged in the location and construction of bathing facilities and/or the production and distribution of soap, and/or the use and promotion of suitable alternatives (Sphere Project, 2004).

People need vessels to collect water, to store it, and to use it for washing, cooking, and bathing. These vessels should be clean, hygienic, and easy to carry and be appropriate to local needs and habits, in terms of size, shape, and design. Children, people with disabilities, and older people may need smaller or specially designed water carrying containers.
Water Security. Since the terrorist attacks of September 11, 2001, the EPA redoubled efforts already underway to promote security at America’s 168,000 public drinking water and 16,000 wastewater facilities. Water utilities are faced with a new challenge: to secure their facilities. The EPA has since partnered with states and the water community to help increase security at the greatest number of water systems (EPA, 2002). One specific action the EPA has taken is to facilitate a water supply vulnerability analysis. The EPA does this by assisting drinking water suppliers to assess infrastructure and to address any weaknesses in its facilities, as well as to develop tools and technical assistance to assist utilities as they work to determine vulnerabilities to attack and prepare emergency response plans. In addition, they work to promote information sharing through a partnership to set up a secure Information Sharing and Analysis Center that will alert water utilities of potential terrorist intentional acts.

Sanitation

During a disaster or complex emergency, sewage systems (a complex network of pipes) may be damaged, plugged, or flooded, causing waste to spill into the environment and exposing people to a number of different hazards. The purpose of a sanitation system is to contain human excreta at the moment of defecation so that it is not free to spread through the environment, and thus to prevent the spread of diarrheal illness. Safe disposal of human excreta creates the first barrier to excreta-related disease, helping to reduce transmission through direct and indirect routes. Safe excreta disposal is therefore a major priority, and in most disaster situations should be addressed with as much speed and effort as the provision of safe water supply. The provision of appropriate facilities for defecation is one of a number of emergency responses essential for people’s dignity, safety, health, and well-being. Reestablishing sanitation is the single most important protective measure that can be taken following a disaster (Landesman et al., 2005). Types of sanitation options in disaster response vary according to location and include latrines, flush toilets, and defecation fields (most frequently used in developing countries). The Sphere Project proposes the following minimum standards for excreta disposal in disaster relief efforts:

1. **Location and number of toilets.** People have adequate numbers of toilets, sufficiently close to their dwellings to allow them rapid, safe, and acceptable access at all times of the day and night.

2. **Design and construction.** People have access to toilets that are designed, constructed, and maintained in such a way as to be comfortable, hygienic, and safe to use (Sphere Project, 2004).

Access to Toilets

**Excreta Disposal Standard 1: Access to, and numbers of, toilets.**

People have adequate numbers of toilets, sufficiently close to their dwellings, to allow them rapid, safe, and acceptable access at all times of the day and night.

**Key indicators:**

- A maximum of 20 people use each toilet.
- Use of toilets is arranged by household(s) and/or segregated by sex.
- Separate toilets for women and men are available in public places (markets, distribution centers, health centers, etc.).
- Shared or public toilets are cleaned and maintained in such a way that they are used by all intended users.
- Toilets are no more than 50 meters from dwellings.

Toilets are used in the most hygienic way and children’s feces are disposed of immediately and hygienically (Sphere Project, 2004).

The design of emergency sanitation systems must address the following issues:

- The supply of latrines or excreta containment facilities must be sufficient to accommodate the entire population in need, with a maximum of 20 people per toilet (United Nations High Commission for Refugees, 1994).
- The sanitation system must be close enough in proximity to the population that people can use it (no more than a 1- to 2-minute walk).
- Cultural differences in sanitation habits must be accommodated (e.g., in some cultures this may mean building separate latrines for men, women, and separate facilities for children). In public places in the United States, this means separate toilets for men and women.
- Communication must occur to notify people of the location of the facilities and to encourage their use.
- Whenever possible, households should not share latrines or toilets with other households.
- Toilets provide a reasonable degree of privacy in line with the cultural norms of the affected population. Privacy screens may need to be constructed.
- Paper, water, and soap must be located in or near the toilet facilities in order to ensure personal hygiene. Hand washing should be promoted.
- Women are provided a place with the necessary privacy for washing or disposing of sanitary protection products.
Cleaning and maintenance routines for public toilets are established and function correctly and regularly. If latrines are used, they must be placed far away from any water source.

Design of Toilets


Toilets are sited, designed, constructed, and maintained in such a way as to be comfortable, hygienic, and safe to use.

Key indicators:

- Users (especially women) have been consulted and approve of the location and design of the toilet.
- Toilets are designed, built, and located to have the following features:
  - They are designed in such a way that they can be used by all sections of the population, including children, older people, pregnant women, and physically and mentally disabled people.
  - They are located in such a way as to minimize threats to users, especially women and girls, throughout the day and night.
  - They are sufficiently easy to keep clean to invite use and do not present a health hazard.
  - They provide a degree of privacy in line with the norms of the users.
  - They allow for the disposal of women’s sanitary protection, or provide women with the necessary privacy for washing and drying sanitary protection cloths.
  - They minimize fly and mosquito breeding.
  - All toilets constructed that use water for flushing and/or a hygienic seal have an adequate and regular supply of water.
  - Pit latrines are at least 30 meters from any groundwater source and the bottom of any latrine is at least 1.5 meters above the water table. Drainage or spillage from defecation systems must not run towards any surface water source or shallow groundwater source.
  - People wash their hands after defecation and before eating and food preparation.
  - People are provided with tools and materials for constructing, maintaining, and cleaning their own toilets if appropriate (Sphere Project, 2004).

Mortality and morbidity rates among displaced populations in the first days and weeks following a disaster are often much higher than rates among the same population after the situation is stabilized. Thus, providing some sanitation facilities during the first days of the crisis is critical. Regardless of the type of facility used, it needs to be established before the population arrives at the site or soon after.

Vulnerabilities and Capacities of Disaster-Affected Populations

The groups most frequently at risk in disasters and public health emergencies are women, children, older people, people with disabilities or chronic illness, and people living with HIV/AIDS. In certain contexts, people may also become vulnerable by reason of ethnic origin, religious or political affiliation, or displacement. This is not an exhaustive list, but it includes those most frequently identified. Specific vulnerabilities influence people’s ability to cope and survive in a disaster, and those most at risk should be identified in each context. When any one group is at risk, it is likely that others will also be threatened. Special care must be taken to protect and provide for all affected groups in a nondiscriminatory manner and according to their specific needs. However, it should also be remembered that disaster-affected populations possess and acquire skills and capacities of their own to cope, and that these should be recognized and supported (Sphere Project, 2004).

FOODBORNE ILLNESS

Foodborne illnesses are defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. Every person is at risk of foodborne illness. Foodborne illness is usually classified in one of three ways: food infections, food poisoning, or chemical poisoning (Merrill & Timmreck, 2006).

Food infections are a result of the ingestion of disease-causing organisms (pathogens), such as bacteria and microscopic plants and animals. Examples of food infections are salmonellosis, giardiasis, amebiasis, shigellosis, brucellosis, diphtheria, tuberculosis, scarlet fever, typhoid fever, and tularemia. Food poisoning is the result of toxins formed in foods prior to consumption, often the waste products of bacteria. Staphylococcus food poisoning is a milder form of food poisoning, producing cramps and a short bout of diarrhea about 6 hours after consumption. The most serious and deadly form of food poisoning is that of botulism. Chemical poisoning is caused by poisonous chemicals from animals and plants that end up in the food.

Food Safety

Food safety is an increasingly important public health issue. Governments all over the world are intensifying their efforts to improve food safety (WHO, 2002b). These efforts are in response to an increasing number...
of food safety problems and rising consumer concerns regarding contamination.

**Magnitude of Foodborne Illness**

Foodborne diseases are a widespread and growing public health problem, both in developed and developing countries. The global incidence of foodborne disease is difficult to estimate, but it has been reported that in the year 2000 alone, 2.1 million people died from diarrheal diseases. A great proportion of these cases can be attributed to contamination of food and drinking water. Additionally, diarrhea is a major cause of malnutrition in infants and young children.

In industrialized countries, the annual percentage of people suffering from foodborne diseases has been reported to be up to 30%. In the United States, approximately 76 million cases of foodborne diseases, resulting in 325,000 hospitalizations and 5,000 deaths, are estimated to occur each year.

Although less documented, developing countries bear the brunt of the problem because of the presence of a wide range of foodborne diseases, including those caused by parasites. The high prevalence of diarrheal diseases in many developing countries may be associated with large population movements, but also suggests major underlying food safety problems.

Although most foodborne diseases are sporadic and often not reported, foodborne disease outbreaks may take on massive proportions. For example, in 1994, an outbreak of salmonellosis caused by contaminated ice cream occurred in the United States, affecting an estimated 224,000 persons. In 1988, an outbreak of hepatitis A, resulting from the consumption of contaminated clams, affected some 300,000 individuals in China.

**Emergence of Foodborne Illness.** New foodborne disease threats occur for a number of reasons. These include disaster conditions, an increase in international travel and trade, microbial adaptation, and changes in the food production system, as well as human demographics and behavior (such as complex emergencies).

- **The globalization of the food supply:** A large outbreak of cyclosporiasis occurred in North America in 1996–1997, linked to contaminated raspberries imported from South America.
- **The inadvertent introduction of pathogens into new geographic areas:** Vibrio cholerae was introduced into waters off the coast of the southern United States when a cargo ship discharged contaminated ballast water in 1991. It is likely that a similar mechanism led to the introduction of cholera for the first time this century into South America in 1991.
- **Travelers, refugees, and immigrants exposed to unfamiliar foodborne hazards while abroad:** International travelers and refugee populations may become infected by foodborne pathogens that are uncommon in their countries. It is estimated that about 90% of all cases of salmonellosis in Sweden are imported.
- **Changes in microorganisms:** Changes in microbial populations can lead to the evolution of new pathogens, development of new virulent strains in old pathogens, development of antibiotic resistance that might make a disease more difficult to treat, or to changes in the ability to survive in adverse environmental conditions.
- **Change in the human population:** The population of highly susceptible persons is expanding worldwide because of aging, malnutrition, HIV infections, and other underlying medical conditions. Age is an important factor in susceptibility to food-borne infections. Those at the extremes of the age spectrum have either not developed or have partially lost protection from infection. In particular, the elderly, foodborne infections are likely to invade the bloodstream and lead to severe illness with high mortality rates. People with a weakened immune system also become infected with foodborne pathogens at lower doses, which may not produce an adverse reaction in healthier persons. Seriously ill persons, suffering, for example, from cancer or AIDS, are more likely to succumb to infections with salmonella, campylobacter, listeria, toxoplasma, cryptosporidium, and other foodborne pathogens. In developing countries, reduced immunity because of poor nutritional status renders people, particularly infants and children, more susceptible to foodborne infections.
- **Safety in food preparation:** Unhygienic preparation of food provides ample opportunities for contamination, growth, or survival of foodborne pathogens. Lack of hand washing and poor personal hygiene are associated with a number of foodborne illnesses including hepatitis A, shigellosis, giardiasis, and gastroenteritis. Improper food storage (caused by electricity failure), inadequate cooking, and poor personal hygiene are common causes of foodborne illnesses following a disaster.
- **Disaster conditions:** Lack of adequate storage facilities and refrigeration will threaten the integrity of a community’s food supply.
- **Vulnerability of the nation’s food supply:** The targeting of the nation’s food supply by terrorist groups is currently a major concern for the U.S. government (see chapter 19 for evidence of previous attacks on the United States that targeted food sources).

**Major Foodborne Diseases From Microorganisms**

Salmonellosis is a major problem in many countries. Salmonellosis is caused by the Salmonella bacteria and symptoms are fever, headache, nausea, vomiting,
abdominal pain, and diarrhea. Examples of foods involved in outbreaks of salmonellosis are eggs, poultry and other meats, raw milk, and chocolate.

Campylobacteriosis is a widespread infection. It is caused by certain species of Campylobacter bacteria and in some countries, the reported number of cases surpasses the incidence of salmonellosis. Foodborne cases are mainly caused by foods such as raw milk, raw or undercooked poultry, and drinking water. Acute health effects of campylobacteriosis include severe abdominal pain, fever, nausea, and diarrhea. In 2% to 10% of cases the infection may lead to chronic health problems, including reactive arthritis and neurological disorders.

Infections due to enterohemorrhagic (causing intestinal bleeding) E. coli, for example, E. coli O157, and listeriosis are important foodborne diseases that have emerged over the last decades. Although their incidence is relatively low, they are severe infections with sometimes fatal health consequences, particularly among infants, children, and the elderly, making them among the most serious foodborne infections.

Pathogenic Escherichia coli strains, such as E. coli O157, which produce a potent toxin, cause hemorrhagic infections in the colon resulting in bloody diarrhea or life-threatening complications such as kidney failure. E. coli O157 outbreaks have been mainly related to beef consumption, however, sprouts, lettuce, and juice have also been found to cause outbreaks.

Listeria monocytogenes is the cause of listeriosis, which has a fatality rate of up to 30%. The most frequent effects are meningitis and miscarriage or meningitis of the fetus or newborn. Many types of foods have been implicated in listeriosis cases. Often, a prolonged refrigeration period seems to have contributed to outbreaks.

Cholera is a major public health problem in developing countries and has caused enormous economic losses. The disease is caused by the bacterium Vibrio cholerae. In addition to water, contaminated foods can be the vehicle of infection. Different foods, including rice, vegetables, millet gruel, and various types of seafood have been implicated in outbreaks of cholera. Symptoms include abdominal pain, vomiting, and profuse watery diarrhea and may lead to severe dehydration and possibly death, unless fluid and salt are replaced.

Bovine Spongiform Encephalopathy (BSE), a fatal, transmissible, neurodegenerative disease of cattle, was first discovered in the United Kingdom in 1985. The cause of the disease was traced to an agent related to scrapie in sheep, which contaminated recycled bovine carcasses used to make meat and bone meal additives for cattle feed. Recycling of the BSE agent led to a distributed common source epidemic of more than 180,000 diseased animals in the United Kingdom alone. The agent affects the brain and spinal cord of cattle, and lesions are characterized by sponge-like changes visible under a microscope. At this time, 19 countries have reported endemic BSE cases, and the disease is no longer confined to the European community; a case of BSE has been reported in a cattle herd of Japan.

In human populations, exposure to the BSE agent (probably in contaminated bovine-based food products) has been strongly linked to the 1996 appearance of a new transmissible spongiform encephalopathy of humans called variant Creutzfeldt-Jakob Disease (vCJD).

Foodborne Illness Investigation

The 1993 Jack-in-the-Box epidemic caused by E. coli, which received widespread media attention, brought concern for food protection and preparation into the national limelight. Hamburger meat contaminated in meat processing plants was identified as the possible source of infection. Over 400 people became ill and four children died as a result of consuming the contaminated meat (Centers for Disease Control and Prevention, 1993).

Even if an epidemic of staphylococcal food poisoning is occurring (for example, being acquired from a fast-food restaurant), most people simply take care of themselves at home. Hundreds of persons could be involved, but the medical and public health community might never know. The outbreak is short, individuals recover quickly, a physician is rarely seen, and the outbreak is not always reported to the public health department. In more serious foodborne and waterborne illnesses such as salmonella, giardia, amoebic dysentery, and shigella, people do not recover so quickly; the symptoms are stronger, last longer, and medical intervention is usually needed. These diseases are serious and sometimes cause death; thus, they are more likely to be reported.

Investigation of a foodborne illness requires interviews, if possible, of all persons (ill and well) who were present at the time of the ingestion of suspect foods. Merrill and Timmreck (2006) describe those factors necessary to a good investigation as follows:

- Discovering who ate the food.
- Discovering who did not eat the food.
- Calculating attack rates for each food.
- For each food, calculating the attack rates among those who ate the food.
- For each food, calculating the attack rates among those who did not eat the food.

Steps to investigating a foodborne disease epidemic are listed in the following:

1. Obtain a diagnosis and disease determination.
2. Establish that an outbreak has taken or is taking place.
3. Determine which foods are contaminated and which are suspect.
4. Determine if toxigenic organisms, infectious organisms, or chemical toxins are involved.
5. Ascertain the source of contamination. How did the food become contaminated?
6. From determining the source of poison and contamination, ascertain how much growth or the extent of contamination that could occur.
7. Identify foods and people implicated in the contamination and intervene to stop further spread of the disease.
9. Exercise intervention, prevention, and control measures.
10. Develop and distribute reports to inform those who need to know—private citizens, appropriate leaders, and public officials (Merrill & Timmreck, 2006).

Challenges in Food Safety

Modern intensive agricultural practices contribute to the increase in the availability of affordable food and contribute to the use of food additives that can improve the quality, quantity, and safety of the food supply. Appropriate controls, however, are necessary to ensure their proper and safe use along the entire food chain. Other challenges that need to be addressed to help ensure food safety include the globalization of trade in food, urbanization, international travel, environmental pollution, deliberate contamination, and natural and man-made disasters. The food production chain has become more complex, providing greater opportunities for contamination (both intentional and nonintentional) and the growth of pathogens.

Food Safety Is Essential for Disease Prevention in the Aftermath of a Disaster

The World Health Organization has issued the following recommendations for ensuring the safety of food supplies following a disaster event:

KEY 1: Keep Clean (Prevent the Growth and Spread of Dangerous Microorganisms)
- Wash your hands with soap and water (or other means such as wood ashes, aloe extract, or diluted bleach) after toilet visits, before and after handling raw food and before eating.
- Avoid preparing food directly in surroundings flooded with water.
- Wash/sanitize all surfaces and equipment—including hands—used for food preparation.
- Protect kitchen areas and food from insects, pests, and other animals.
- Keep persons with diarrhea or other symptoms of disease away from food preparation areas.
- Keep fecal material away from food preparation areas (separate kitchen and toilet areas).
- Avoid eating food (e.g., vegetables or fruits) raw if they may have been flooded (see also Key 5).

Dangerous microorganisms are widely found in the gut of animals and people and also in water and soil in areas with poor sanitation as well as in areas with flooding. These microorganisms can be transferred to food and can, even in low numbers, cause foodborne disease.

KEY 2: Separate Raw and Cooked Food (Prevent the Transfer of Microorganisms)
- Separate raw meat, poultry and seafood from ready-to-eat foods.
- Separate animal slaughtering and food preparation areas.
- Treat utensils and equipment used for raw foods as contaminated—wash and sanitize before other use.
- Store separately raw (uncooked) and prepared foods.
- Avoid contamination with unsafe water—ensure water used in food preparation is potable or boiled.
- Peel fresh fruits before eating.

Raw food, especially meat, poultry, and seafood, and their fluids may contain dangerous microorganisms that can be transferred onto other foods during food preparation and storage. Prevent the transfer of microorganisms by keeping raw and prepared food separate. Remember that cooked food can become contaminated through the slightest contact with raw food, unsafe water, or even with surfaces where raw food has been kept.

KEY 3: Cook Thoroughly (Kill Dangerous Microorganisms)
- Cook food thoroughly, especially meat, poultry, eggs, and seafood, until it is steaming hot throughout.
- For cooked meat and poultry to be safe their juices must run clear and no parts of the meat should be red or pink.
- Bring foods like soups and stews to boiling and continue to boil for at least 15 minutes to make sure all parts of the food has reached at least 70°C.
- Although cooked food should generally be eaten immediately, if necessary thoroughly reheat cooked food until it is steaming hot throughout.

Proper cooking kills dangerous microorganisms. The most important microorganisms are killed very quickly above 70°C (158°F), but some can survive up to 100°C (212°F) for minutes. Therefore, all cooked food should generally reach boiling temperatures and be cooked at
such temperatures for extended periods. Remember that big pieces of meat will only heat up slowly. It is also important to remember that in emergency situations with the potential for significant contamination levels in food, the food should be cooked for longer periods.

**KEY 4: Keep Food at Safe Temperatures (Prevent Growth of Microorganisms)**

- Eat cooked food immediately and do not leave cooked food at room temperature longer than 2 hours.
- Keep cooked food steaming hot (more than 60°C or 140°F) prior to serving.
- Cooked and perishable food that cannot be kept refrigerated (below 5°C or 41°F) should be discarded.

Microorganisms multiply quickly if food is stored at ambient temperature—multiplication is quicker the higher the temperature and quickest at around 30 to 40°C (86°F–104°F). The higher the number of microorganisms in the food, the higher the risk for foodborne disease. Most microorganisms cannot multiply in food that is too hot or too cold (higher than 60°C or lower than 5°C).

Refrigeration: In the event of a power loss, refrigerators will keep food cold for approximately 4 to 5 hours, if unpowered. Blocks of ice or dry ice can be used to extend the life of food. Only foods that have a normal color and odor should be consumed, and perishable foods should be discarded after 2 hours at room temperature regardless of their appearance or smell. Frozen food can be kept frozen with dry ice, but once thawed must be immediately cooked or discarded. As with refrigerated food, frozen food that thaws and has been at room temperature for 2 hours must be discarded.

Stored Foodstuffs: Canned foods and unopened dry mixes will stay fresh for up to 2 years if stored in a cool, dry place away from any heat source. Cans that bulge or leak should be discarded. Flooded food supplies not in cans should be discarded. All stored food containers should be dated to monitor and rotate for maximum freshness.

**KEY 5: Use Safe Water and Raw Materials (Prevent Contamination)**

- Use clean containers to collect and store water and clean utensils to dispense stored water.
- Select fresh and wholesome foods; discard damaged, spoiled, or moldy food.
- Breastfeed infants and young children at least up to the age of 6 months.

Raw materials, including water, may be contaminated with microorganisms and dangerous chemicals, especially in areas hit by flooding. Likewise the risk of vegetables and fruits being contaminated with water containing sewage is high under a flooding disaster. Toxic chemicals may be formed in spoiled and moldy foods. Safe water may be seriously contaminated with dangerous microorganisms through direct contact with hands or unclean surfaces. Breastfeeding protects infants against diarrhea through its anti-infective properties, and minimizes their exposure to dangerous foodborne microorganisms.

For more information see the following Web site:

http://www.who.int/foodsafety/consumer/5keys/en/index.html


The WHO Food Safety Program (see Figure 10.2) and other WHO programs work on strengthening food safety systems, promoting good manufacturing practices, and educating retailers and consumers about appropriate food handling. Education of consumers and training of food handlers in safe food handling is one of the most critical interventions in the prevention of foodborne illnesses.

**Shelter From the Elements**

When a disaster displaces individuals and families from their homes, finding safe shelter and protection from the elements becomes of paramount importance. Variability in climate, based on geographical location and the post-disaster meteorological conditions creates health issues based on exposure to heat or cold. Exposure to cold in northern climates is directly associated with hypothermia, frostbite, and stress-related cardiovascular events (see “Winter/Ice Storms,” chapter 17). Additionally, living in cold conditions increases daily caloric demands in order to maintain the same activity level, regardless of sufficient and proper clothing. In general, approximately 1% more calories are needed for each degree below 20°C (68°F). Therefore, someone whose house temperature is 10°C (50°F) requires 10% greater food intake to sustain a normal activity level (Landesman et al., 2005).
Figure 10.2 WHO 5 keys to food safety following a disaster.
Source: WHO 2006
Personal Hygiene

Health promotion during disasters or public health emergencies must address issues related to personal hygiene. Personal hygiene is the single most important determinant of health and at the same time, can be the most difficult behavior to change. Personal health habits are deeply rooted in cultural and religious beliefs and may vary significantly from population to population. Different languages often do not have comparable concepts or descriptions for “privacy” or “diarrheal illness.” Personal hygiene habits will influence the overall health of the population regardless of the infrastructure and resources provided during a disaster response. Regardless of the location, the importance of soap and hand washing as a protection against fecal-oral illness cannot be overestimated. Soap provides protection against disease and therefore, soap and water must be provided to all disaster victims and responders. Education, encouragement, and evaluation are also components of an effective health promotion campaign designed to improve personal hygiene practices. Education alone will not change behaviors, and nurses will find that they need to have the resources present (soap, water, basins, towels, alcohol-based hand purifiers) and be very persistent with insisting on their use.

Vector Control

Major environmental disasters such as tornadoes, floods, and earthquakes are known to displace many types of living organisms—human beings being but one of them. The disturbance of rats and many types of insects can create the potential spread of infectious disease following a disaster. Vector-borne diseases are a major cause of illness and death in many national and international situations. Depending on the location of the disaster, malaria is the vector-borne disease of greatest concern to public health. In the United States, monitoring of mosquito infestations along with mosquito spraying is a routine part of posthurricane surveillance systems (see chapter 17 for further discussion). Flies have been implicated in the transmission of diarrheal disease. Lice may carry typhus. Rats are known to destroy food stores, damage property and electrical wiring, and spread a number of diseases such as salmonella, plague, and leptosporosis. Nuisance pests such as bed-bugs can cause physical discomfort and loss of sleep.

Vector-borne disease is a complex and challenging problem that often requires the interventions of professional experts in vector control. In the event of a situation where this expertise is not immediately available, there are simple and effective measures that nurses can take to reduce the spread of vector-borne disease. The Sphere Project establishes three standards for vector control:

1. Individual and family protection. All disaster-affected people have the knowledge and the means to protect themselves from disease and nuisance vectors that are likely to represent a significant risk to health or well-being.

2. Physical, environmental, and chemical protection measures. The numbers of disease vectors that pose a risk to people’s health and nuisance vectors that pose a risk to people’s well-being are kept to an acceptable level.

3. Good practice in the use of chemical vector control methods. Vector control measures that make use of pesticides are carried out in accordance with established international norms to ensure that staff, the people affected by the disaster, and the local environment are adequately protected, to avoid creating resistance to pesticides.

Methods of Vector Control

The control of vector-borne illness begins with making sure that people have access to shelters that are equipped with insect control. Site selection of the shelters is important, and people need to be settled away from a “malarial zone,” if at all possible. Mosquito control is most important in geographic areas where malaria is a real health concern. Efforts may include drainage of standing water. Spraying to reduce breeding sites in stagnant water is a safe, simple, and effective way to reduce mosquito-related morbidity. Mosquito netting around beds may reduce exposure to these insects. Intensive fly control may be necessary in areas of high-density populations where there is a significant risk of diarrheal disease.

The purchase, transport, storage, use, and disposal of pesticides must be done according to international standards or those standards in accordance with the EPA. Basic environmental efforts can be taken to reduce the risk of vector-borne disease, such as establishing adequate shelters and a clean water supply and disposal of human and animal excreta and solid waste materials to reduce flies.

Disposal of Solid Waste Materials. Health promotion and disease prevention programs following a disaster must address the disposal of solid waste materials. If organic solid waste materials are not properly disposed, the major risks posed are fly infestation and rat breeding (see Vector Control) and contamination of surface water. Uncollected and accumulating solid waste and debris left after a natural or human-generated disaster may create a depressing and ugly environment, create discontent, and discourage efforts to improve other aspects of environmental health. Solid waste may clog waterways, leading to environmental health problems associated with stagnant and polluted
surface water. Ultimately, disease outbreaks will increase.

The Sphere Project establishes the following minimum standards for solid waste management:

1. **Solid waste collection and disposal.** People have an environment that is acceptably uncontaminated by solid waste, including medical waste, and have the means to dispose of their domestic waste conveniently and effectively.
2. **Solid waste containers/pits.** People have the means to dispose of their domestic waste conveniently and effectively. Waste can be buried or in some cases burned.

**SUMMARY**

Populations affected by a disaster may experience severely diminished environmental conditions that put them at risk for negative health outcomes. Health promotion and disease prevention initiatives must be implemented immediately to protect the health of all affected individuals, including meeting basic physiologic needs in a timely manner to ensure survival. Infectious disease outbreaks will usually occur in the postimpact and recovery phases of a disaster (not during the acute phase), and the risks of epidemics increase if drought, famine, and/or large displacements of people are involved.

The establishment, implementation, and continuous monitoring of minimum standards for water safety, food safety, sanitation, shelter, and personal hygiene provide a firm foundation for health promotion. Successful planning for potential outbreaks demands that nurses be knowledgeable of the diseases endemic to the disaster area. Food safety is a particular concern, and not only during disaster conditions. Awareness of the emergence of foodborne illnesses is of importance to the health and well-being of the entire population. Working in conjunction with their public health colleagues, and as members of an interdisciplinary disaster response team, nurses must be able to detect environmental changes that will increase the potential for the spread of infectious disease.

**STUDY QUESTIONS**

1. What should health promotion and disease prevention activities focus on in the immediate aftermath of a disaster?
2. Describe health promotion and quality of life. Why are these important in disaster nursing?
3. Apply Maslow’s hierarchy of needs theory to disaster nursing. How well can it be applied to disaster conditions? Defend your position. Research nursing theories of health promotion. Is there one that you would use in disaster situations?
4. What are the goals for health promotion in disaster nursing? Develop a response plan for the first 24 hours following a major disaster that works toward achieving these goals. What else should be included in this plan? How would you prioritize your actions?
5. What are the major risk factors for disease outbreaks from disasters?
6. Describe the factors that should be addressed in meeting the water needs of a population affected by disaster.
7. Describe the factors that should be addressed in meeting the sanitation needs of a population affected by disaster.
8. Identify the spectrum of foodborne illness. What is happening to the worldwide incidence of foodborne illness? Why?
9. What are some of the major microorganisms that cause foodborne illness?
10. Design an educational campaign for people who live in a place that is at high risk for a disaster to occur that will inform them of how to prepare food and water supplies.
11. Describe the protection of food supplies following a disaster.
12. Describe a plan for vector control following a disaster. Why is vector control important?
13. Discuss personal hygiene in terms of health promotion. What methods of health promotion would you employ to effect behavior change in regard to personal hygiene?

**REFERENCES**


An introduction to epidemiology.


10.1 Ten Essential Functions of Public Health

How Public Health Serves (the Practice of Public Health)

In nondisaster times, public health serves communities and individuals within them by providing an array of essential services. Many of these services are invisible to the public. Typically, the public only becomes aware of the need for public health services when a problem develops (e.g., an epidemic occurs). The practice of public health becomes the list of essential services. Both distinct from and encompassing clinical services, public health’s role is to assure the conditions necessary for people to live healthy lives through communitywide prevention and protection programs.

Monitor Health Status to Identify and Solve Community Health Problems. This service includes accurate diagnosis of the community’s health status; identification of threats to health and assessment of health service needs; timely collection, analysis, and publication of information pertaining to access, utilization, costs, and outcomes of personal health services; attention to the vital statistics and health status of specific groups that are at higher risk than the total population; and the management of integrated information systems in successful collaboration with private providers and health benefit plans.

Diagnose and Investigate Health Problems and Health Hazards in the Community. This service includes epidemiologic identification of emerging health threats; public health laboratory capability equipped with modern technology to conduct rapid screening and high-volume testing; active infectious disease epidemiology programs; and technical capacity for epidemiologic investigation of disease outbreaks and patterns of chronic disease and injury.

Inform, Educate, and Empower People About Health Issues. This service involves social marketing and targeted media public communication; the provision of accessible health information resources at the community level; active collaboration with personal health care providers to reinforce health promotion messages and programs; and joint health education programs with schools, churches, and worksites.

Mobilize Community Partnerships and Action to Identify and Solve Health Problems. This service involves convening and facilitating community groups and associations—including those not typically considered to be health related—in undertaking defined preventative, screening, rehabilitation, and support programs, as well as skilled coalition-building ability in order to draw on the full range of potential human and material resources in the cause of community health.

Develop Policies and Plans That Support Individual and Community Health Efforts. This service requires leadership development at all levels of public health; systematic community- and state-level planning for health improvement in all jurisdictions; development and tracking of measurable health objectives as a part of continuous quality improvement strategies; joint evaluation with the medical system to define consistent policy regarding prevention and treatment services; and development of codes, regulations, and legislation to guide the practice of public health.

Enforce Laws and Regulations That Protect Health and Ensure Safety. This service involves full enforcement of sanitary codes, especially in the food industry; full protection of drinking water supplies; enforcement of clean air standards; timely follow-up of hazards, preventable injuries, and exposure-related diseases identified in occupational and community settings; monitoring quality of medical services (e.g., laboratory, nursing homes, and home health care); and timely review of new pharmacologic, biologic, and medical device applications.

Link People to Needed Personal Health Services and Assure the Provision of Health Care When Otherwise Unavailable. This service (often referred to as outreach or enabling services) includes assuring effective entry for socially disadvantaged people into a coordinated system of clinical care; culturally and linguistically appropriate materials and staff to ensure access to services by special population groups; ongoing care management; transportation services; targeted health information to high-risk population groups; and technical assistance for effective worksite health promotion and/or disease prevention programs.

Ensure a Competent Public and Personal Health Care Workforce. This service includes education and training for personnel to meet the needs for public and personal health services; efficient processes for licensure
of professionals and certification of facilities with regular verification and inspection follow-up; adoption of continuous quality improvement and lifelong learning within all licensure and certification programs; active partnerships with professional training programs to assure community-relevant learning experiences for all students; and continuing education in management and leadership development programs for those charged with administrative and executive roles.

Evaluate Effectiveness, Accessibility, and Quality of Personal and Population-Based Health Services. This service calls for ongoing evaluation of health programs, based on analysis of health status and service utilization data, to assess program effectiveness and provide information necessary for allocating resources and reshaping programs.

Research for New Insights and Innovative Solutions to Health Problems. This service includes continuous linkage with appropriate institutions of higher learning and research and an internal capacity to mount timely epidemiologic and economic analyses and conduct needed health services research.


CASE STUDY

10.2 World Health Organization (WHO)

The World Health Organization, the United Nations’ specialized agency for health, was established on April 7, 1948. WHO’s objective, as set out in its constitution, is the attainment by all peoples of the highest possible level of health. Health is defined in WHO’s constitution as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (Preamble to the Constitution of the WHO as adopted by the International Health Conference, New York, June 19–22, 1946; signed on July 22, 1946 by the representatives of 61 states [Official Records of the World Health Organization, No. 2, p. 100] and entered into force on April 7, 1948).

WHO is governed by 192 Member States through the World Health Assembly, which is comprised of representatives from WHO’s Member States. The primary tasks of the World Health Assembly are to approve the WHO program and the budget for the following biennium and to decide major policy questions.

The Secretariat is headed by the Director-General, who is nominated by the Executive Board and elected by Member States for a period of 5 years. Dr. Anders Nordström is Acting Director-General of WHO. He was appointed by the WHO Executive Board, following the sudden death of Dr. LEE Jong-wook, Director-General, on May 22, 2006. WHO’s Secretariat is staffed by some 3,500 health professionals, other experts, and support staff working at headquarter in Geneva, in the six regional offices, and in many countries. WHO’s regional offices are the following:

- Regional Office for Africa, located in Brazzaville, Republic of Congo
- Regional Office for Europe, located in Copenhagen, Denmark
- Regional Office for South-East Asia, located in New Delhi, India
- Regional Office for the Americas/Pan-American Health Organization, located in Washington, D.C., U.S.A.
- Regional Office for the Eastern Mediterranean, located in Cairo, Egypt
- Regional Office for the Western Pacific, located in Manila, Philippines

In carrying out its activities, WHO’s secretariat focuses its work on the following six core functions:

- Articulating consistent, ethical, and evidence-based policy and advocacy positions.
- Managing information by assessing trends and comparing performance and setting the agenda for and stimulating research and development.
- Catalyzing change through technical and policy support, in ways that stimulate cooperation and action and help to build sustainable national and intercountry capacity.
- Negotiating and sustaining national and global partnerships.
Setting, validating, monitoring, and pursuing the proper implementation of norms and standards.

Stimulating the development and testing of new technologies, tools, and guidelines for disease control, risk reduction, health care management, and service delivery.


CASE STUDY

10.3 Water-Related Diseases: Trachoma

The Disease and How It Affects People
Trachoma is an infection of the eyes that may result in blindness after repeated infections and may be encountered by nurses responding to international disasters. It is the world’s leading cause of preventable blindness and occurs in areas where people live in overcrowded conditions with limited access to water and health care. Trachoma spreads easily from person to person and is frequently passed from child to child and from child to mother within family groups. Infection typically occurs first during childhood; however, those infected usually do not become blind until adulthood. The disease progresses over years as repeated infections with the pathogen cause scarring to accumulate on the inside of the eyelid, earning trachoma the moniker, “the quiet disease.” Persons afflicted with advanced cases suffer from eyelashes that eventually turn inward, which causes rubbing on the cornea at the front of the eye. As a result of this action, the cornea becomes scarred, leading to progressively severe vision loss and, eventually, total blindness.

The Cause
Trachoma is caused by an organism called Chlamydia trachomatis. Through the discharge from an infected person’s eyes, trachoma is passed on by contact with hands or skin, on clothing, or by flies that land on the face.

Distribution
Trachoma occurs worldwide but is most often in poor, rural communities in developing countries. Blinding trachoma is widespread in the Middle East, north and sub-Saharan Africa, parts of the Indian subcontinent, southern Asia, and China. Pockets of blinding trachoma occur in Latin America, Australia (primarily among native Australians), and the Pacific islands. The World Health Organization (WHO) estimates that 6 million people worldwide are blind because of trachoma and more than 150 million people are infected and in need of medical treatment for the disease.

Interventions
Primary interventions advocated for preventing trachoma infection include improved sanitation, reduction of fly breeding sites, and increased facial cleanliness (using clean water) among children at risk of contracting the disease. The scarring and visual changes produced by trachoma can be treated with a simple surgical procedure performed at village-level facilities in which the inward-turned eyelashes are reversed.

Effective personal and environmental hygiene has been proven successful in combating trachoma. Encouraging the washing of children’s faces, improved access to clean water supplies, and proper disposal of human and animal wastes have been shown to decrease the number of trachoma infections in many communities.

Global Alliance for the Elimination of Trachoma by the Year 2020 (GET 2020)
The WHO, in conjunction with an alliance of interested parties, has adopted the SAFE strategy to combat trachoma. The four components of this strategy include:

- Surgery
- Antibiotic treatment (tetracycline eye ointment, the standard drug, has been joined by a new antibiotic, azithromycin, which has been tested in a number of countries with promising initial results)
- Facial cleanliness
- Environmental changes

Water-Related Diseases: Dengue and Dengue Hemorrhagic Fever

Dengue is a mosquito-borne infection that, in recent years, has become a major international public health concern. Dengue fever is a severe, flu-like illness that affects infants, young children, and adults but rarely causes death. Dengue hemorrhagic fever (DHF) is a potentially lethal complication and is today a leading cause of childhood death in several Asian countries.

The clinical features of dengue fever vary according to the age of the patient. Infants and young children may have a feverish illness with rash. Older children and adults may have either a mild feverish illness, or the classical incapacitating disease with abrupt onset and high fever, severe headache, pain behind the eyes, muscle and joint pains, and rash. The rash may not be visible in dark-skinned people. DHF is a potentially deadly complication that is characterized by high fever, hemorrhage—often with enlargement of the liver—and in the most severe cases, circulatory failure. The illness commonly begins with a sudden rise in temperature accompanied by facial flushing and other general symptoms of dengue fever. The fever usually continues for 2–7 days. It can be as high as 40–41°C (104–105°F), and may be accompanied by febrile convulsions.

The Cause

There are four distinct, but closely related, viruses that cause dengue. Recovery from infection by one provides lifelong immunity against re-infection with that type, but confers only partial and transient protection against subsequent infection by any of the other three types. Indeed, there is good evidence that sequential infection with different types increases the risk of the more serious disease known as dengue hemorrhagic fever (DHF). Dengue viruses are transmitted to humans through the bites of infective female Aedes mosquitoes. Mosquitoes generally acquire the virus while feeding on the blood of infected people during the time the virus is circulating in their bloodstream. This is approximately the same time as they are experiencing fever. Once infected, a mosquito is capable of transmitting the virus to susceptible people for the rest of its life. Infected female mosquitoes may also transmit the virus to the next generation of mosquitoes.

Distribution

The global prevalence of dengue has grown dramatically in recent decades. Dengue is found in tropical and subtropical regions around the world, predominately in urban and peri-urban areas, where Aedes mosquitoes are prevalent. The disease is now found in more than 100 countries in Africa, the Americas, the eastern Mediterranean, south and southeast Asia, and the western Pacific. It is typically a disease of urbanized areas, where the mosquitoes find breeding opportunities in small water collections in and around houses: drinking water containers, discarded car tires, flower vases, and ant traps are well-known breeding places.

Scope of the Problem

Globally there are an estimated 50 to 100 million cases of dengue fever and approximately 500,000 cases of DHF each year.

Interventions

At present, there is no vaccine to protect against dengue. The most effective method of prevention is to eliminate the mosquito that causes the disease. This requires removal of the mosquito breeding sites, a process known as source reduction. Proper disposal of solid waste helps to reduce the collection of water in discarded articles. Other control measures include preventing mosquito bites with screens, protective clothing, and insect repellents; in epidemic risk areas, application of insecticide is practiced through an application method known as fogging to decrease the mosquito population.

Public Health in a Katrina Shelter

Janice Springer

On August 30, as I made my way to the shelter assignment as a Red Cross Disaster nurse, I had no idea what challenges I would face. At that time, it was not known that the levees would be breached, thousands would be stranded, and a public health emergency would ultimately be declared. Shelter health care, it turns out, is population-focused nursing care and all that implies.

The shelter had nearly 2,000 residents that first week of September. These individuals had evacuated before Katrina hit the coast and were nearly all from the New Orleans area. The demographics were diverse by age and ethnicity; however, the majority of residents were African American. The building itself was just one large open room. There were no private rooms. When I arrived, there was no documentation system in place in the health care area, no registration, and a general sense of being in a chaotic triage-only mode of sorting and treating clients even though this population had evacuated just before or during the storm.

We immediately started a registration form to capture name, age, chief complaint, where in the building they “lived,” and if they had diabetes or hypertension. The choice of those two chronic conditions was merely speculative as we wanted to find ways to quickly determine some of the risk factors we might be dealing with in the population. As a public health support tool, this registration form became essential to identifying trends, tracking individuals, and monitoring the population overall health status.

As the greater community became aware of the implications of having so many people living in close quarters, the Louisiana Department of Health in partnership with the CDC and the Red Cross organized a plan for making shelter visits, and they created a form for daily reporting of such things as the number of cases of diarrhea, the number of fevers of unknown origin, newly identified diabetics, the number of newly identified (not necessarily newly diagnosed) cases of psychiatric or stress-related illness, and other factors.

On another public health front, we had only about 16 sinks for hand washing. These were in the four bathrooms that were in the shelter. Port-a-Pottys were outside, but they had no hand washing stations. We started an aggressive campaign of distribution of giant bottles of hand sanitizer. Hand sanitizing stations were set up within the shelter, at the health desk, at the entrance to the food consumption areas, in the serving line, near the toilet areas, and at most desks. One day a donation of pocket-sized hand sanitizers arrived, and we put one on each pillow in the building.

One other early public health measure we were able to take was a daily bottle sanitizing station. We had many infants on bottle feeding and were fortunate enough to have a “side” kitchen with a sterilizer installed. With RN training in proper washing, rinsing, and sterilizing technique, teams of non-health care volunteers quickly took over that area of responsibility and served very conscientiously.

In Louisiana in September it is about 94 degrees and 94% humidity on any given day. Keeping cold food and drinks, like milk, properly cold was very challenging. Our food distribution people had access to ice and were able to create self-serve tables for access to these drinks, but then the ice quickly melted, and a potential pool for bacteria growth unfolded as people dipped their hands into the water to take a beverage. This was solved by discontinuing the self-serve option, having a volunteer with gloves monitor the beverage table, and each drink selected was wiped clean with a paper towel before dispensing. We were not able to do any tests on bacteria growth, but this seemed a reasonable way to decrease the potential for contaminated drink or milk boxes.

Throughout the 3 weeks I was there, we only had one small outbreak of diarrhea, which was contained within 3 days, and some small outbreaks of viral upper respiratory infections. This was achieved by nearly daily reminders in loudspeaker announcements that clean hands would be about the only way to stop disease spread, and that residents had to be personally responsible and pretty determined about seeking hand cleansing opportunities to keep us all healthy. They rose to the occasion.

There were other individual illnesses that could be as a result of congregate care living that, although not a “public” health illness, is still an outcome that could be affected by thinking in a population framework. We had more than one urinary track infection that required hospitalization. They occurred in elderly persons who were possibly not getting enough to drink, were sleeping too far from the bathrooms so tried to “hold it” too long.
too many times, and who were over time becoming quite stressed by being so out of their routine life.

There were exacerbations of and deterioration of stability in psychiatric illness. Some of this was due to lack of access to proper medications, but again the stress of living in the shelter environment took its toll on individual coping mechanisms. We were fortunate in this shelter to have a top-notch team of Red Cross mental health workers and huge support of the local psychiatric community. We were getting daily visits by more than one psychiatrist during the time I was there.

Another population of concern was those who were on methadone prior to the disaster. It was important for them and for the overall shelter population that these individuals be identified and cared for in a timely manner, before withdrawal symptoms emerged. We were again fortunate in our situation to have resources readily available and were able to make a plan for daily dosing without having the drug in the shelter.

We had public health concerns regarding clients who presented to us. One, a tuberculosis (TB) client who had been off the TB drugs for 3 months but had never completed her original therapy plan—could she stay or not? Our investigation took us to the State Health Department TB unit who came and interviewed her and assured us that even though she had had a break in her treatment regimen, she was not a danger to others by being contagious. Within a shelter that included everything from newborns to patients undergoing chemotherapy, this was a huge relief for us all.

Concern existed that HIV-positive patients were soon going to run out of the critical medications that were available only through a public-funded program and would not be available through the low-cost systems emerging to help Katrina evacuees. This was a very disturbing reality we faced. Any interruption in antiretroviral medications could result in a serious compromise of their immune system. There was little communication for at least 2 weeks into the relief effort about where these clients could go for continuation of their medications. We were able to piece together medications for some, but others ended up missing their medications for many days.

In summary, in a long-term (greater than 3 to 4 days) shelter of a large population of individuals and families, there are many considerations for the Red Cross nurse and shelter management team. The intensity of the need after Katrina brought more questions than we might have liked to mind than could be addressed. Questions we asked over those weeks and did not always answer included the following:

- How many weeks into pregnancy can a woman be before the shelter is no longer safe for her? We were a 1½ hour drive from the nearest hospital that took clients for delivery. We counseled all the pregnant women and their families who were more than 35 weeks about the risks involved in the transportation and medical care access issues. Baton Rouge was able to sponsor these families in a local housing arrangement and worked with these families.

- Can a newborn come to the shelter? These same houses in Baton Rouge were sometimes able to take postpartum families, and some families were able to make other arrangements after delivery. One 3-day old came back for a visit, and we had infants from 2 weeks old and up who lived at the shelter until other housing came available for their families.

- What about people on chemotherapy? A giant building with 2,000 people is not where you would want an immuno-suppressed person to be, but there were not other options. One of our families refused to have anything to do with us helping them move out. The woman (on chemo) said she had never received as much love as she had been receiving at that shelter, and she would rather have her last days in that environment than alone in a hospital room.

During Katrina, we often had no other options for these clients except to stay put and make it as safe as possible. There was not alternate housing for every situation, and hospitalization in a system already overloaded was never an option. We did not experience outbreaks of any highly contagious diseases that necessitated isolation or quarantine. This does occasionally happen in Red Cross shelters and is a situation that we had planned for.

If you would like to become a Red Cross Disaster nurse, you can go to www.redcross.org to find your local chapter and click on volunteer to get started in disaster training.
Key Messages

■ Nurses are frequently called on to provide care to patients at special events involving large numbers of people.
■ Increased rates of injuries and illness can be anticipated when large numbers of people gather (concert, sporting event, fair), more than would be expected at smaller events.
■ Any large crowd has the potential to decompensate into a mass casualty incident (MCI).
■ Mass gatherings/events provide a difficult setting to render appropriate emergency care response.
■ Forward planning for any major event involving potentially large masses of people is critical. A well-planned event will be able to meet the health care needs of all who attend.
■ The design of nursing services requires that nurses collaborate with security, crowd control, and other medical support (emergency medical services and physician services) to assure integration with all other service provision plans.
■ The type and duration of the event and the characteristics of the crowd will determine the amount and nature of the patient encounters that can be anticipated.
■ Weather conditions are a major factor in the types of illnesses and injuries that will occur.
■ Warm weather events increase the likelihood of heat-related problems, especially among athletes, but also among the spectators.
■ Cold weather decreases the total number of injuries, but it does produce a variety of injuries and illnesses that are unique to colder temperatures.
■ Medical and nursing aid stations should be placed for easy accessibility within a reasonable time by all event patrons.
■ Site layout and location of transport services are important considerations when planning for a special event.
■ Nurses should possess minimum core competencies in order to provide safe, effective patient care at mass gatherings.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the importance of preplanning for nursing services for special events.
2. Understand that the type of event will determine the type of health care needed.
3. Appreciate the inherent dangers associated with large gatherings of people and the potential for any large crowd to decompensate into a mass casualty incident.
4. Describe a framework for evaluating the amount and types of services that will be needed based on type, duration, location of event, and characteristics of the crowd.
5. Describe the decision making for medical and nursing aid station design and placement.
6. Discuss the importance of communication systems during large events.
7. Know the location of transport vehicles, all escape routes, and how to activate the emergency operations plan.
Managing Emergencies Outside of the Hospital: Special Events, Mass Gatherings, and Mass Casualty Incidents

Tener Goodwin Veenema

CHAPTER OVERVIEW

Any event that draws a large number of individuals to the same location at the same time creates a potential hazard to health and safety. Multiple variables are present during a mass gathering that interact to create the potential for increased illness and injuries to attendees. Mass gatherings provide difficult settings to plan for or render an appropriate emergency health care response. The role of the nurse in the disaster situation demands ingenuity, flexibility, adaptability, creativity, and an understanding of the need to expand one’s practice parameters outside normal health care situations.

MASS GATHERINGS

Nurses are frequently called on to provide health care for large groups of people attending major, or “special events,” such as political events, sporting events, rock concerts, summer festivals, and religious gatherings. In fact, nurses are best suited to mass gathering work (Milsten, 2006). Each year, millions of individuals attend National Football League, Major League Baseball, National Basketball Association, National Collegiate Athletic Association events, National Association for Stock Car Auto Racing, and other large-scale events. Typically, mass gatherings are defined as events with large numbers of individuals (generally defined as a group of 1,000 persons or more) gathered together in a specific area for a specific purpose. Mass gathering health care is concerned with the provision of emergency care at organized events with more than 1,000 people in attendance; however, the majority of the scientific literature on the topic involves crowds greater than 25,000 individuals (Milsten, Maguire, Bissell, & Seaman, 2002). Although the majority of the health care needed at mass gatherings is of minor severity, these events may pose a threat to health, life, safety, or social stability.

Whether the event draws 1,000 individuals or 25,000 people, health care services will be needed.
Although it is not possible to predict with accuracy how much medical care will be needed at these events, it is essential that adequate patient care services are available. Any large crowd will attract individuals with various medical conditions and will always have the potential to deteriorate into a mass casualty incident (MCI; Leonard & Moreland, 2001). Mass casualties events that occur as the result of a disaster will, in all probability, occur and need to be handled outside of the hospital setting. Care of injuries and illness outside the hospital during disasters or special events have many common elements, which will be described in this chapter.

MASS CASUALTY INCIDENTS

The fundamentals of nursing practice during a disaster, MCI, or special event are essentially the same. Nurses must realize that in stressful circumstances such as these the demand on their skills may be greater and the circumstances unusual; therefore, the nursing fundamentals practiced in other settings and during smaller crises will still be applicable. Time is an important factor. The longer the delay in care for a seriously injured patient, the less chance for recovery. The governing principle is to do the greatest good for the greatest number of casualties. The basic principles of nursing during special (events) circumstances and disaster conditions include:

- Rapid assessment of the situation and of nursing care needs (see Table 11.1 and Case Study 11.1 for further discussion).
- Triage and initiation of life-saving measures first (see chapter 9 for further discussion).
- The selected use of essential nursing interventions and the elimination of nonessential nursing activities.
- Adaptation of necessary nursing skills to disaster and other emergency situations. The nurse must use imagination and resourcefulness in dealing with a lack of supplies, equipment, and personnel.
- Evaluation of the environment and the mitigation or removal of any health hazards.
- Prevention of further injury or illness.
- Leadership in coordinating patient triage, care, and transport during times of crisis (see chapter 2).
- The teaching, supervision, and utilization of auxiliary medical personnel and volunteers.
- Provision of understanding, compassion, and emotional support to all victims and their families.

The American Red Cross proposes that disaster nursing is “doing the best for the most, with the least, by the fewest.” The Japan Society for Disaster Nursing, following the Great Hanshin-Awaji earthquake and the sarin attack in Japan in 1995, defines disaster nursing as “the systematic and flexible utilization of knowledge and skills specific to disaster-related nursing, and the promotion of a wide range of activities to minimize the health hazards and life-threatening damage caused by disasters, in collaboration with other specialized fields” (Japan Society for Disaster Nursing, 2002). In other words, disaster and MCI nursing should include the fundamental nursing activities, ranging from disaster prevention to initial, medium-, and long-term nursing care. The Emergency Nurse Association issued a position statement on MCIs for their nurses (see Case Study 11.1 for further discussion).

PRACTICE PARAMETERS FOR NURSING CARE

The nursing fundamentals practiced in normal daily situations and during smaller crises will be applicable during a special event or mass casualty situation. All nurses providing health care at mass gatherings must be competent in the basic principles of first aid, including cardiopulmonary resuscitation and the use of the automated external defibrillator. In addition, the nurse should possess the following minimum core competencies:

- Nursing Assessments
  - Perform a respiratory, airway assessment
  - Perform a cardiovascular assessment, including vital signs, monitoring for signs of shock
■ Perform an integumentary assessment, including a burn assessment
■ Perform a pain assessment
■ Perform a trauma assessment from head to toe
■ Perform a mental status assessment, including a Glasgow Coma Scale
■ Know the indications for intubation
■ Intravenous (IV) insertion and administration of IV medication
■ Emergency medications
■ Principles of fluid therapy

Nursing Therapeutics
■ Concepts of basic first aid
■ Triage and transport
■ Pain management
■ Management of hypovolemia and fluid replacement
■ Suturing (if appropriate based on practice parameters and initial wound care)
■ Blast injuries/dealing with tissue loss
■ Eye lavage techniques
■ Decontamination of chemical exposures
■ Fractures/immobilization of fractures
■ Management of hemorrhage
■ Stabilization of crush injuries
■ Movement of patients with spinal cord injury

In all types of special events and MCIs, the American Red Cross (Guidelines for Disaster Nursing, 2002) states that nurses will be expected to exercise great leadership and discerning judgment in

1. Assessment and triage of patient’s condition for priority care.
2. Provision of care, treatment, and health protection.
3. Appropriate utilization of nursing service personnel.
4. Detection of changes in the event environment and organizing activities to modify or eliminate health hazards.
5. Dealing with mass casualties should it become necessary.

The national American Red Cross (as well as local chapters) is an excellent source for nurses seeking information regarding planning and design of nursing services for special events and mass casualties (see http://www.redcross.org/services/nursing/). The Centers for Disease Control and Prevention (CDC) also hosts a Web page devoted to the care of mass trauma and is located at http://www.cdc.gov/masstrauma/guides/phprofessionals.htm. This Web page contains resources for clinicians on the management of brain injuries, mass trauma events, burns, injuries, and coping with mass trauma. In addition, clinicians can locate the Glasgow Coma Scale and an instrument for the rapid assessment of injuries at mass casualty events.

Preplanning for a Special (Major) Event
As described in the first two chapters of this book, the most important aspect of disaster or special event management is planning in advance. Cuny (1998) describes three types of advanced planning activities:

1. Strategic planning—these are planning activities that focus on preparing the organization for any type of threat.
2. Contingency planning—these are planning activities related to a site-specific threat that may occur at any time.
3. Forward planning—these are planning activities for a known imminent event, for example, an impending snowstorm or rock concert.

Forward planning for a disaster or any major event involving potentially large masses of people is critical and requires the cooperative efforts of the hospital(s), emergency medical services (EMS), police department, fire department, selected community agencies (e.g., American Red Cross), and local government officials in the community where the event is to be held. A well-planned event will be able to meet the health care needs of all who attend. While most of the presenting medical complaints will be minor, provisions must be made to address those health care concerns that are of a serious nature. Forward planning begins with information collection. When will the event occur? Where will the event be located? What type of structures will be used to house the event? What types of facilities will be available to health care providers working at the event? What types of communication systems will be put in place and who will be responsible for it? Information gathering involves identifying what type of event will be held, as many specific details regarding the event planned as are available, and who is sponsoring the event.

The nurse responsible for organizing and coordinating nursing services should meet with the person in charge of the event well in advance of the date the event is scheduled. It is important to determine what other health care providers will be in attendance at the event and who will be in charge. The contribution of the nurse to the provision of health care and the expectations of the event sponsor should be discussed. The role of the nurse in a mass gathering may range from providing nursing care services along with EMS providers on site, to the leadership and coordination of all health care services for the event. Expenses (to cover supplies or medical equipment) and any remuneration for nursing staff should be negotiated up front.
Ancillary Personnel

The police and fire departments and EMS must be involved in all special events planning as they will need to be present during the event to provide a safe environment for participants, spectators, and health care providers. Determination should be made as to location and availability of basic life support services and advanced life support services (ALS). Some events may provide their own private security. Government officials may have Secret Service coverage of the event. The design of nursing services requires that nurses are aware of who will be attending the event in terms of security, crowd control, and other medical support so that services can be provided that will integrate with all other service provision plans.

Lack of Guidelines

One of the primary challenges for the providers of health care at mass gatherings has been the lack of standards, or formal guidelines, that can help direct local health care clinicians who must supply coverage for the event (Jaslow, Yancey, & Milsten 2000; Parrillo, 1998). The American College of Emergency Physicians and the National Association of Emergency Medical Services Physicians have published position papers regarding their recommendations (Jaslow, Yancey, & Milsten, 2000; Leonard, Nuji, Petrilli, & Calabro, 1990), but because of the myriad of variables associated with mass events, the establishment of guidelines remains a daunting challenge (Milsten et al., 2002).

Goals of Emergency Care at Mass Gatherings

The goal of pre-event planning for mass gatherings is to facilitate the provision of emergency medical and nursing care, as well as the preservation of the abilities of the EMS system to provide its normal services (Milsten et al., 2002). Although most mass gatherings are a collection of basically healthy individuals, emergencies do occur with increased frequency and the provision of adequate amounts of appropriate care is required. On-site access to emergency health care services includes rapid access to the patient, triage, stabilization, and transport to a more definitive level of care. Nurses must also be prepared to deal with routine minor injuries as well as the unexpected sudden cardiac death or the precipitous birth.

HISTORICAL LESSONS

Review of the literature (Michael & Barbera, 1997; Milsten et al., 2002; Sanders et al., 1986; Thompson, Savoia, Powell, Challis, & Law, 1991) reveals that data has been collected and analyzed from previous events. Examination of these data may provide valuable advice in pre-planning care for future events. Some of the events that have been analyzed include the Olympics, marathons, large stadium events, air shows, papal masses, rock concerts, and the Indy 500 car race. Collaboration with agencies such as the local American Red Cross and emergency medical services is important, as they will have had previous experience with managing special events and can provide advice as well as assistance.

TYPE OF EVENT

The nature of patient encounters that the nurse can anticipate is largely determined by the type of the crowd and the environment in which the event is held. Crowds attend events based on the specific nature of the gathering, and the type of event is often the best predictor of the characteristics of the people who will be potentially seeking medical care. The type of crowd drawn to attend a rock concert is in all probability quite different from the crowd drawn to attend the Democratic National Convention or a papal mass. Heat exhaustion, muscle injuries, and trauma are more common to sporting events. Alcohol, drug usage, and dehydration can be expected to be higher at rock concerts and major spectator sporting events. Most patient encounters are minor complaints such as headache, fatigue, minor abrasions, lacerations, sunburn, and bee stings. Michael and Barbera (1997) report that individuals who attend rock concerts and papal masses are more likely to suffer a significant illness during the event.

DURATION OF THE EVENT

How long is the event scheduled to last? Will the event occur on a weekend or a weekday? Will it be open after dark? Is the event scheduled to occur in a rural area or in the middle of a large city? Are there people living on the grounds where the event is to occur? These factors will influence not only the number of attendees but also the types of medical problems treated. An air show held in the Colorado Rockies presents a very different challenge to health care planners than the Molson 500 automobile race held in the streets of Toronto. The health care planning for a 1-day youth soccer tournament held on a September Saturday in the Northeast differs significantly from planning for the World Cup Soccer event.

In general, the longer the duration of the event, the greater the number of individuals who will seek care (Flabouris & Bridgewater, 1996). Health care usage rates may be higher in settings where groups are allowed to move about more freely. Such mobility allows for more minor trauma and exposure-related or exertion-related
illnesses than in events where spectators are seated for most of the duration (Michael & Barbera, 1997). Health care providers may need to be available before and after the event to provide care for the events staff and for the attendees as they arrive (Leonard & Moreland, 2001).

CHARACTERISTICS OF THE CROWD

What is the actual number and type of people expected to attend? Based on the expected attendance, one can estimate the potential number of patients. If the event involves ticket sales, this number may be easy to obtain. If not, prior similar event attendance may provide a good starting point for estimating the size of the anticipated crowd. What are the characteristics of the people who are expected to attend? Will they be young or elderly? Will they be predominantly male or female? Perhaps the crowd will consist of a combination of both. Will the event attract individuals who may have an underlying medical condition? An example of this would be a walk to raise money for asthma or HIV. This will increase the probability of individuals needing care for certain conditions. Will alcohol be sold and consumed at the event? Bowdish, Cordell, Bock, and Vukov (1992) studied factors that predicted patient volumes during the Indianapolis 500 race and identified alcohol as a major cause of patient complaints. From their analysis, the authors proposed a model using the following seven variables to help predict the use of medical facilities at the event: Bowdish, Cordell, Bock, and Vukov (1992) studied factors that predicted patient volumes during the Indianapolis 500 race and identified alcohol as a major cause of patient complaints. From their analysis, the authors proposed a model using the following seven variables to help predict the use of medical facilities at a major gathering: weather, level of alcohol use, availability of care, the type of event, injury or illness type, crowd mood, and other variables (age, gender, and pre-existing medical conditions). This model is helpful in creating a useful framework for planners.

WEATHER AND ENVIRONMENTAL INFLUENCES

Weather conditions are a major factor in the types of illnesses and injuries that the nurse will need to respond to. Papal visits to San Antonio and Denver resulted in many persons with heat-related illnesses (Gordon, 1988; Paul, 1993). Rapid changes in weather patterns during a mass event are associated with an increased number of individuals seeking care (Walsh, 1994). Insect stings occur primarily in warm weather. Warm weather events increase the likelihood of heat-related problems.

Heat

The spectrum of heat-related illness is broad, and nurses need to be able to differentiate between minor and serious illness. Walker and Chamales (2002) describe the following types of heat-related illness associated with mass gatherings:

- **Heat Rash.** Heat rash is commonly referred to as “prickly heat,” a maculopapular rash accompanied by acute inflammation and blocked sweat ducts. Heat rash frequently affects areas of the body covered by tight clothing. Initial treatment is the application of chlorhexidine lotion to remove any desquamated skin (talcum powder is not effective).

- **Heat Cramps.** Heat cramps are painful, often severe, involuntary spasms of the large muscle groups used in strenuous exercise. Heat cramps occur after intense physical exertion. They usually develop in people performing heavy exercise in the heat while sweating profusely and drinking non-electrolyte-containing water. Hyponatremia results and causes cramping in the over-stressed muscle. Initial treatment is rehydration with salt-containing fluids. Rehydration will bring rapid relief to patients suffering minor cramps. Patients experiencing severe heat cramps will need intravenous rehydration therapy. Several sports drinks on the market provide all of the necessary electrolytes to prevent heat cramps. Salt tablets should not be used as they provide inadequate fluid replacement and can be a gastric irritant. Cases of heat cramps are more likely to be seen than cases of heat stroke. However, even well-trained athletes may suffer heat stroke.

- **Heat Syncope.** Heat exposure can cause postural hypotension leading to a syncopal or near-syncopal episode. Heat syncope is believed to result from intense sweating, which leads to dehydration, followed by peripheral vasodilatation. Initial management of the patient with heat syncope involves cooling and rehydration of the patient with oral rehydration solutions (such as commercially available sports drinks).

- **Heat Exhaustion.** Heat exhaustion is the precursor to heat stroke. The two conditions appear similar clinically; however, with heat exhaustion, the patient remains neurologically intact. Heat exhaustion presents as headache, nausea and vomiting, dizziness, fatigue, myalgias, and tachycardia. Heat exhaustion is characterized by excessive dehydration and electrolyte depletion. The body temperature may be normal but is generally elevated. Initial therapy involves removing patients from the heat and replenishing their fluids. Mild cases can be treated with oral rehydration; however, moderate to severe (most patients) will require intravenous fluid replacement therapy. Patients will need several hours of observation prior to being released.

- **Classic Heat Stroke.** Classic heat stroke occurs during periods of sustained high temperatures and humidity (e.g., a heat wave; see chapter 12 for further discussion...
Frostbite can occur anywhere, but it is most common. Typical patients are infants, the elderly, and the chronically ill who may not have access to air conditioning. Sweating is absent in many of those affected. Heat stroke is a medical emergency, and patients need initiation of life-saving measures and transport to the nearest emergency facility.

**Exertional Heat Stroke.** Exertional heat stroke develops in healthy young persons and is not related to heat waves. Athletes and military personnel are frequently victims due to physical exertion during hot weather conditions. These patients present with marked sweating and are treated in the same manner as patients with classic heat stroke. Immediate intervention is imperative as patients can go on to develop rhabdomyolysis, acute renal failure, hepatic damage, impairment of the central nervous system, and disseminated intravascular coagulation. The initiation of life-saving measures, including rapid cooling and immediate transport to an emergency facility, is indicated (Walker & Chamales, 2002).

**Hypothermia.** Hypothermia is defined as a core temperature of less than 35°C (95°F). While hypothermia can affect any organ system in the body, the most prominent effects are on the neurological and cardiovascular systems. Mild hypothermia is a core body temperature between 32°C and 35°C. In this range of core temperature, patients present with shivering and increased heart rate and blood pressure. Moderate hypothermia is seen with a core temperature between 27°C and 32°C. As the temperature drops below 32°C, progressive slowing of all bodily functions is observed. Shivering ceases between 30°C and 32°C. Decreased mentation develops, and atrial fibrillation or other arrhythmias may occur. Below 28°C, the irritability of the myocardium increases, making the patient more susceptible to the development of ventricular fibrillation. Hypothermia may occur in settings that do not necessarily involve cold temperatures. It is especially likely in mass gatherings involving water, such as triathlons or citizen swim meets. The presence of rain in a nonwater event markedly increases the likelihood of hypothermia (Parrillo, 2002).

**ALCOHOL AND DRUG USE**

Patterns of alcohol and drug use have long been associated with certain types of mass gatherings and as significant contributors to increased patterns of morbidity and mortality. Studies from summer rock concerts (Glastonbury Fair, Watkins Glen, Woodstock) and association with specific rock groups (Grateful Dead, Phish) report evidence of rampant drug and alcohol use. The use of drugs and alcohol leads to other crowd behaviors ("moshing," "stampedes") that result in increased injuries as well (Erickson, 1996). Event security should attempt to provide reasonable limitations on alcohol consumption and a complete ban on recreational drug usage at mass events in order to reduce the negative health consequences associated with their use.

**CROWD MOOD**

Crowd mood is an important and yet unpredictable variable in mass gatherings and can influence the
health-seeking behavior of attendees. The type of music played at a concert, religious revivals, political demonstrations, rivalry between competing sports teams, all contribute to creating an emotionally charged event. Feelings of claustrophobia, paranoia, or aggression can be incited in certain individuals attending large events. Crowd mood combined with the variable drug and alcohol use ("crowd hysteria") can result in devastating consequences. Crowd mood at the World Cup Soccer Tournament and in the chaos that ensued following the Olympic bombing in Atlanta, created dangerous conditions and the potential for additional injuries.

**SITE LAYOUT**

Nurses need to be aware of the physical or geographical layout of the event. The presence of physical barriers such as ditches, large fields, or fences that would limit patient movement must be noted. Hazardous areas or access to busy roads should be roped off in advance. If the event is to be held indoors, are there elevators, stairwells, locked doors, or other potential barriers to patient access? Where will the site for health care facilities be located? The plan must include provisions for drinking water and sanitation facilities. Depending on weather conditions, health care providers may need access to electricity and air conditioning. Shelter should be a major concern during event planning, especially for outdoor events, lengthy events, or adverse weather conditions.

Where are the exits and escape routes located? Are they clearly marked in all appropriate languages? In the event that a mass gathering should decompensate into a MCI, every health care provider must be aware of the entire site layout, location of all escape routes, and how to activate the emergency operations plan (see chapter 1).

**MEDICAL AND NURSING AID STATIONS**

The placement of medical and nursing aid stations should be so that the stations are easily accessible within a reasonable time by all. The size of the event and the site layout will determine the number of aid stations needed. For example, a small indoor event may require only one aid station, whereas an event in a large open field such as an exposition, air show, or automobile race may require multiple stations. All aid stations should be clearly marked with signs. Location and directions to aid stations should be listed in the event program (in all appropriate languages) and announced over the loudspeaker during the event. Aid stations should have tables and sufficient room for equipment, supplies, and personnel. They should have beds or cots for patients to lay down on. Ideally they should be located near sanitation facilities. Accommodations must be made for the physically challenged and special accommodations must be made for any high-risk, high-vulnerability groups in attendance (see chapter 9 for further discussion).

How will patients access the triage and treatment areas and how will nursing and EMS personnel reach patients unable to ambulate? Depending on the size and scope of the event, provisions should be made for a mobile health care team to meet the needs of patients who are unable to walk to the aid station. Most patients will present to the station to receive care, but some will be unable to do so. Consideration needs to be given as to what equipment nurses and paramedics may use and in what manner that equipment will be carried. The locations of patient litters or backboards should be logical and easy to access. Specific routes should be marked. Leonard and Moreland (2001) recommend that very large outdoor venues may require the mobile team to have supplies such as IV drugs, a cardiac monitor, intubation equipment, oxygen, and a defibrillator. Patient extrication devices such as golf carts, backboards, or wheelchairs can assist in the removal of patients from the crowd (Leonard & Moreland, 2001). Careful selection of the location of patient treatment areas is paramount in increasing their effectiveness.

**TRANSPORTATION CONSIDERATIONS**

Ambulance areas should be within easy access of the medical treatment stations. Although transportation considerations may not be the responsibility of the nurse, all health care providers should be aware of the plans for transportation and know where transport vehicles will be located. Consideration as to what roads are available for ambulance traffic as well as what physical obstructions ambulances may encounter must be part of the overall planning process. In addition, the plan should consider the number of ambulances that should be kept at the site as opposed to those that are on call. If air medical transportation is necessary, a clear and safe landing zone must be established and maintained. The receiving hospitals for patients should be determined in advance, and mechanisms for notifying these hospitals of incoming patients must be implemented prior to an event. (See Case Study 11.3 for a discussion of guidelines for mass casualty prediction for receiving hospitals.)

**COMMUNICATION SYSTEMS**

Communication systems must be established so that health care providers can communicate with each other, with leadership, and with collaborating partners such as police, fire, security, and local hospitals. Good
communication is essential for the successful operation of any large health care activity. Communication techniques used in mass gatherings should closely parallel daily communication techniques used by the health care service providers. As with disaster and MCI, radios will provide the bulk of the communications. Regular telephones and walkie-talkies are helpful if available. Cellular telephones may also be considered, although their use may be limited by the local infrastructure and geographical location of the event.

STAFFING

Nurse staffing needs will be determined based on a number of factors, including the total number of medical and nursing aid stations, the anticipated size of the gathering, the type of event, and the anticipated medical problems that may be encountered. The total amount of physician coverage and EMS coverage will also factor into the nurse staffing needs for the event. Sanders and colleagues (1986) recommend that health care provider staffing for special events accommodate the provision of (a) basic first aid and basic life support within 4 minutes, (b) advanced life support within 6 minutes, and (c) evacuation to a hospital within 30 minutes.

DOCUMENTATION

A written record does not need to be generated for the vast majority of trivial visits. A standard medical record should be kept, however, for all but the most trivial encounters. Standard medical record items include demographic data and brief medical history, including medications and allergies, type of illness or injury, treatment rendered, and disposition. Various databases can be used if they are available. Detailed records absolutely must be kept for those patients sick or injured enough to be sent to a hospital. The patient encounter should include some description of the characteristics of the spectators, including age, gender, type of event, the availability of alcohol and other drugs, and any other important variables. The use of handheld digital devices for medical record documentation during mass gathering events may expedite and improve record keeping (Parrillo, 2002).

SUMMARY

Multiple interacting variables combine to create complexity and uncertainty to mass gathering health care planning. Advance preparation of our national nursing workforce for such events is predicated on the belief that mastery of the knowledge and skills needed to respond appropriately to such an event can improve patient outcomes.

The fundamentals of nursing practice during a disaster, MCI, or special event are essentially the same. Despite the unusual and unfamiliar circumstances and additional stress, the nursing fundamentals practiced in other settings and during smaller crises will still be applicable. Time becomes a major factor in predicting patient recovery—the longer the delay in care for a seriously injured patient, the less chance for a full recovery. Rapid assessment of the situation and nursing care needs, triage and the initiation of life-saving measures first, and the selected use of essential nursing interventions, along with the simultaneous elimination of nonessential measures are the skills needed to successfully manage emergencies outside of the hospital. The governing principle is always to do the greatest good for the greatest number of casualties.

REFERENCES


Sherri-Lynne Almeida

The Emergency Nurses Association (ENA) is the national association for professional nurses dedicated to the advancement to emergency nursing practice. Since the event of 9/11, the ENA has joined numerous collaboratives and coalitions that seek to expand the level of knowledge of first-line health care providers in the event of another terrorist event. It is our belief that all health care personnel should receive at minimum an “awareness”-level education in bioterrorism preparedness. This should be followed by a functional education with clinical and didactic components designed to familiarize the frontline clinician with key clinical concepts in bioterrorism syndromic recognition and treatment. The goal is to recognize potential illness patterns as early as possible, to alert the appropriate response authorities for verification, and to initiate early appropriate treatment. Only by providing a consistent education and demonstrating application to practice will frontline medical personnel have the clinical ability to rapidly identify and intervene in a pandemic event. To support this belief, the ENA has issued two position papers, which address the issue of preparedness.

Statement of Problem

A mass casualty incident occurs as the result of events in which sudden and high patient volume exceeds an emergency department’s resources. An emergency department’s resources can be significantly challenged by many factors. A mass casualty incident commonly occurs with bus or train crashes, high-occupancy structural fires, or incidents from natural or intentional causes. The emergency department is the entry point into the hospital system and the initial facility-based patient care area for victims of a mass casualty incident.

Association Position

- ENA supports response planning based on an all-hazards disaster management approach. A coordinated community-wide response plan using an all-hazards approach will link local, state, regional, and national resources.
- ENA supports integration of all responding entities using a common framework that is applicable to all hazards.
- ENA believes that an effective response to a mass casualty incident will require an integration of community resources to augment the health care response. This will require an integration of police, fire, emergency medical services, health departments, medical examiners, and emergency management agencies. Volunteer responders should participate and deploy only as part of a requested group or team to assure proper education, practice experience, and knowledge of the mass casualty system.
- ENA supports emergency nurses’ participation in planning a hospital response to a mass casualty incident. Emergency nurses are a critical element of a hospital planning effort due to their skills in triage and rapid prioritization of needs within a rapidly changing scenario.
- ENA advocates planning that addresses internal and external incidents.
- ENA supports the Joint Commission on Accreditation of Hospital Organizations standards that advocate emergency management based on the stages of mitigation, preparedness, response, and recovery.
- ENA supports implementing a hazard vulnerability analysis that is reviewed annually.
- ENA supports cooperative planning of the hazard vulnerability analysis with fire, police, emergency medical services, health departments, medical examiners, and emergency management agencies.
ENA believes emergency management concepts apply to all hospitals and medical facilities.
ENA supports the inclusion of content on MCIs in core and continuing education curriculums for health care professionals.

Rationale
All hospitals and medical facilities are vulnerable to MCIs. Emergency nurses with requisite skills and knowledge, hospitals with the proper resources and plans, and integration with the community offer victims the best chance for survival.

Developed: 2002 Weapons of Mass Destruction Workgroup
Approved by the ENA Board of Directors: July 2002.
Emergency Nurses Association
915 Lee Street
Des Plaines, IL 60016-6569
(847) 460-4000

CASE STUDY
11.2
Rapid Assessment of Injuries Following a Mass Casualty Event

CDC Mass Casualties Data Instrument
This data instrument developed by the Centers for Disease Control and Prevention will help health departments and other decision makers collect core data useful for investigating the number, type, timing, and severity of injuries associated with a mass casualty event. The instrument was adapted from a tool initially used to collect information about injuries among survivors of the World Trade Center bombing. Its contents or format can be modified to accommodate the circumstances of a particular mass casualty event. Each data element is defined in the “Explanatory Notes” so that a local or state health department can quickly train and dispatch workers to collect comparable injury data from area hospitals or where other casualties are treated. These data can then be provided to decision makers to help guide public health responses to the mass casualty event or provide the basis for more in-depth investigations.

Timing the Assessment
The sooner a rapid assessment begins, the quicker the state and local public health authorities can respond to circumstances specific to the event. Most survivors of the event will likely have been examined by health care personnel within 16 hours after the event. By this time, the local or state health department can begin a rapid assessment of casualties.

Selecting the Hospital(s) for Assessment
Public health authorities should first define the occurrence or string of occurrences that constitute the mass casualty event. The location or particular circumstances of the event will determine which hospital emergency departments, trauma facilities, or other field hospitals are being used to care for casualties. Then, public health authorities may decide that either a sample or a complete accounting of casualties is most appropriate for a rapid assessment.

Assembling and Training Public Health Workers
Public health workers from local or state health departments can be trained to use the data abstraction form. However, public health workers with experience in medical chart abstraction or surveillance would be better suited for initial data collection.

Working With Hospitals to Assure Access and Confidentiality
Health departments will need to work with hospital representatives to gain access to medical records from selected hospital facilities. A high-ranking public health official should explain, either through direct communication or through a formal letter, the purpose and crucial importance of the rapid assessment to the public health emergency response, and how confidentiality of medical records will be maintained. In some circumstances, public health authorities may be authorized by law to collect or receive such information for the purpose of preventing or controlling disease.
Part II  Disaster Management

Mass Trauma Data Instrument

| Facility: ___________________________ | Date: __/__/__ | Time: ________ (24 hour) |
| Last Name: ___________________________ | DOB: __/__/__ | Age: _______ Yrs    Months |
| First Name: ___________________________ | Sex: M F No Data |
| Medical Record #: ___________________ | Other: ____________ |

Demographics

Reason for Visit: ______________________________________

How did the injury happen? ______________________________________

What was she doing? ______________________________________

Where did the injury occur? ______________________________________

Was the injury caused by the event?  
☐ Direct Effect  
☐ Indirect Effect  
☐ Not Event Caused  
☐ No Data

How Patient Arrived:  
☐ Ambulance  
☐ Public Transportation  
☐ Private Vehicle  
☐ Walked / Carried  
☐ Other: ________________________  
☐ No Data

Circumstances of Injury

Injury Condition(s): (Check all that apply)  
☐ Amputation  
☐ Brain Injury (concussion)  
☐ Burn ___% ___Degree  
☐ Crush  
☐ Cut / Open Wound  
☐ Drowning / Submersion  
☐ Foreign Body  
☐ Fracture  
☐ Overexertion  
☐ Other: ____________________________  
☐ No Data

Other Condition(s): (Check all that apply)  
☐ Abdominal Pain / N / V / Diarrhea  
☐ Alcoholism / Drug Abuse  
☐ Alter Mental Status / Coma  
☐ Breathing Problem  
☐ Chest Pain  
☐ Psychological Problem  
☐ Eye / Vision Problem  
☐ Fever  
☐ Hearing Problem  
☐ Neurologic Problem  
☐ Other: ____________________________  
☐ Pregnancy  
☐ No Data

Summary Information

Condition #1: ____________________________________________  
☐ Body Part(s): ___________________  
Condition #2: ____________________________________________  
☐ Body Part(s): ___________________  
Condition #3: ____________________________________________  
☐ Body Part(s): ___________________  
Condition #4: ____________________________________________  
☐ Body Part(s): ___________________

Disposition:  
☐ Hospitalized  
☐ Discharged Home  
☐ Transferred to Other Medical Facility  
☐ Left / AMA  
☐ Died  
☐ Other: ____________________________________________  
☐ No Data

Details of Conditions

Condition #1: ____________________________________________  
☐ Body Part(s): ___________________  
Condition #2: ____________________________________________  
☐ Body Part(s): ___________________  
Condition #3: ____________________________________________  
☐ Body Part(s): ___________________  
Condition #4: ____________________________________________  
☐ Body Part(s): ___________________
CASE STUDY

11.3 Mass Casualty Prediction for Receiving Hospitals

In the confusion that often follows a mass casualty event, managing a hospital can be challenging. Past mass casualty events can be valuable as they reveal patterns of hospital use. It is possible to estimate initial casualty volume and pattern after a mass casualty event. Public health professionals and hospital administrators can use this information to handle resource and staffing issues during a mass casualty event.

Patterns of Hospital Use

- Within 90 minutes following an event, 50–80% of the acute casualties will likely arrive at the closest medical facilities.
- Other hospitals outside the area usually receive few or no casualties.
- The less-injured casualties often leave the scene under their own power and go to the nearest hospital. As a result:
  - They are not triaged at the scene by emergency medical services.
  - They may arrive to the hospital before the most injured.
- On average, it takes 3–6 hours for casualties to be treated in the emergency department before they are admitted to the hospital or released.

Casualty Predictor

As nurses try to determine how many casualties a hospital can expect after a mass casualty event, it is important to remember that casualties present quickly and that approximately half of all casualties will arrive at the hospital within a 1-hour window.

- This 1-hour window begins when the first casualty arrives at the hospital.

To predict the total number of casualties your hospital can expect, double the number of casualties the hospital receives in the first hour.

**Casualty Predictor**

\[
\text{Total Expected Casualties} = (\text{Number of casualties arriving in one hour window}) \times 2
\]

The total expected number of casualties will be an estimate. Many factors may affect the accuracy of this prediction, such as transportation difficulties and delays, security issues that may hinder access to victims, and multiple explosions or secondary effects of explosion (such as a building collapse).
The events of 9/11 and subsequent anthrax attacks underscored the need for U.S. health care organizations and public health agencies to be prepared to respond to acts of bioterrorism and other public health emergencies. Many states and health care organizations and systems have developed preparedness plans that include enhancing surge capacity to respond to such events.

Many of these plans assume that even in large-scale emergencies, health care will be delivered according to established standards of care and that health systems will have the resources and facilities needed to support the delivery of medical care at the required level. However, it is possible that a mass casualty event—defined, for the purpose of this book, as an act of bioterrorism or other public health or medical emergency involving thousands, or even tens of thousands, of victims—could compromise, at least in the short term, the ability of local or regional health systems to deliver services consistent with established standards of care. To address this extremely important issue, in August 2004, a meeting of a number of the foremost experts in the fields of bioethics, emergency medicine, emergency management, health administration, health law and policy, and public health was convened by the Agency for Healthcare Research and Quality (AHRQ) and the Office of the Assistant Secretary for Public Health Emergency Preparedness within the U.S. Department of Health and Human Services.

Key Findings of the Meeting

The key findings that emerged from the experts’ discussion of the provision of health and medical care in a mass casualty event are summarized below.

- The goal of an organized and coordinated response to a mass casualty event should be to maximize the number of lives saved.
- Changes in the usual standards of health and medical care in the affected locality, or region, will be required to achieve the goal of saving the most lives in a mass casualty event. Rather than doing everything possible to save every life, it will be necessary to allocate scarce resources in a different manner to save as many lives as possible.
- Many health system preparedness efforts do not provide sufficient planning and guidance concerning the altered standards of care that would be required to respond to a mass casualty event.
- The basis for allocating health and medical resources in a mass casualty event must be fair and clinically sound. The process for making these decisions should be transparent and judged by the public to be fair.
- Protocols for triage (i.e., the sorting of victims into groups according to their need and resources available) need to be flexible enough to change as the size of a mass casualty event grows and will depend on both the nature of the event and the speed with which it occurs.
- An effective plan for delivering health and medical care in a mass casualty event should take into account factors common to all hazards (e.g., the need to have an adequate supply of qualified providers available), as well as factors that are hazard specific (e.g., guidelines for making isolation and quarantine decisions to contain an infectious disease).
- Plans should ensure an adequate supply of qualified providers who are trained specifically for a mass casualty event. This includes providing protection to providers and their families (e.g., personal protective equipment, prophylaxis, staff rotation to prevent burnout, and stress management programs).
- A number of important nonmedical issues that affect the delivery of health and medical care need to be addressed to ensure an effective response to a mass casualty event. They include:
  - The authority to activate or sanction the use of altered standards of care under certain conditions.
  - Legal issues related to liability, licensing, and intergovernmental or regional mutual aid agreements.
  - Financial issues related to reimbursement and other ways of covering medical care costs.
  - Issues related to effective communication with the public.
Issues related to populations with special needs.

Guidelines and companion tools related to the development of altered standards of care in a mass casualty event are needed by, and would be extremely useful to, preparedness planners at the federal, state, regional, community, and health systems levels.

Key Messages

■ Historically, traumatic mass casualty incidents are likely to involve burn injuries.
■ Burn care is highly specialized.
■ The American Burn Association, U.S. burn centers, and government agencies have written a plan to respond to these types of events and are continuing to prepare the nation’s health care system.
■ It is essential that communities create their own plans to respond to a burn disaster.

Learning Objectives

When this chapter is completed, readers will be able to

1. Identify main components of a burn disaster plan.
2. Describe the etiology, basic pathophysiology, and initial management of burn injury.
3. Discuss the impact of a burn mass casualty incident on a health care system.
4. List the American Burn Association criteria for referring a patient to a burn center.
Thermal injury is a major cause of morbidity and mortality in the United States. According to the U.S. Fire Administration, fire killed more Americans in 2004 than all natural disasters combined, with nearly 3,900 deaths and about 18,000 injured. The United States has the fourth-highest fire death rate of all industrialized countries with about 80% of all fire deaths being associated with residential fires (United States Fire Administration, 2005).

According to the American Burn Association (ABA), the definition of a burn mass casualty incident (MCI) is any catastrophic event in which the number of burn victims exceeds the capacity of the local burn center to provide optimal care. Up to 30% of casualties from historic MCIs have required burn care, with 10% being burn-only injuries and the remaining 20% being a combination of burns and other trauma. The etiology of these incidents may be natural or man-made, intentional or accidental. They can occur with industrial accidents, structural fires or collapses, terrorist attacks, mass transit accidents, earthquakes, wildfires, or other catastrophic events. Burn patients may constitute a small percentage of the total number of people injured, but this group consumes a disproportionately large amount of health care resources compared to a nonburned trauma patient. For example, of those injured at the World Trade Center on 9/11, massive traumatic injuries were associated with imminent mortality and the walking wounded were treated and released. Burn patients, however, remained hospitalized for several months and exhausted the local health care system (American Burn Association Board of Trustees and the Committee on Organization and Delivery of Burn Care, 2005).

It does not take a nationally publicized event to seriously impact a health care system; even a local apartment fire can cause a regional hospital system to exceed its surge capacity. A burn center’s capacity is determined by available burn beds, burn surgeons, burn nurses, support staff, operating rooms, equipment, supplies, and related resources; it is a dynamic number. Surge capacity is the ability to handle up to 50% more than the normal maximum burn patient census when there is an emergency.

Burn care is a highly specialized field because of the need of specific treatment modalities, supplies and equipment, and specialized personnel. Patients with severe burns are usually referred to a regional or designated burn center; yet, half of all thermal injury admissions are at hospitals without burn care facilities.
Physicians and nurses at these facilities must have an understanding of initial burn management and understand when referral to a regional or state designated burn center is appropriate. The ABA burn center referral criteria are found at the end of this chapter (American Burn Association, 2005a).

The disaster life cycle for a mass burn casualty incident is similar in structure to all other disasters. This chapter will discuss preparedness, mitigation, response, recovery, and evaluation. It is imperative that disaster planners, first responders, and clinicians understand principles of burn disasters to be able to plan and implement an effective management strategy. Also, an understanding of burn care is needed to be able to make decisions regarding triage, transport, and treatment. In addition to restoring damaged infrastructure and initiating psychiatric follow-up, the recovery phase should lead into a thorough evaluation of the response. The evaluation should generate recommendations for revision of the disaster plan for future use.

**PREPAREDNESS/PLANNING**

Effective planning for a burn MCI must occur at multiple levels and every plan must be repeatedly drilled. At the most basic level, families and businesses should design and practice escape plans and evacuation drills. Community response plans can be complicated, as they require the integration of many disciplines such as fire services, public safety, emergency medical services, public health, and hospital systems. These organizations should collaborate to create a structured response to local events that may range in size from a house fire to a major structural fire (hospital, school, airport, etc.). A detailed community hazard vulnerability analysis should be conducted to determine potential causes or sites of a burn disaster. Oil rigs, railroads, chemical or industrial plants, and arid forests are all possible sources of major fires. Low-income housing can be a potential hazard, as the building material may be cheaply made, the units may be built close together, and improvised heating sources are frequently used. Schools, hospitals, and other large, densely populated buildings may not inherently be likely to catch fire, but certainly should be included in planning because of the potential for major life and property loss. Burn centers and other tertiary care facilities should have evacuation plans as part of their hospital disaster plans for internal disasters (Wachtel, 2002).

In the case of an external disaster, hospitals should have the ability to discharge any patient who does not immediately require hospital care (e.g., elective preoperative patients) to make room for patients from an MCI. This is a complicated process and needs to be drilled regularly. Surge capacity should be calculated as part of the planning process and includes not only physical beds but staff and supplies (e.g., ventilators and pain medication). Written transfer agreements between burn centers and other hospitals/burn centers are a requirement for a disaster plan; these agreements should include stipulations about whether patients will be transferred back to the referring hospital when it has available beds.

At the state and national levels, government agencies are responsible for creating or delegating disaster planning responsibilities. Emergency medical service (EMS) systems, usually directed by state health departments, are often responsible for much of the state planning activities, including communications, transportation, and drills. Burns disasters are specifically included in the National Disaster Medical System (NDMS). Further discussion of this topic is included in the “Mitigation” section.

**MITIGATION**

Mitigation activities relating to burn MCIs include prevention measures (actions and education) and anything done to lessen the effects of a disaster once it occurs. Fire is among the most preventable of all traumatic events and disasters (United States Fire Administration, 2005). The single most important element of prevention is education at the individual, community, and national levels. Beginning in elementary school, children should be learning the basics of fire prevention, including electrical device and kitchen safety, smoke alarm use, and escape plans. Resources for school-age education are abundant; Web sites such as www.ameriburn.org and www.usfa.fema.gov/kids provide information and interactive ideas for educating children. Community prevention includes enforcing fire codes in private residences and public buildings. Publicizing the importance
and proper use of antifire technology has traditionally been the domain of health departments and fire services. Smoke alarms, carbon monoxide detectors, sprinkler systems, and other devices have been shown to decrease morbidity and mortality significantly when properly used (United States Fire Administration, 2005). Legislators need to be made aware of fire-related issues to develop appropriate policies and allocate funding. Legislator education can be done by individuals, nonprofit organizations, or private companies. After much lobbying by the ABA, in June 2004 New York State adopted legislation mandating the sale of fire-safe cigarettes; this is significant because cigarettes are a leading cause of fatal house fires in the United States (American Burn Association, 2005b).

The ABA has partnered with the Department of Health and Human Services (HHS) to identify and track availability of hospital burn beds in the continental United States. This is done through weekly updates of an HHS Web site that collects data from U.S. burn centers, including number of total burn beds, number of available burn beds, surge capability, and staffing. In the event of a mass burn casualty incident, available beds are readily identifiable and the necessary contact information is available on the Web site. In the first 3 to 7 days following an incident, it is possible that nonburn centers will have to care for burn patients until they can be transferred to burn centers. Even if there is a local burn center, its surge capacity may be reached quickly and other hospitals would need to care for patients until transfer arrangements could be made with burn centers across the state or country. This is a problematic mitigation issue because burn care is highly specialized: Education and experience are key to a successful patient resuscitation. At present, there are no official guidelines to help prepare nonburn center hospitals for their role in initial burn patient management following a disaster. It is the responsibility of state disaster planning agencies and burn centers in the United States to prepare their communities for a burn disaster with educational programs. Advanced Burn Life Support (ABLS) is a standardized 8-hour course designed to teach health care providers to assess and stabilize serious burns during the first critical hours following injury. The course can be taught to nonburn centers to enhance a community’s capacity to respond to a burn MCI. In the event that a large event incapacitates a local/state burn community for several days, education beyond that of ABLS may also be required to allow providers to safely care for burn patients up through the first few days postinjury. These courses may include information such as continuing and completing fluid resuscitation, limb perfusion issues, infectious complications, nutrition issues, and outpatient management.

Local hospitals or burn centers may need staff support to care for patients and assist with secondary triage of burn patients to other burn centers. Some regional Disaster Medical Assistance Teams (DMATs) have specialized subunits known as Burn Specialty Teams (BSTs) that are deployed with the DMAT team and a stock of burn supplies. A BST is led by an experienced burn surgeon and consists of 15 members (nursing, anesthesiology, respiratory therapy, administration, and support personnel). Once activated, the members become federal employees for liability purposes, eliminating the need for state licensure. As with DMATs, BSTs arrive at the site of a disaster with enough equipment and supplies to sustain themselves for 72 hours (National Disaster Medical System, 2006). If further human resource support is needed, the U.S. Army can deploy SMART teams, or Special Medical Augmentation Response Teams. SMARTs can provide short-duration medical assistance to local, state, federal, and Department of Defense (DOD) agencies responding to disasters, civil-military cooperative actions, humanitarian assistance missions, weapons of mass destruction incidents, or chemical, biological, radiological, nuclear, or explosive incidents. There are 37 SMARTs, including two burn-specific SMARTs, operated by the U.S. Army Institute of Surgical Research at Brooke Army Medical Center. Currently, burn SMARTs are primarily used for long-range air-medical evacuation of combat burn casualties (American Burn Association, 2005a). When replenishment of supplies is needed, the U.S. Strategic National Stockpile (SNS) includes burn-specific dressing supplies and medications and can be delivered within 12 hours to any location in the United States in the event of a burn MCI (Centers for Disease Control and Prevention, 2005). Further federal response information, including the processes of declaring a burn MCI a federal disaster and requesting the SNS, is outlined in chapter 2, “Leadership and Coordination in Disaster Health Care Systems: The Federal Disaster Response Network.”

**RESPONSE**

Certain events are blatantly catastrophic, and it is immediately clear that a mass casualty incident has occurred. Activation of the disaster plan occurs and a structured response is mobilized. Other events, such as an apartment building fire may not immediately declare themselves as disasters; as casualties accumulate and local resources are dispensed, it will be decided if part of the entire disaster plan must be activated. The on-scene incident commander may be a firefighter or other first responder, depending on the nature of the incident. Please see chapter 8, “Disaster Management,” for information regarding the structure and function of the Incident Command System.
12.1 Burn Classification

<table>
<thead>
<tr>
<th></th>
<th>FIRST-DEGREE BURN</th>
<th>SECOND-DEGREE BURN</th>
<th>THIRD-DEGREE BURN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of Injury</td>
<td>Epidermis</td>
<td>Epidermis, some dermis</td>
<td>Epidermis, all dermis</td>
</tr>
<tr>
<td>Appearance</td>
<td>Redness, intact skin</td>
<td>Fluid-filled blisters, pink dermis</td>
<td>Charred, leathery</td>
</tr>
<tr>
<td>Moisture</td>
<td>Dry</td>
<td>Most</td>
<td>Dry</td>
</tr>
<tr>
<td>Perfusion</td>
<td>Normal</td>
<td>Quick capillary refill</td>
<td>Markedly delayed or absent capillary refill</td>
</tr>
<tr>
<td>Sensation</td>
<td>Normal</td>
<td>Painful, pinprick sensation intact</td>
<td>Pressure sensation only or no sensation</td>
</tr>
</tbody>
</table>

Burn Triage in Mass Casualty Incidents

Primary triage ideally occurs at the disaster site, or it can be at the hospital receiving patients from the scene. The primary triaging of patients should be conducted as the local disaster triage criteria dictate. Those overseeing triage should be in communication with the nearest burn and trauma centers to assist in decision making. In a burn MCI, the number of casualties could create a situation where secondary triage is necessary. Secondary triage occurs at a hospital or burn center when it has reached capacity and must begin transferring patients to other burn centers. The ABA triage policy is that all burn patients should be transferred to a burn center within 24 hours of injury. If health care resources are overwhelmed by casualties and transfer possibilities are insufficient, resources should be allocated to where they will do the most good for the most people. The ABA has developed a triage decision table of benefit-to-resource ratio based on patient age and total burn size. This table applies only to MCIs where there are absolutely not enough resources available and classifies patients as outpatients; high, medium, or low benefit to resource ratio; and expectant (American Burn Association Board of Trustees, 2005).

Pathophysiology of Burn Injury

All burns—thermal, chemical, radiological, or electrical—are classified as first, second, and third degree, depending on the extent of skin injury (Table 12.1).

Although burns are cutaneous injuries, the effects can influence nearly all systems of the body. The overall morbidity associated with a burn injury will be determined by burn depth, percentage total body surface area (TBSA) involved, patient age, and presence of inhalation injury. Children and older adults have thinner skin and are more likely to sustain a deeper burn injury. Patients at the age extremes are also less likely to tolerate the stress of burn shock. The presence of an inhalation injury severely impacts survival in all age groups (Lentz & Elaraj, 2005).

Extensive burn injuries produce a systemic response that pulls fluid from the vascular system into the interstitial space. This is exacerbated in burns greater than 20% TBSA by a significant capillary leak into the microvasculature and generalized edema. Without proper treatment, intravascular fluid loss and hypovolemic burn shock result. This is why immediate initiation of fluid resuscitation is important. A successful fluid resuscitation will maintain intravascular volume and organ perfusion until capillary membrane integrity is restored (approximately 24 to 48 hours postinjury).

Management of a Mass Casualty Burn Patient

This section is intended to give basic guidelines for initial clinical management of a burn patient in a mass casualty incident. For information about becoming certified in Advanced Burn Life Support, go to http://www.ameriburn.org/ABLS/ABLS.htm.

Initial burn patient management priorities include:

1) Stop the burning process
2) Manage the airway, breathing, and circulation
3) Begin fluid resuscitation
4) Keep the patient warm
5) Evaluate for other life-threatening injuries

Primary Survey

Stop the Burning Process

To prevent further injury and establish safety for the health care provider, the first rescue action may need to be stopping the burning process. Smoldering clothing should be removed and the burn wounds should be irrigated with cool water while other personnel address the patient’s airway. The use of ice or ice water is
contraindicated because it causes vasoconstriction and potentially ischemia in the burned skin, resulting in a deeper injury. If the patient is found down, the cervical spine should be placed in an immobilization collar until injury is ruled out.

**Airway/Breathing/Circulation**

As in all emergency care, airway is the initial priority. Assess for a clear airway and evaluate breathing. Immediate intubation is indicated in patients with hoarseness, stridor, excessive use of accessory muscles, difficult respirations, decreased level of consciousness, or inability to protect the airway. Endotracheal tubes should be secured with twill tape in patients with facial burns, as adhesive does not stick to burned skin. Large burns and facial burns do not always need immediate intubation but may require it once fluid resuscitation begins (before edema creates a difficult airway). Patients who have been in an enclosed burning building should be suspected of having smoke inhalation injury and carbon monoxide poisoning until proven otherwise. These patients should be treated with humidified 100% oxygen if they are not already intubated. Smoke inhalation is highly unlikely in patients injured outdoors since smoke dissipates quickly in open-air environments. Findings that may be associated with inhalation injury include hoarseness, wheezing, facial burns, singeing of facial hair, and carbon deposits in the oropharynx or carboxaceous sputum. A definitive diagnosis of inhalation injury can only be done with bronchoscopy (Lentz & Elaraj, 2005). Cardiac status and circulatory emergencies must be addressed as in Basic Life Support. Two large-bore peripheral IV catheters should be placed through nonburned tissue if possible. If the catheters must be placed through burned skin, they should be secured in place (again, adhesive does not stick to burns). Keep in mind that patients with extensive, deep torso burns may not be candidates for cardioversion or defibrillation due to poor conduction in burned tissue.

**Other Considerations**

Burn patients are usually awake and alert after they have been injured. If there is an alteration in mental status, consider the following: associated traumatic injury, carbon monoxide poisoning, hypoxia, or preexisting medical conditions (American Burn Association, 2005a).

The patient’s skin should be briefly exposed to be able to assess for burn size and depth (see estimation rules). Because burns result in skin loss, the body loses some of its ability to regulate body heat. It is vitally important to keep the patient warm using any means available, such as rescue blankets or dry sheets at the scene and warm blankets at the hospital. Since burned tissue can swell significantly, all constricting clothing and jewelry should be removed immediately to prevent circulatory compromise. Finger rings should be removed as soon as possible, with a ring cutter if necessary. Hand and finger swelling will make later removal very difficult. Earrings should also be removed as they can cause pressure necrosis in a swollen ear (Lentz & Elaraj, 2005).

**Fluid Resuscitation**

Second- or third-degree burns greater than 10%–20% TBSA or patients with significant smoke inhalation injury will require fluid resuscitation. Peripheral IV catheters can be used, but placement of a central venous catheter is optimal. An indwelling urine catheter should be placed so that output measures can be used to monitor the status of fluid resuscitation.

There are multiple formulas that can be used to fluid-resuscitate a burn patient. The Parkland formula is well established and commonly used. Before calculation can be done, it is necessary to determine the patient’s weight (in kilograms) and correctly estimate the percentage TBSA burned. A good estimation tool for use in the field is the Rule of Nines (Figure 12.1). Because of their disproportionately large heads, children under 30 kg require an adjusted approximation of percentage TBSA. A child’s entire head represents 18% of the TBSA, and each lower extremity represents 14% of the TBSA.

Chapter 12  Management of Burn Mass Casualty Incidents

---

**Burn Size Estimation:**

For irregularly distributed burns, the palm of the victim’s hand represents approximately 1% of their TBSA.

Warmed Lactated Ringer’s (LR) solution should be used in burn fluid resuscitation. The Parkland formula indicates that a volume of 2–4 mL/kg/%TBSA burned (in both adults and children) should be administered over the first 24 hours from the moment of injury, with half of the volume being administered over the first 8 hours and the second half infusing over the next 16 hours. Although this is the classic teaching of the application of the Parkland formula, it is not recommended. It is best to use the formula to determine the initial hourly rate (0.25 mL × kg × %TBSA), but to then follow the patient’s urine output to guide the rest of the fluid resuscitation (this is a more accurate indication of what the individual’s fluid needs truly are). The titration should reflect the amount of urine the patient is producing with the goal being at least 0.5 mL/kg/hr of output in adults and 1 mL/kg/hr in children less than 30 kg. A good rule of thumb is to decrease the fluid rate by 10% every hour that the patient has made their goal for urine output. If at any point the patient is not meeting their hourly output goal, increase the fluid rate by 20% and observe the
Part II Disaster Management

Figure 12.1 Burn size estimation.

For irregularly distributed burns, the palm of the victim’s hand represents approximately 1% of their TBSA.

Rules of NINES diagram

Next hour. Ideally, the fluid is titrated down to a maintenance rate at 24 hours from the time of injury. The adult maintenance fluid requirement is 30 mL/kg/day plus an estimation of insensible losses (1 mL/kg/%TBSA burned). Small children require maintenance fluids throughout fluid resuscitation in addition to the calculated rate. A maintenance solution with 5% dextrose is best to prevent rapid loss of the child’s glycogen stores.

Pediatric Maintenance Fluids:

First 10 kg of body weight 100 mL/kg over 24 hours
Second 10 kg of body weight Add 50 mL/kg to above total
Each kg over 20 kg Add 20 mL/kg to above total

Some clinical situations may require a higher than predicted total volume for fluid resuscitation. Be aware of the following indicators, which are risk factors for needing extra volume: smoke inhalation injury, associated trauma, large TBSA burns (>50%), deep burns, electrical injury, delayed resuscitation, or alcohol/drug use.

Other Initial Priorities

Once the patient is brought to a hospital or burn center, the room should be heated to a minimum of 30 °C. The patient should be kept covered with dry blankets at all times with only brief exposures for wound assessment and care delivery. Peripheral circulation should be monitored as soon as possible using an ultrasonic flow meter as circumferential full-thickness extremity burns may compromise distal perfusion and require escharotomy. Radial, ulnar, palmar arch, posterior tibial, and dorsalis pedis pulses should be checked hourly for progressive decrease or total loss. If necessary, escharotomies should be done in consult with a burn center to avoid severe neurologic
damage and tissue necrosis (American Burn Association, 2005a).

Secondary Survey

When the primary survey is complete, a thorough head-to-toe evaluation is conducted to assess for other injuries. This may be done at the scene if time and resources permit or at the first receiving hospital. The secondary survey should include getting an accurate history—the circumstances of the injury and medical history—conducting a complete examination to evaluate for other traumas such as fractures, pneumothoraces, contusions, shrapnel, corneal injury; and closely reexamining the burn wound size and depth.

Burn Wound Care

The principles of burn wound care in a disaster are the same as any other time: Keep the wound clean, moist, and covered. At the scene of a disaster, or when waiting for transport to the receiving facility, it is sufficient to cover the burn wound with a clean, dry sheet. Aggressive wound care should not begin until the patient has reached the receiving facility/burn center, as wounds will need to be assessed upon arrival. Nurses can keep the wound covered for transport with a clean dry towel, gauze, or if available, an impregnated dressing. Judgment, of course, should be used: If the patient is going to be awaiting transport for more than 24 hours, initial wound care should be done (Wachtel, 2002).

Burn care is essentially the same for thermal, chemical, electrical, and radiation burns. When the patient arrives at the receiving facility, the first step in burn wound care is to cleanse with soap and warm water. Remove any debris and loose, dead skin, and pat dry. Temporary topical treatment for areas of first-degree burns can be done with any nonirritating moisturizing cream. Petrolatum can be used on partial thickness burns to the face or neck and wounds should be left uncovered. Partial and full thickness burns to the body can be treated with a basic first aid and antimicrobial ointment.

Pain Control

Full-thickness burns are unlikely to be painful since the nerve endings have been damaged. Partial-thickness burns, however, are known to cause variable degrees and types of pain because the nerve endings have lost protection. Intravenous narcotics are usually sufficient to maintain adequate pain control. Continuous infusions are appropriate for those who are mechanically ventilated. Oral and subcutaneous routes should not be used to treat burns greater than 20% TBSA because of decreased absorption secondary to burn shock.

Walking Wounded

Patients with first-degree burns or small non-life-threatening deep burns can be treated as outpatients as long as they are able to care for themselves or have someone to help them. This population must be anticipated by the hospital staff and efficiently managed to avoid using too many resources. Hospitals should plan for these patients to arrive early, possibly before the critical patients, as they are likely to self-transport. There should be a designated care area away from where the critical patients will arrive. The burns should be assessed, cooled, cleaned, and dressed. Before these patients are sent home, they must have adequate pain control on oral medications and prove to be able to meet their nutrition and hydration needs. Outpatient kits should ideally be assembled before the disaster or at least before patients begin to arrive. The kits should include general wound care instruction sheets, basic dressing supplies, and information about warning signs and follow-up care.

Special Topics

Chemical Burn Injury

Agents that cause chemical burns fall into three categories: alkalis, acids, and organic compounds. Alkalis and acids can be found in home and commercial cleaning products, whereas organic compounds are found in petroleum products. The mechanisms of chemical injury are different, but the treatment remains the same. The extent of the injury is determined by the type of agent, concentration and amount of the agent, and the duration of exposure. Acids injure by causing tissue coagulation, whereas alkalis cause liquefaction necrosis. Alkali burns can be potentially more destructive to tissues than acids because liquefaction enables the chemical
to continue penetrating deeper into tissue (Sanford & Herndon, 2002).

Liquid chemicals should be copiously irrigated off the skin until symptoms subside; this may take at least 30 minutes. Neutralizing agents are not recommended unless the chemical agent is known for certain. Powdered chemicals should be brushed off before skin irrigation is started. Irrigating before brushing away a powdered chemical may cause it to become incorporated into the solution and increase the depth and surface area of injury. Chemical burns to the eye require continuous irrigation with normal saline for at least 15 minutes.

Improvised eye wash station:
When there is not access to running water, an improvised eyewash station can be made by spiking a bag of normal saline with IV tubing, cutting the tubing, and fitting the connector end of new nasal cannula oxygen tubing over the IV tubing. The saline will flow from the nasal prongs in two streams, one for each eye.

In the event of a suspected chemical injury to a patient, first responders and clinicians must remember to wear appropriate PPE to prevent secondary exposure during transport from the scene and during irrigation (Sanford & Herndon, 2002).

Electrical Injury
Electrical injuries account for approximately 3% of all burn center admissions and cause around 1,000 deaths per year (American Burn Association, 2005a). These injuries are frequently work related. Appearance of electrical injuries can be deceiving. The surface injury may appear to be small, but damage below the epidermis can be significant. This concept should be kept in mind during triage. Many factors will influence the degree of tissue damage, including type and voltage of electrical current, resistance, pathway of transmission in the body, and duration of contact (Briggs & Brinsfield, 2003). Deep conductive electrical burns, arc injuries, surface thermal burns, associated trauma (musculoskeletal, neurologic, etc.), cardiac arrhythmias, and compartment syndromes are all manifestations of electrical injuries. Arrhythmias are due to the injury to the myocardium caused by the electric current at the moment of injury and the resulting ischemia; it is not the result of electrical damage to the cardiac conduction system. As with all traumatic injuries, management considerations include a primary survey, secondary survey, proper fluid resuscitation, cardiac monitoring, maintenance of peripheral circulation, and ongoing wound care (American Burn Association, 2005a). Patients who sustain electrical injuries are at risk for the development of compartment syndrome and may require a fasciotomy to decompress tissue compartments.

Radiation Injury
The physical appearance of radiation burns and thermal burns is the same. The difference lies not only in their etiology, but in the time it takes for the wound to appear. Thermal injury is often visible instantaneously or appears soon after a person is burned. Radiation injury can take days to weeks to appear, depending on the dose. A visible injury is an indication of a high localized dose of radiation and the wound must be decontaminated as in chemical injury. This localized radiation exposure can result in various changes to the skin, depending on the dose. Although the patient’s wound may be contaminated, the patient and the wound are not radioactive.

The use of radiation dispersal devices, commonly referred to as dirty bombs, is particularly concerning for disaster planning and emergency preparedness personnel. An RDD is an explosive device designed to spread radioactive material without a nuclear explosion (Briggs & Brinsfield, 2003). The initial blast from the explosion can kill or inflict mechanical trauma on those who are close in proximity to the explosion while the radioactive material is dispersed. Please refer to chapter 27, “Radiological Incidents and Emergencies,” for further information on decontamination, radiation sickness, and personal protective measures.

RECOVERY
The recovery phase of a burn MCI should aim to return the affected community to its predisaster state. Buildings and infrastructure that have been damaged by the incident should be repaired or removed if damage is too severe. The American Red Cross has traditionally reached out to those involved in fire-related disasters by helping them access available resources to meet their needs. Psychological effects on those affected may
Chapter 12  Management of Burn Mass Casualty Incidents

SUMMARY

Burns are unique injuries, and planning for a burn MCI may seem overwhelming. By following the basic principles of the disaster life cycle, an effective response plan can be created. For more information on your community or state plan for a burn MCI contact your local and state health departments.

REFERENCES


American Burn Association Board of Trustees and the Committee on Organization and Delivery of Burn Care. (2005). Disaster Management and the ABA Plan, 26(2), 102–106.


Persist for years after the event has occurred. The mental health response is especially important in a burn MCI because those involved have lived through a potentially psychologically damaging event and can experience complicated emotional reactions. Please see chapter 5, “Understanding the Psychosocial Impact of Disasters,” for more information.

Burn patients consume many resources and have long lengths of stay. After the response to the disaster is over, these patients can remain hospitalized for months. The average length of stay for a patient with 50% TBSA burns is 50 days. Burn center staff may become exhausted, operating at or above capacity for this period of time. It is recommended that staff work regular 8-hour shifts if possible to prevent emotional and physical fatigue.

EVALUATION

Each phase of the disaster from planning through recovery needs to be closely examined so that modifications can be made for future burn MCIs. It is especially helpful to make any lessons learned available to the health care and disaster planning communities at large through publications so that others can make use of the information. For example, the William Randolph Hearst Burn Center’s experience following World Trade Center disaster in 2001 was published to share the information that was learned from that incident. One issue involved the NDMS nurses who were deployed for 50 days to assist with patient care at the hospital. Although the nurses were experienced in critical care and burn care, they were unfamiliar with the hospital and how the computerized charting system worked. The hospital solved this problem by creating a brief orientation class for these workers that allowed them to learn the necessary information and quickly go back to assisting with patient management. This is certainly a problem that other institutions will potentially have if NDMS workers are deployed to their aid and should be considered when developing a disaster plan (Yurt et al., 2005).
CASE STUDY

12.1 The Bali Burn Disaster

A deadly explosion and fire in a nightclub at the internationally renowned holiday resort of Bali, Indonesia, in 2002 was caused by terrorist attack. Bali, approximately 1,000 miles north of Australia, is a popular destination for Australian holidays. The attack resulted in the deaths of 200 people, 88 of whom were Australians. Three days after the initial disaster, 60 patients from Australia were flown home to receive ongoing medical care. Their burn injuries ranged from 15% to 85% TBSA and most of which were classified as full-thickness burns. In addition to the burn injury, primary and secondary blast injuries were associated with every patient. Initial first aid treatment was given at the disaster site and at local hospitals by Indonesian doctors and volunteers. Once initial triage was completed, 60 Australian and European burn patients were flown back to the northern-most city of Darwin for further evaluation, triage, and treatment. Of major concern was the transport of burn patients over the long distance. Transport makes monitoring of fluid resuscitation and temperature control difficult. Once landed, patients were triaged and then sent to hospitals throughout the country according to the availability of intensive care and burn unit beds. Mental health facilities with counseling were established at Australian airports. These services continued during the course of many weeks. During the course of this event, victims and a number of staff members presented with psychological problems and required counseling. Cases of survivor guilt also were noted in a number of patients, all of whom had lost family members or close friends.

The three-day delay before receiving patients allowed Australian Burn Centers to prepare for the influx of these patients. Unlike many disasters, they were able to perform a thorough assessment of beds, ventilators, operating rooms, medical supplies, and staff. Considering that disasters with large numbers of burn injuries are commonly associated with the use of explosives, burn and trauma centers should create guidelines and training to address blast injuries and their management.


CASE STUDY

12.2 The Station Nightclub Fire

The Station nightclub fire was the fourth-deadliest nightclub fire in U.S. history. It occurred in Warwick, Rhode Island, on February 20, 2003. Of the approximately 439 people inside the Station at the time of the blaze, 96 people died at the scene, and 4 more died in hospitals during the following weeks. Two hundred fifteen people were injured. The Station nightclub was a single-story wood frame building with an area of about 412 square meters (4,484 square feet). The main entrance on the north side, with double doors, led to a short hallway with a single interior door. In addition to the main entrance, there were doors leading directly to the outside, adjacent to the platform on the west end of the building and at the side of the main bar at the east end of the building. The kitchen also had an exit door. There were windows along the north side of the building on both sides of the main entrance.

The fire began when pyrotechnics used during a rock concert ignited the polyurethane foam lining of the walls and ceiling of the stage, and spread quickly...
Figure 12.2 The Station nightclub.

Along the ceiling over the dance floor, smoke was visible in the main entrance doorway in a little more than one minute after ignition, and flames were observed breaking through a portion of the roof in less than five minutes. Crowding at the main entrance to the building hampered egress from the nightclub. One hundred people lost their lives in the fire.

The 1950s-era building did not have a sprinkler system. Reports indicate that if the patrons of the Station were not out of the building within 3 minutes, they did not have a chance of survival. Within 30 minutes of the start of the fire, the building had completely collapsed.

A triage station run by Rhode Island's emergency medical services was set up at the scene. Ambulances and helicopters ferried patients to 15 local and regional hospitals. Of concern was the communication during the disaster. Individual ambulance crews were given discretion as to which area hospitals to transport patients, resulting in some severely injured patients being transported to non-Level I centers. Communication between institutions was infrequent and it proved difficult to match patients with available resources in the community. Kent Hospital, which was the nearest to the nightclub already had a full emergency room when the first burn patients began to arrive, some transported by ambulance, others driven by personal automobiles. Kent's emergency department stabilized and transported the sickest patients and only admitted patients with minor injuries.

Rhode Island Hospital (RIH), the state's only Level I trauma center, activated their disaster plan to mobilize staff and resources. They evaluated 64 patients during a 4-hour time block, with 47 patients being admitted and 18 being discharged from the emergency room. Of the 47 admitted patients, 33 patients had less than 20% TBSA burns, 12 patients had 21% to 40% TBSA burns, and 2 patients had 40% TBSA burns, and 28 patients had inhalation injury. During the next week, their team performed 23 operations and used two dedicated burn operating rooms. Twelve weeks after the admission of the first patient from the Station fire, the last patient was discharged to rehabilitation.

CASE STUDY

12.3 American Burn Association Disaster Plan
Disaster Management and the ABA Plan

ABA Board of Trustees; the Committee on Organization and Delivery of Burn Care

This article presents the ABA Plan, developed by the Committee on Organization and Delivery of Burn Care and the Board of Trustees, for the management of mass burn casualties resulting from mass disasters and terrorist acts. Information is presented demonstrating the following: the extent of burn injuries in mass disasters and terrorist acts; the importance of appropriate triage and surge capacity policy; why treatment of burn patients in burn centers is preferable; the critical role that burn centers play in the local, regional, and federal response to mass burn casualty situations; and the important role of the ABA in interacting with federal agencies and other entities in mass burn casualty disaster preparedness.

Key Background Facts

Burn Injuries Are Common in Mass Disasters and Terrorist Acts. In general, in most traumatic events, approximately 25% to 30% of the injured will require burn care treatment. Approximately one third of those hospitalized in New York City on 9/11 had severe burn injuries; the Pentagon attack resulted in 11 burn patients, again a high percentage of those injured.

Burn Center Care Is the Most Efficient and Cost-Effective Care for Burn Injuries. Burn injuries are not like other trauma injuries; burn injuries often require a lengthy course of treatment as compared with simple or even complex trauma patients. For example, for burn patients with 50% body surface area burn, the average length of stay in the intensive care unit is 50 days. In a mass casualty, the average burn is typically greater than 50% body surface area.

Burn Centers Are Not the Same as Trauma Centers. Although there are literally thousands of trauma centers in the United States, there are only 132 burn care centers throughout the country, representing 1,897 burn beds nationwide. Of the 132 burn centers, only 43 are currently verified through a rigorous joint review program of the American Burn Association (ABA) and the American College of Surgeons to assure the center has the resources for the provision of optimal care to burn patients.

Burn Centers Are a Unique National Resource. Given the unique nature of burn care and the nationwide availability of highly specialized burn care systems established to address the complex nature of burn injuries, burn centers have been specifically recognized in federal bioterrorism legislation, with subsequent action of the U.S. Department of Health and Human Services (HHS) to incorporate burn centers in state and local disaster plans. Furthermore, although most burn surgeons have the expertise and training to treat burn—as well as trauma—victims in the event of a mass casualty, the reverse is not necessarily so, which supports the need for unique benchmarks to ensure that the needs of the burn-injured are met in the event of a terrorist incident.

The American Burn Association Has the Capacity to Be a Key Component in National Disaster Readiness for Mass Burn Casualties. The ABA responded within hours to national and state agencies with burn resource information following the 9/11 tragedies and on an ongoing basis during preparations for the war in Iraq.

Definitions, Supporting Documentation, and Key Policy Statement

Mass Burn Casualty Disaster. This is defined as any catastrophic event in which the number of burn victims exceeds the capacity of the local burn center to provide optimal burn care. Capacity includes the availability of burn beds, burn surgeons, burn nurses, other support staff, operating rooms, equipment, supplies, and related resources.

Surge Capacity. Surge capacity is the capacity to handle up to 50% more than the normal maximum number of burn patients when there is a disaster. Normal capacity will be different for each burn center, may be seasonal, and will vary from week to week or possibly every day to day.

Primary Triage. Primary triage is triage that occurs at the disaster scene or at the emergency room of the first receiving hospital. Primary triage should be handled...
according to local and state mass casualty disaster plans. Under the federal bioterrorism legislation and the implementation actions of the Health Resources and Services Agency of the HHS, state disaster plans must incorporate burn centers into such plans.

ABA Primary Triage Policy. Burn patients should be triaged to a burn center within 24 hours of an incident. The disaster site incident commander should call the nearest verified burn center regarding available capacity and alternate site burn center information, if needed. Appropriate field triage may depend on first-responder and hospital emergency room personnel knowledge of burn triage recommendations. The ABA’s recommended triage decision table—specific for mass burn casualty disasters and not other situations—is in the appendix to the article.

Secondary Triage. Secondary triage is the transfer of burn patients from one burn center to another burn center upon reaching surge capacity. Secondary triage policy should be put into place at every burn center, with formal written transfer agreements previously established.

ABA Secondary Triage Policy. Secondary triage should be implemented by the Burn Center Director when the burn center’s surge capacity is reached. Transfer of burn patients should be to verified burn centers when feasible, then to other burn centers, within the first 48 hours following the incident when possible.

Tiered Response Plans

The magnitude of a disaster will determine whether the involvement of local, state, or federal government agencies is necessary. It is imperative that all elements of the ABA, from local burn units to the national office, work together efficiently and interact in a similar manner with various federal, state, and local agencies to create the maximum state of preparedness and the most effective response when a burn mass casualty event occurs. Disaster response in the United States is multileveled, reflecting limits placed on federal (in particular, the military) involvement in local affairs.

Levels of medical response for a burn mass casualty disaster can be ranked as follows, from most to least likely to be used:

1. State and local response systems
2. National disaster medical system (NDMS)
   a. Disaster medical assistance teams (DMAT)
   b. Burn specialty teams (BST)
3. Military support to civil authorities

a. U.S. Army special medical augmentation response teams (SMARTs)

Under Homeland Security Presidential Directive 5, the Secretary of the Department of Homeland Security is the principal federal official responsible for domestic incident management. Initial responsibility lies with local and state officials; the federal government assists when state capabilities are overwhelmed or when federal interests are involved.

Implementation of Homeland Security Presidential Directive 5 involves two core documents:
1. National Incident Management System
2. National Response Plan, which includes the NDMS

National Disaster Medical System. NDMS manages and coordinates the federal medical response to major emergencies and federally declared disasters, including natural disasters, technological disasters, major transportation accidents, and acts of terrorism, including those that might involve weapons of mass destruction. NDMS is a section within the Federal Emergency Management Agency in the Department of Homeland Security and works in partnership with the Department of Health and Human Services, the Department of Defense (DOD), and the Department of Veterans’ Affairs.

NDMS has three functions:
1. Medical response to the disaster site
2. Patient movement from the disaster area to unaffected areas of the nation
3. Definitive medical care in unaffected areas

Under NDMS, the patient regulation and movement mission is the responsibility of the DOD, and specifically, the Global Patient Movement Requirements Center of the U.S. Transportation Command, Scott Air Force Base, Illinois. NDMS may be activated in four ways:
1. The governor of an affected state may request a presidential declaration of disaster or emergency
2. A state health officer may request NDMS activation by the Department of Homeland Security
3. The Assistant Secretary of Defense for Health Affairs may request NDMS activation when military patient levels exceed DOD and Department of Veterans’ Affairs capabilities
4. At the request of the National Transportation Safety Board

Once NDMS is activated, Federal Coordinating Center coordinators collect data on the number of available beds and the number of patients who can be processed
through a patient receiving area and transported to local NDMS hospitals within a 24-hour period. The DOD operates 24 Federal Coordinating Centers and the Department of Veterans’ Affairs operates 37 Federal Coordinating Centers.

It should be noted that in the preparations for the Iraq war, there was considerable inaccurate information on burn bed availability through this system. The American Burn Association Central Office worked directly with the U.S. Army Institute of Surgical Research to provide much more accurate and timely burn bed availability information.

**Disaster Medical Assistance Teams.** NDMS helps to develop local DMATs. Each DMAT is sponsored by a major medical center and comprises approximately 35 physicians, nurses, technicians, and administrative support staff designed to provide medical care during a disaster.

**Burn Specialty Teams.** BSTs are specialized DMATs affiliated with a local DMAT to allow sharing of assets. They are designed to be deployed along with a DMAT to provide burn expertise. DMATs and BSTs provide a community resource for local and state requirements but can also be federalized to support national needs (see above for the three ways in which NDMS can be activated). Since the inception of BSTs, Dr. Susan Briggs has been the coordinating BST Program Manager. Dr. Briggs is a longtime ABA member and provides an excellent liaison between the American Burn Association and NDMS.

BSTs are primarily designed to augment existing local capabilities. As such, deployment may not involve the entire team. A major goal is to have NDMS teams on the scene within 12 hours. The team may direct secondary triage and transfer efforts or assist with evaluation and resuscitation. Each BST is currently led by an ABA member and is composed of approximately 15 burn-experienced personnel, including the following: one surgeon (team leader); six registered nurses; one anesthesia provider; one respiratory therapist; one administrative officer; and five support personnel selected based on mission requirements.

BST Team 1—Boston, Medical Director, Robert Sheridan, MD (rsheridan@partners.org)

BST Team 2—Tampa, Medical Director, David Barillo, MD (dbarillo@earthlink.net)

BST Team 3—Galveston, Medical Director, David Herndon, MD (dherndon@shrinenet.org)

BST Team 4—Minneapolis/St. Paul, Medical Director, William Mohr, MD (William.j.mohr@healthpartners.com)

Two more BSTs are currently planned. All BSTs are looking for additional volunteers. When a BST is activated, team members become federal employees during activation, which provides liability coverage and obviates state licensure needs.

Clearly, there are limitations of the current NDMS system regarding BSTs: not all burn centers are members of NDMS; burn centers that are not located in one of the NDMS metropolitan areas would not receive burn casualties under the NDMS system; some hospitals that report burn bed availability to the NDMS do not ordinarily care for burn patients.

**ABA NDMS Policy**

For purposes of NDMS involvement in regional burn disasters, the ABA recommends that the primary function of the NDMS disaster teams should be to assist the local burn center director with secondary triage of burn patients to other burn centers, according to the following prioritization:

1. Burn centers currently verified jointly by the ABA/American College of Surgeons
2. Other burn centers

**ABA Burn Bed Availability Policy**

The ABA’s Central Office is working with the U.S. Department of Health and Human Services Office of Public Health Emergency Preparedness to establish and maintain a real-time burn bed availability program for the nation. In the recent past, the ABA worked with the U.S. Army Institute of Surgical Research on a burn bed resource capacity project. The ABA Central Office will continue to work with HHS and others to develop and maintain a real-time burn bed resource capacity reporting system.

**Military Support to Civil Authorities**

Military support to civil authorities is the final tier in the nation’s disaster response system. Federal resources that may be implemented in the event of a major biochemical or radiation disaster are the U.S. Army Special Medical Augmentation Response Teams. The mission of the SMART teams is to provide short-duration medical liaison to local, state, federal, and DOD agencies responding to disasters, civil-military cooperative actions, humanitarian assistance missions, weapons of mass destruction incidents, or chemical, biological, radiological, nuclear, or explosive incidents. There are 37 SMART teams, including two burn SMART teams operated by the U.S. Army Institute of Surgical
Chapter 12  Management of Burn Mass Casualty Incidents  235

Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

Since direct involvement of the DOD in a domestic incident is considered beyond NDMS and is intended to be limited in extent and duration, the burn SMART teams have not yet been used under military support to civil authorities and have been used primarily for long-range air-medical evacuation of combat burn casualties or for assistance to foreign governments following mass casualty events.

ABA Burn Smart Team Policy

The ABA recommends that, if needed, the involvement of burn SMART teams in regional burn disaster management should be in facilitating secondary triage and transport of burn patients to burn centers outside the disaster area.

ABA Action Items on Disaster Preparedness

In addition to greater interaction between the American Burn Association and HHS, the Department of Homeland Security, NDMS, and U.S. Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

Since direct involvement of the DOD in a domestic incident is considered beyond NDMS and is intended to be limited in extent and duration, the burn SMART teams have not yet been used under military support to civil authorities and have been used primarily for long-range air-medical evacuation of combat burn casualties or for assistance to foreign governments following mass casualty events.

The ABA recommends that, if needed, the involvement of burn SMART teams in regional burn disaster management should be in facilitating secondary triage and transport of burn patients to burn centers outside the disaster area.

ABA Burn Smart Team Policy

The ABA recommends that, if needed, the involvement of burn SMART teams in regional burn disaster management should be in facilitating secondary triage and transport of burn patients to burn centers outside the disaster area.

ABA Action Items on Disaster Preparedness

In addition to greater interaction between the American Burn Association and HHS, the Department of Homeland Security, NDMS, and U.S. Institute of Surgical Research, the following are a number of specific action items that will be taken to enhance overall mass burn casualty disaster preparedness at the national, regional, and local level.

1. Distribution of the publication “Burn Care Resources in North America” to the disaster planning agency in every state.

2. Communication to the nation’s 33,000 fire departments of the availability of burn center resource information and triage recommendations on the ABA Web site, as well as the availability of burn center transfer stickers with specific burn center contact information for their area that are designed for placement on first-responder incident boards.

3. Communication to fire departments and other first responders, hospital emergency room physicians in the nation’s 7000 hospitals, and others regarding the availability of advanced burn life support (ABLS) training through both the traditional ABLS courses and the new Web-based ABLS Now course.

4. Provision of a laminated burn transfer criteria guide to all hospital emergency rooms in the nation, to also contain reference to ABA Web site information on verified and other burn centers in their area.

5. Work with the U.S. Departments of Health and Human Services and Homeland Security to assist in the development of mass burn casualty disaster planning at the federal level to include the following:

a. Provision of “Disaster Management and the ABA Plan” and other resource information, such as the ABA’s “Burn Care Resources in North America” to relevant federal disaster planning agencies, including information on ABA Web site access for ongoing updates and ABA Central Office contact information.

b. ABA development, in conjunction with HHS, the Department of Homeland Security, and private sector entities, of a real-time communication system for burn bed, as well as supplies and personnel, availability.

c. Surge capacity issue discussion, addressing disaster area (noting the potential desirability of temporary use of burn specialty teams under the National Disaster Medical System to both augment burn services at the disaster area and to assist with secondary triage transfer of burn patients to burn centers outside the disaster area), the potential for deployable burn care facilities, and increasing the number of National Disaster Medical System Burn Specialty Teams.

d. Related issues for discussion/possible federal legislation proposals include the following:

- Compensation for the receiving burn center and burn surgeons when the persons transferred are uninsured

- Preferential reimbursement for verified burn centers, so that these facilities will survive economically and continue as a national resource for mass disaster preparedness

- The different levels of burn supplies that should be in reserve in the National Strategic Stockpile overseen by the Centers for Disease Control and Prevention in HHS for different numbers of mass disaster burn casualties and interacting with efforts such as the “Customs Trade Partnership Against Terrorism” and the industrial hotline to obtain supplies in a disaster, and drawing on the expertise of the American Association of Tissue Banks relative to the availability/transport of skin for burn victims

- Possible grant funding and/or legislative initiatives to increase the supply of burn surgeons and nurses through educational loan forgiveness and fellowship support

- Federal grants to increase widespread knowledge of initial burn evaluation and treatment through ABLS and the expansion of ABA’s National Burn Repository program to better ascertain resource needs in disaster situations and the most effective triage and care components

6. Encourage all burn centers to execute a Burn Center Transfer Agreement with other burn centers, because secondary triage transfer from one burn center to another will require a transfer agreement. (The ABA will give consideration to requiring burn center transfer agreements to be in place for verification.)
7. Encourage incorporation into the hospital-specific disaster plan of ABA-recommended triage plan for burn casualty mass disaster situations and provide outpatient care for nonintubated patients with burns covering <20% TBSA; also, address issues of communication with families, psychological support needs, and media control.

8. Communication systems to ensure the ability of ongoing communication among emergency personnel, hospitals, and disaster response coordinators are a critically important issue that needs to be addressed on the federal, state, and local levels.

ABA Board of Trustees: Richard L. Gamelli, MD, FACS; Gary F. Purdue, MD, FACS; David G. Greenhalgh, MD, FACS; Roger W. Yurt, MD, FACS; Richard J. Kagan, MD, FACS; G. Patrick Kealey, MD, FACS; Robert L. Sheridan, MD, FACS; David R. Patterson, PhD; Lynne C. Viorko, RN, BSN; Patricia W. Gillopis, RN, BSN; MS; Barry K. Bennett, LCSW; Lynn D. Solem, MD, FACS; Marion H. Jordan, MD, FACS; Jeffrey R. Saffle, MD, FACS.

ABA Committee on Organization and Delivery of Burn Care: Nicole S. Gibran, MD, FACS; Anita M. Fields, RN, BSN; Verna J. Cain, RN; Matthew B. Klein, MD; David W. Moozingo, MD, FACS; Bruce A. Cairns, MD; Timothy Embolf, MD, Jette Hind, RN; Elles Howard, PhD, RN, BSN; William B. Hughes, MD; Yvonne M. Humphries, RN; Patrick R. Kadlak, RN, MSN, CNS; Cynthia Lynn Bogart, RN, BSN; Lee D. Fauchoe, MD; Susan M. Harfield, Pa-C; William J. Moe Jr., MD, Pamela A. Wielbelhaus, RN, BSN; Brett D. Arnoldo, MD; David J. Barillo, MD, FACS; Betty Jane Bartelson, RN, MSN; Palmer Q. Hoover, MD, FACS; Carolyn B. Bayne, RN, BSN; Leopoldo C. Cancio, MD; Kathe M. Conlon, RN; Justin C. Murphy, RN, BSHA; Nelson Sarto Piccolo, MD, John A. Twomey, MD, FACS.

American Burn Association Board of Trustees and the Committee on Organization and Delivery of Burn Care. (2005). Disaster Management and the ABA Plan, 26(2), 102–106.

CASE STUDY

12.4 ABA Burn Center Referral Criteria

Burn Centers are a unique national resource. According to the American Burn Association (ABA), the United States currently has 132 burn care centers representing approximately 1,897 burn beds nationwide. A listing of these centers can be found at www.ameriburn.org. In comparison, there are as many as 1,000 trauma centers.

In recognition of the complex nature of burn injuries, the U.S. Department of Health and Human Service have incorporated burn centers into state and local disaster plans. They have also been recognized by the federal government in bioterrorism legislation. The ABA Burn Unit Referral Criteria is well published and followed in the medical community. Burn Unit Referral Criteria, as recognized by the ABA and the American College of Surgeons, include the following:

1. Partial thickness burns greater than 10% total body surface area (TBSA)
2. Burns that involve the face, hands, feet, genitalia, perineum, or major joints
3. Third-degree burns in any age group
4. Electrical burns, including lightning injury
5. Chemical burns
6. Inhalation injury
7. Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality
8. Any patients with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or mortality. In such cases, if the trauma poses the greater immediate risk, the patient may be initially stabilized in a trauma center before being transferred to a burn unit. Physician judgment will be necessary in such situations and should be in concert with the regional medical control plan and triage protocols.
9. Burned children in hospitals without qualified personnel or equipment for the care of children
10. Burn injury in patients who will require special social, emotional, or long-term rehabilitative intervention

Key Messages

- Blast victims, though rarely treated in domestic U.S. hospitals, present with injury patterns that are unique to their mechanism.
- Penetrating and blunt injuries are commonly sustained following an explosion; therefore, standard Advanced Trauma Life Support and Advanced Cardiac Life Support principles can be applied. However, unique injuries occur due to the mechanism of blast waves.
- Higher morbidity and mortality are associated with explosions occurring in confined areas and any related structural collapse.
- Of the survivors seeking care, half will present to medical professionals in the first hour postinjury. Additionally, ambulatory patients will arrive to medical facilities prior to the most critical, producing a unique triage situation (Centers for Disease Control and Prevention [CDC], 2005d).

Learning Objectives

When this chapter is completed, readers will be able to

1. Discuss the classification of explosives and the associated mechanisms of injury.
2. Identify the types of injuries resulting from explosions and blasts.
3. Discuss the clinical care of blast survivors.
4. Discuss the initial management of the event and the associated injuries.
Traumatic Injury Due to Explosives and Blast Effects

Tara Sacco

CHAPTER OVERVIEW

Excluding military medical personnel, few health care practitioners in the United States have experienced the effects of an explosion. The impetus for practitioners to gain an understanding of the care of this patient population and the management of the event is directly related to the increased threat of domestic and international terrorist attacks (DePalma, Burris, Champion, & Hodgson, 2005). This chapter will present a brief description of the history of explosions and blast injuries, the classification of explosives and their mechanisms of injury, and will also discuss traumatic blast injuries, the clinical care of survivors, and event management.

INTRODUCTION

According to the Institute for Counter-Terrorism (2003), an Israeli organization, there have been 1,427 terrorist attacks from 1980 to 2002. Countries affected have included Afghanistan, Algeria, Bangladesh, Chechnya, China, Colombia, Jordan, Kenya, India, Indonesia, Israel, Pakistan, the Philippines, Russia, Saudi Arabia, Spain, the United States, Yemen, and others. Selected domestic attacks have included the events of 9/11, the Oklahoma City bombing in 1995 (Arnold, Halpern, Tsai, & Smithline, 2004), and the World Trade Center explosion in 1993 (Wightman & Gladish, 2001). From 1991 to 2000, 88% of terrorist attacks involved explosions and resulted in significant strain on emergency medical systems in the affected countries (Arnold et al., 2004). Compared with chemical and biologic terrorism, explosive attacks produce greater cost associated with mortality, injury, and the associated effects on infrastructure (DePalma et al., 2005). Terrorist attacks have become a realistic threat to the United States over the past decade, necessitating health care practitioners to care for mass casualty victims.

Many health care practitioners have the knowledge and skill sets required to care for blunt and penetrating trauma from motor vehicle accidents, falls, gunshot wounds, and the like; however, few have cared for survivors of an explosion. Whether the result of an industrial accident or a terrorist attack, explosions produce casualties that will present with blunt and penetrating...
injuries but will also present with injuries unique to the type, proximity to, and location of the explosion. Physicians and health care practitioners have tradition-
ally believed that they would very rarely care for those suffering from blast injuries unless they were partici-
pating in humanitarian efforts or involved in military activity (Wightman & Gladish, 2001). The Centers for Disease Control and Prevention (CDC, 2005c), however, states: “As the risk of terrorist attacks increases in the U.S., disaster response personnel must understand the unique pathophysiology of injuries associated with explo-
sions and must be prepared to assess and treat the people injured by them” (n.p.). This includes all health care practitioners participating in disaster management and response. Preparation includes expanding knowl-
edge of explosives, mechanisms of injury, clinical care of survivors, and event management.

CLASSIFICATION OF EXPLOSIVES

Explosives used in terrorist attacks can be classified into two categories: high-order explosives (HE) and low-
order explosives (LE). HEs pose a greater injury risk to those closest to the explosion because they produce an overpressurization shock wave, whereas an LE does not (CDC, 2005c). Plastic explosives, HE mixed with oil or wax, are used by terrorists because they are easily con-
cealable. HEs often are composed of a trigger, a fuse, and a main charge. Detonation, the process by which the ex-
plosive agent converts into a gas of the same volume, can be triggered by motion detectors, photoelectric cells, timers, radiation, and remote-controlled signals. When an HE detonates, the gas produced expands and com-
presses the occupied area. This produces a blast wave, which demonstrates brisance, or the peak-shattering characteristic, Briggs and Brinsfield (2003, p. 95) state, “The

Table 13.1. Types of Explosives

<table>
<thead>
<tr>
<th>HIGH-ORDER EXPLOSIVES</th>
<th>LOW-ORDER EXPLOSIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TNT</td>
<td>Pipe bombs</td>
</tr>
<tr>
<td>C-4</td>
<td>Gunpowder</td>
</tr>
<tr>
<td>Semtex</td>
<td>Molotov cocktails</td>
</tr>
<tr>
<td>Nitroglycerine</td>
<td>Aircraft improvised (guided missiles)</td>
</tr>
<tr>
<td>Dynamite</td>
<td>Flash powder</td>
</tr>
<tr>
<td>PETN</td>
<td>Ammonium nitrate fuel oil</td>
</tr>
</tbody>
</table>

The combined explosion produces a blast wave origi-
nating from a larger area, prolonging it, thus producing more damage (DePalma et al., 2005). Different types of explosives and their classification can be viewed in Table 13.1.

Following an HE detonation, a blast wave is pro-
duced. Each blast wave consists of three parts: posi-
tive pressure, negative pressure, and blast wind. The period of positive pressure, also referred to as the blast
front, is short and occurs as blast energy moves from its point of origin outward in an equally spherical man-
ner. The blast front causes the most damage (Linsky & Miller, 2005). The physical change from the constant
pressure of the medium in which the blast occurs to the blast wave pressure produces overpressure, or the amount increase in pressure. If the blast wave is pow-
erful enough, the change in pressure will result in a shock wave and will demonstrate the principle of bri-
sance (Wightman & Gladish, 2001). Peak overpressure is a term used to describe the extent of the blast front
impulse and is influenced by the size of the explosive, distance from the detonation site, and the surrounding
medium (air, water, etc.). Detonating a bomb underwa-
ter will produce more damage than air detonation be-
cause water is incompressible. This property results in
blast wave transmission at a higher speed and intensity (Linsky & Miller, 2005). Considering this unique char-
acteristic, Briggs and Brinsfield (2003, p. 95) state, “The
lateral radius around an explosion underwater is about
three times that of a similar explosion in the air.” In ad-
in, the presence of walls, structures, or people,
Chapter 13  Traumatic Injury Due to Explosives and Blast Effects  241

MECHANISMS AND CLASSIFICATION OF INJURY

Injuries produced by a blast wave are caused by the following principles: shearing, spalling, implosion, pressure differentials, and inertia. Because the body is composed of tissues of different densities, as the blast wave moves through the body, the tissues will move at different speeds. When adjacent tissues move at different speeds, shearing occurs. Tissue density is also the variable in spalling. This occurs when the blast wave moves through different body tissues and interacts with their density, causing the velocity of the wave to change (Briggs & Brinsfield, 2003). The tissues of higher density are thrown into those of lower density, causing injury. Regions of the body containing air, such as the lungs, sinuses, inner ear, and colon, are at risk for implosion. As the blast wave moves through the area, the air-filled space experiences a rebound expansion because air is easily compressible. When the blast wave moves from a compressible (air-filled) area to one that is incompressible (fluid-filled), a pressure gradient is produced that will also result in a shearing injury. The inertia produced by the blast wind contains enough force to throw a body against various objects, resulting in blunt or penetrating injuries (Linsky & Miller, 2005). Note the victims’ distance from the explosion’s epicenter. There is a strong correlation between the severity of the blast injury and the proximity to the epicenter; those closest to the epicenter generally have poorer health outcomes (Leibovici, Gofrit, & Shapira, 1999).

In the discussion of blast injuries, it is essential to include the difference between blunt and penetrating trauma. Blunt injuries occur with a change in velocity, whether an acceleration, deceleration, or direct transfer. Factors that may directly affect injury pattern include extrication, or rescue time; ejection; location; speed; direction of impact; and status of associated casualties. Penetrating injuries are those that result from objects breaking the skin and tunneling through underlying tissues. Care must be taken not to underestimate the severity of these injuries because external wounds may not be representative of internal damage (Urdan, Stacy, & Lough, 1998). Considerations with penetrating injuries include region of the body affected, velocity and size of the penetrating object, and the distance of the wound from the force behind the penetrating object (American College of Surgeons, 2004). Different blunt and penetrating injuries will be discussed further in the following sections.

All injuries that are the result of an explosion are categorized as primary, secondary, tertiary, and quaternary blast injuries. Casualties with primary blast injuries are a direct result of the blast wave from HEs. The

Figure 13.1 Progression of a blast wave over time.


The blast wave will be reflected, amplifying the wave’s energy. More damage will be done to a structure or a person adjacent to a reflected blast wave. This principle explains why closed-space explosions are more injurious than open-air explosions (Linsky & Miller, 2005). A vacuum, or underpressure, is created during the negative pressure portion of the blast wave as the pressure produced drops below that of predetonation pressure. This occurs because the gas produced continuously expands (Wightman & Gladish, 2001) and draws debris inward to the site of the explosion, resulting in more damage (Linsky & Miller, 2005). Finally, the blast wind produced can reach speeds similar to hurricane gales. In comparison, the blast wind, though not sustained, has enough force to launch objects through the air (Vaughan, 2005). See Figure 13.1 for a graphical depiction of a blast wave over time.

Resultant bodily and structural damage following an explosion is dependent on numerous variables, including type of explosive, medium in which the explosion occurred, and proximity to the explosion’s epicenter. HEs have the unique characteristic of producing a blast wave, which will inflict more damage than the use of an LE. Water’s unique property of incompressibility results in increased intensity of a blast wave, thus producing more damage. Air explosions will produce less damage than underwater explosions; however, damage will also depend on whether the explosion occurred in an open or closed air space because of reflection and subsequent amplification of the blast wave. Knowledge of the type of explosive, medium, and the area surrounding the incident will assist health care providers to determine what type of injuries and how many casualties to expect following an explosion.
Mechanism of Blast Injury

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CHARACTERISTIC</th>
<th>BODY PART AFFECTED</th>
<th>TYPES OF INJURIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Unique to HE, results from the impact of the overpressurization wave with body surfaces.</td>
<td>Gas-filled structures are most susceptible—lungs, GI tract, and middle ear.</td>
<td>Blast lung (pulmonary barotrauma). TM rupture and middle-ear damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Abdominal hemorrhage and perforation—globe (eye) rupture, concussion (FBI without physical signs of head injury).</td>
</tr>
<tr>
<td>Secondary</td>
<td>Results from flying debris and bomb fragments.</td>
<td>Any body part may be affected.</td>
<td>Penetrating ballistic (fragmentation) or blunt injuries.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Eye penetration (can be occult).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fracture and traumatic amputation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Closed and open brain injury.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Burns (flash, partial, and full thickness).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crush injuries.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Closed and open brain injury.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Asthma, COPD, or other breathing problems from dust, smoke, or toxic fumes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Angina.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hyperglycemia, hypertension.</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Results from individuals being thrown by the blast wind.</td>
<td>Any body part may be affected.</td>
<td></td>
</tr>
<tr>
<td>Quaternary</td>
<td>All explosion-related injuries, illnesses, or diseases not due to primary, secondary, or tertiary mechanisms.</td>
<td>Any body part may be affected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Includes exacerbation or complications of existing conditions.</td>
<td>Any body part may be affected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


overpressure or underpressure produced by this wave causes barotrauma to air-filled organs (DePalma et al., 2005). Secondary injuries are those caused by debris thrown by the blast wave and comprise 20% to 40% of all blast injuries. The incidence increases in a closed-space explosion. IEDs may induce further secondary injury because they are packed with nails and bolts, and military-grade HEs are designed to fragment (Linsky & Miller, 2005). In regards to secondary injuries, DePalma et al. (2005, p. 1338) state, “Penetrating injuries... are the leading cause of death and injury in both military and civilian terrorist attacks, except in cases of a major building collapse.” Tertiary blast injuries are the consequence of an explosion’s blast wind. In contrast to secondary injury, tertiary injuries are blunt-force injuries caused by victims being thrown by the blast wind (Linsky & Miller, 2005). Finally, quaternary injuries, also referred to as miscellaneous injuries, are those that are a result from the explosion but are not due to the blast wind or blast wave. Preexisting conditions that are exacerbated as a result of the blast are also considered quaternary injuries (CDC, 2005c). Of particular concern following an explosion is structural collapse, which is associated with a very high mortality rate. A large amount of explosive is required to cause structural collapse and the high mortality rate is due to crush injuries, an increased likelihood of reflective blast waves, and extended extrication time (Briggs & Brinsfield, 2003). Table 13.2 provides a summary of blast injuries categories, characteristics, affected body areas, and selected types of injuries. A presentation of blast injuries by body system is presented in the following sections.

BLAST INJURIES AND CLINICAL CARE OF SURVIVORS

Initial treatment of casualties of an explosion or blast is the same as for those with injuries from motor vehicle accidents, gunshots, falls, burns, and other major traumatic mechanisms. Vaughan (2005, n.p.) states the immediate focus in the event of an explosion is maintaining “life and limb.” The principles of Advanced Cardiac Life Support (ACLS), Advanced Burn Life Support (ABLS), Advanced Trauma Life Support (ATLS), and Advanced Trauma Care for Nurses (ATCN) should also be applied in this situation. Each of these certification programs discusses assessment in reference to primary and secondary surveys, progressing
## 13.3 ATLS Primary Survey

<table>
<thead>
<tr>
<th>SURVEY</th>
<th>IDENTIFICATION AND MANAGEMENT</th>
<th>POTENTIAL HAZARDS</th>
</tr>
</thead>
</table>
| A: Airway and cervical spine immobilization | ■ Assess and maintain airway patency: assess for foreign bodies and fractures that may lead to obstruction.  
■ Unknown laryngeal fracture or incomplete airway transection. |
| B: Breathing and ventilation | ■ Assess for bilateral chest wall movement. Auscultate, percuss, visualize, and palpate the chest wall and lung fields.  
■ Pneumothorax, flail chest, hemothorax, and open pneumothorax must be identified and treated. | ■ Intubation and positive pressure ventilation may complicate pneumothoraces and tension pneumothoraces.  
■ Following intubation and ventilation, the chest must be reexamined and chest X-ray obtained to rule out further complications.  
■ Tachycardia may not be present in the hypovolemic elderly or athletic victim.  
■ Children compensate for hypovolemia rapidly; tachycardia and hypotension are late signs. |
| C: Circulation | ■ Consider hypovolemia the cause of hypotension until proven otherwise.  
■ Assess level of consciousness, skin color, and pulse for signs of hypovolemia and hypoxia.  
■ Identify and control external hemorrhage, identify internal hemorrhage | ■ Level of consciousness and neurologic status can deteriorate rapidly, necessitating frequent reevaluation. |
| D: Disability and neurologic deficit | ■ Assess Glasgow Coma Scale, pupil size and reactivity, and for spinal cord injury.  
■ A decreased level of consciousness may require intubation for airway protection.  
■ Assess for hypoglycemia, alcohol, and drugs as they may alter level of consciousness. | |
| E: Exposure and environmental control | ■ Expose the patient to view all body surfaces for evidence of injury. Cover with warm blankets and use warmed intravenous fluids to maintain temperature. | ■ Rapid and massive infusions of fluid and blood products will induce hypothermia. Early control of hemorrhage and warming methods will prevent hypothermia. |

Source: This information is compiled from American College of Surgeons. (2004). Advanced Trauma Life Support for doctors (7th ed.). Chicago: American College of Surgeons.

From the most life-threatening injury to the least and varying only slightly, basic ACLS protocol calls for Airway, Breathing, Circulation, and Defibrillation in the primary survey. The ACLS secondary survey includes Airway, Breathing, Circulation, and Differential diagnosis (American Heart Association, 2004). The primary surveys for ABLs and ATLS are identical and include Airway, Breathing and ventilation, Circulation, Disability and neurologic deficit, Exposure and environmental control. They differ, however, in the secondary survey. ABLs includes the following components: history, physical examination, and adjunctive therapies, including initiation of fluid resuscitation. The ABLs physical examination also includes determining the depth and total body surface area of the burn (American Burn Association, 2005). These processes are further discussed in this chapter but do apply to all blast injuries as they are at risk for thermal, chemical, electrical, and radiation burns.

ATLS and ATCN follow the same primary and secondary surveys. During the primary survey, identification and management of life-threatening injuries occur simultaneously. See Table 13.3 for a description of the primary survey per ATLS protocol. Within the secondary survey, a complete history of the event and past medical history is obtained. To aid and expedite this process, an AMPLE history can be completed. This includes Allergies, Medications, Past illnesses and Pregnancy, Last meal, and Events leading to the injury. A physical examination follows; this is more detailed than the initial exam in the primary survey. Table 13.4 outlines assessment considerations during the secondary survey.
## 13.4 Secondary Survey Physical Examination

<table>
<thead>
<tr>
<th>BODY SYSTEM</th>
<th>EXAMINATION</th>
<th>POTENTIAL HAZARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurologic</td>
<td>■ Assess level of consciousness, sensory and motor function, and pupillary response.</td>
<td>■ Secondary brain injury may result from increased intracranial pressure and hypoxia may lead to secondary brain injury.</td>
</tr>
<tr>
<td></td>
<td>■ Consult neurosurgery and obtain a head CT if a head injury is suspected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Maintain spine precautions. Consult neurosurgery or orthopedics if an injury is suspected.</td>
<td></td>
</tr>
<tr>
<td>Head</td>
<td>■ Examine scalp and head for injury and fractures.</td>
<td>■ Facial and periorbital edema will progressively impair eye exams. Completion of an initial eye exam is essential.</td>
</tr>
<tr>
<td></td>
<td>■ Assess vision and pupils. Hemorrhage, penetrating injury, lens dislocation, and ocular entrapment may occur.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Contacts should be removed at this time.</td>
<td></td>
</tr>
<tr>
<td>Maxillofacial</td>
<td>■ Assess for fractures and soft-tissue injury. Management may be delayed until the patient is safely stabilized.</td>
<td>■ Reassessment is necessary as facial fractures may not be identified early during the primary and secondary surveys.</td>
</tr>
<tr>
<td></td>
<td>■ Place a gastric tube orally in patients with suspected or confirmed facial fractures.</td>
<td></td>
</tr>
<tr>
<td>Cervical Spine and Neck</td>
<td>■ Visualize, palpate, and auscultate the patient's neck.</td>
<td>■ Blunt injuries of the neck require frequent reassessment as signs develop late.</td>
</tr>
<tr>
<td></td>
<td>■ Maintain spine precautions. Surgical assessment is necessary for penetrating neck wounds.</td>
<td>■ Spine injuries should be ruled out as soon as possible as the patient is at risk for pressure ulcers from spine immobilization techniques.</td>
</tr>
<tr>
<td>Chest</td>
<td>■ Assess and palpate the chest anteriorly and posteriorly.</td>
<td>■ The elderly rapidly progress to respiratory difficulty in the event of chest injuries.</td>
</tr>
<tr>
<td></td>
<td>■ Auscultate breath and cardiac sounds.</td>
<td>■ Significant chest injury may be present in children with a lack of blatant signs.</td>
</tr>
<tr>
<td>Abdomen</td>
<td>■ Unexplained hypotension may be the result of an internal hemorrhage.</td>
<td>■ Frequent reassessment is necessary as signs of abdominal injury change with time.</td>
</tr>
<tr>
<td></td>
<td>■ Peritoneal lavage, ultrasound, and abdominal CT may be necessary to rule out injury.</td>
<td>■ Avoid pelvic manipulation if possible due to the potential for internal hemorrhage.</td>
</tr>
<tr>
<td>Perineum, rectum, and vagina</td>
<td>■ Assess for contusions, hematomas, lacerations, and bleeding.</td>
<td>■ Perineal, rectal, and vaginal injuries may be the result of pelvic injuries.</td>
</tr>
<tr>
<td></td>
<td>■ Perform a rectal exam prior to placing a Foley catheter.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ A gynecologic exam should be performed.</td>
<td></td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>■ All extremities, the pelvic ring, peripheral pulses, and thoracic and lumbar spine should be assessed.</td>
<td>■ Hemorrhage from pelvic fractures is not uncommon.</td>
</tr>
<tr>
<td></td>
<td>■ If necessary, X-rays should be obtained when the patient is stabilized.</td>
<td>■ Hand, foot, and wrist fractures and soft tissue injuries may be missed. Frequent reevaluation should take place to identify these.</td>
</tr>
</tbody>
</table>

Expected; however, other neurologic and preexisting conditions may mimic the signs and symptoms of MTBI due to the risk of infection and cerebral abscess. Loss of consciousness (LOC), headache, confusion, dizziness, nausea, impaired memory, and potential amnesia are characteristics of concussions.

A contusion, or bruise, is caused by an acceleration-deceleration mechanism. Mild traumatic brain injury (MTBI), a primary injury, may result from the blast wave itself. Again, the closer to the epicenter, the higher the likelihood of secondary injury because they will continue to be suspected (CDC, 2005b). MTBI may also be caused by secondary, tertiary, and quaternary mechanisms. With any abnormal neurologic finding, MTBI should be suspected (CDC, 2005b). Other blunt and penetrating injuries to the head include skull fracture, missile injury, concussion, contusion, epidural hematoma (EDH), subdural hematoma (SDH), subarachnoid hemorrhage (SAH), intracerebral hemorrhage (ICH), and diffuse axonal injury (DAI).

Brain Injury

Victims of blast injury are susceptible to neurologic insult by primary, secondary, tertiary, and quaternary mechanisms. Mild traumatic brain injury (MTBI), a primary injury, may result from the blast wave itself. Again, the closer to the epicenter, the higher the likelihood of a MTBI. In patients presenting with headache, anxiety, insomnia, and decreased level of consciousness without any obvious blunt or penetrating injury, a MTBI should be suspected (CDC, 2005b). MTBI may also be caused by secondary, tertiary, and quaternary mechanisms. With any abnormal neurologic finding, MTBI should be suspected; however, other neurologic and preexisting conditions may mimic the signs and symptoms of MTBI (CDC, 2005b). Other blunt and penetrating injuries to the head include skull fracture, muscle injury, concussion, contusion, epidural hematoma (EDH), subdural hematoma (SDH), subarachnoid hemorrhage (SAH), intracerebral hemorrhage (ICH), and diffuse axonal injury (DAI). Head trauma may occur with or without skull fractures. As with all fractures, they may be open or closed; open fractures often require surgical intervention to remove fragments and debris. Basilar skull fractures are often associated with cerebrospinal fluid (CSF) leak and place the victim at risk for meningitis. A missile injury is a penetrating trauma that causes a focal neurologic injury. Fragments and debris from open skull fractures and missile injuries may require neurosurgical intervention due to the risk of infection and cerebral abscess.

Develop over time. EDH develops on top of the dura and is the result of an arterial bleed. Skull fractures that tear the middle meningeal artery often cause EDH. Victims with EDH may present with brief LOC, progress to lucidity, and exhibit a rapid deterioration in level of consciousness and Glasgow Coma Scale. In contrast to EDH, SDH is a venous bleed between the dura and arachnoid membrane. Acceleration-deceleration and rotational mechanisms cause SDH and may require neurosurgical intervention (Urdon et al., 1998). SAH is a bleed between the arachnoid membrane and the brain, occurring in the CSF spaces. These bleeds are often capillary or venous in origin (Sheeh, 2005). Depressed skull fractures, penetrating trauma, and acceleration-deceleration mechanisms may cause an ICH, which occurs within the cerebral hemispheres. Clinical progression of an ICH may be rapid or may develop over 6 to 10 days. Finally, DAI is caused by acceleration-deceleration and rotational mechanisms in which a shearing of axons occurs. This disrupts impulse transmission and varies in severity. Severe DAI is associated with poor neurologic outcomes (Urdon et al., 1998). Any victim in which a severe neurologic injury is confirmed or suspected should, at minimum, be seen by a neurosurgeon or transferred to a facility with neurosurgical services.

Nursing interventions following a brain injury should focus on optimizing function and preventing secondary injury. ABCs should be maintained at all times. Patients are at risk for elevated intracranial pressure (ICP). To minimize this, the following interventions should be initiated: maintain a quiet environment, maintain head and neck alignment, avoid constricting the neck vessels with tape and devices to secure an endotracheal tube (ETT), avoid procedures that may increase ICP, avoid repeating procedures that cause elevated ICP, avoid multiple procedures, elevate the head of the bed after spine care and medicate for pain. In the event that the victim requires mechanical ventilation, the ETT should be secured in another fashion, such as with half face tapes. In addition to pain medication, sedation, chemical paralysis, mannitol, and anticonvulsants may be necessary. Frequent monitoring of the head-injured victim includes vital signs, ICP and cerebral perfusion pressure (CPP) monitoring, pupillary reaction, level of consciousness, and Glasgow Coma Scale. If monitored, the ICP should be maintained between 0 and 15 and CPP determined by mean arterial pressure–ICP, between 60 and 70. Simultaneous rise in systolic blood pressure, bradycardia, and changes in respiration are signs of impending herniation and require immediate attention (Hotz, Henn, Lush, & Hollingsworth-Fridlund, 2003). Severe head injuries, particularly SAH and SDH, are the leading cause of death for explosion casualties and that the most common mechanisms is not due to the primary blast wave (Wightman & Gladish, 2001).
Head, Face, and Neck Injuries

Casualties with brain injuries are likely to present with head, face, and neck injuries. Tympanic membrane perforation is the result of primary injury mechanisms; symptoms include hearing loss, tinnitus, vertigo, and bleeding from the ear canal. Injury severity is dependent on the victim’s position in relation to the blast wave at the time of detonation (CDC, 2005c). Temporary or permanent hearing loss, tinnitus, and vertigo may be lasting consequences of tympanic membrane rupture because of damage to sensory organs in the middle and inner ear (Wightman & Gladish, 2001). Head and facial injuries caused by secondary, tertiary, and quaternary mechanisms include facial fractures, soft-tissue injuries, and ophthalmic injuries. Facial fractures may result from blunt or penetrating mechanisms; common sites are the nose, maxilla, and mandible. Maxillary facial fractures can be categorized as Le Fort I, Le Fort II, and Le Fort III. With Le Fort I fractures, the maxilla separates from the facial skeleton in a horizontal fashion. Le Fort II fractures include a classic Le Fort I fracture with orbit, ethmoid, and nasal involvement. Finally, complete facial bone separation from the cranium characterizes Le Fort III. Victims with Le Fort III fractures are at risk for CSF leaks. Soft-tissue injuries include abrasions and lacerations (Urden et al., 1998). Eye injuries, such as scleral lacerations, orbital fractures, lid lacerations, hyphema, traumatic cataracts, globe rupture, and serous retinitis, may result if the patient with facial fractures remains in a supine position due to lack of bony support. Progressive airway obstruction may result from hemorrhage from penetrating neck wounds. Bleeding into the trachea, bronchus, and lungs will all compromise the victim’s airway and ventilatory status. An artificial airway should be placed to maintain airway patency until intubation is required (American College of Surgeons, 2004). Chin lift/jaw thrust technique may be needed to open the airway for suctioning and bag-valve mask ventilation. Oropharyngeal and nasopharyngeal airways may also be used. However, oropharyngeal airways should not be used in patients with a positive gag reflex or oropharyngeal trauma. A nasopharyngeal airway should not be inserted in a patient with suspected facial fractures. Endotracheal intubation, performed by a credentialed professional, should be initiated in the event of airway compromise. If endotracheal intubation is unsuccessful, due to obstruction or edema, a needle cricothyroidotomy or surgical cricothyroidotomy may need to be performed by a surgeon until a tracheostomy can be placed (Hotz et al., 2003). After the airway is secured, continue with the primary and secondary surveys, including otoscopic evaluation for tympanic membrane rupture (CDC, 2005c), gastric tube placement. Any patient with confirmed or suspected facial fracture should have a gastric tube placed orally, not nasally. Transfer to definitive treatment may be necessary for proper injury management of victims with head, face, and neck injuries.

Cardiothoracic Injury

Primary, secondary, tertiary, and quaternary cardiothoracic injuries may result from an explosion. Several life-threatening conditions, hemorrhage, and hypovolemic shock are included in this discussion. The only primary blast injury in this category is blast lung, which may occur without the presence of gross external thoracic injury. Blast lung is the most fatal primary blast injury (CDC, 2005a). Tearing, hemorrhage, bruising, and edema are the direct result of the blast wave’s effect on the lungs. These mechanisms lead to ventilatory difficulty and a ventilation-perfusion mismatch. Casualties will present with dyspnea, tachypnea, cyanosis, hemoptysis, chest pain, wheezing, apnea, diminished breath sounds, and potential hemodynamic instability. A butterfly pattern on chest X-ray is indicative of blast lung (CDC, 2005a). As with all primary blast injuries, the victim’s body proximity to the wave determines the severity of blast lung. The side of the body closest to the epicenter will exhibit a more severe injury. Blast waves may also cause hemopneumothoraces, traumatic emphysema, alveoloventaneous fistulas, vagal nerve-mediated cardiogenic shock without vasoconstriction, bronchopleural fistulas, cardiac contusions, esophaegal rupture, and arterial air embolism (Wightman & Gladish, 2001). Chest and lung injuries resulting from blunt and penetrating trauma include rib fractures, flail chest, ruptured diaphragm, pulmonary contusion, pneumothorax, tension pneumothorax, open pneumothorax, and hemothorax. Rib fracture may indicate more severe chest injury. Vascular injuries are associated with...
first- and second-rib fractures, whereas hepatic and splenic injuries are associated with 7th through 10th-rib fractures. Pain associated with the work of breathing places the patient with these injuries at risk for ventilatory compromise. Flail chest is the incontinuity of the chest wall due to fractures of three or more ribs in two or more places, resulting in a free-floating segment of the chest wall. Paradoxical chest wall movement on inspiration and expiration is seen in this injury. A ruptured diaphragm is the result of high intra-abdominal pressure. Abdominal organs migrate into the chest cavity, which can compress heart, lungs, and mediastinum, diminishing venous return and cardiac output. The clinical presentation of pulmonary contusion is similar to blast lung. Contusions can be unilateral or bilateral and can increase pulmonary vascular resistance, reducing blood flow to the injured area. True manifestations of pulmonary contusions may take 1 to 2 days to develop. Pneumothorax occurs when air leaks into the pleural space. Tension pneumothorax occurs when the air flowing into the pleural space pushes the mediastinum into the unaffected lung. As the air pressure rises, and the heart and associated vessels are also forced to the unaffected side, the result is a decrease in cardiac output. Dyspnea, hypotension, chest pain, deviated trachea, and absent breath sounds are clinical signs of tension pneumothorax. Decompression of the affected side must be performed immediately as this is a life-threatening condition. An open pneumothorax, often caused by penetrating trauma, allows for atmospheric air to enter the pleural space. Clinical presentation is similar to that of a tension pneumothorax. Hemorrhage is the accumulation of blood into the pleural space. Hypovolemic shock may be the result of a hemorrhothorax due to blood loss and decreased cardiac output (Urden et al., 1998).

Nursing considerations for pulmonary injuries focus on the ABCs. Vitals signs should include pulse oximetry. Airway compromise, or occlusion, is initially unlikely in patients presenting with blast lung without the presence of copious hemoptysis; however, ventilatory difficulty is still likely. Airway protection and artificial airways should be used as needed. The highest oxygen concentration should be administered to those with blast lung. Other techniques to consider, if intubated, include pressure-controlled ventilation, positive end expiratory pressure of 10, reverse inspiratory/expiratory ratio, and nitric oxide (Wightman & Gladish, 2001). High peak inspiratory pressures should be avoided if possible because of the risk of air embolism and pneumothorax (DePalma et al., 2005). A patient presenting with rib fractures will primarily require pain management and close monitoring, particularly in the presence of pre-existing lung disease. Depending on severity, patients with flail chest, pulmonary contusions, pneumothorax, and hemothorax may require intubation and mechanical ventilation to maintain respiratory status. Fluid resuscitation is required if the lung injury decreases cardiac output or causes hypovolemia for any reason. Chest tubes should be placed in the case of pneumothorax, tension pneumothorax, open pneumothorax, and hemothorax. In addition, an occlusive dressing, taped on three sides, should be placed over an open pneumothorax wound. This dressing will prevent air from entering the pleural cavity on inspiration but also allow for air escape from the pleural cavity on expiration (Urden et al., 1998).

Following a pulmonary blast injury, victims are at risk for myocardial infarction (MI) due to arterial air embolism. This will cause cardiogenic shock and requires intervention (Wightman & Gladish, 2001). Blast victims may also suffer from penetrating cardiac injuries. The right ventricle is more prone to these injuries due to the heart’s position in the chest. Penetrating cardiac injuries result in high mortality rates in all trauma victims. Elevated central venous pressure with jugular distention, diminished heart sounds, and hypotension are signs and symptoms of Beck’s Triad, which is indicative of cardiac tamponade, the progressive compression of the heart from fluid entering the pericardial sac. Pulseless electrical activity may also be indicative of cardiac tamponade in absence of tension pneumothorax and hypovolemia. Decreased cardiac output, heart failure, and cardiogenic shock may result if intervention does not occur. Blunt cardiac injuries include cardiac contusion, concussion, and rupture. External chest trauma may indicate a potential blunt cardiac injury and EKG findings may include dysrythmias, ST segment changes, heart block, or sinus tachycardia (Urden et al., 1998).

Management considerations for MI due to arterial air embolism include maintaining preload in the presence of cardiogenic shock. Nitrates, vasodilators, and thrombolytic medications are contraindicated in this type of MI. Prevention of arterial air embolism includes placing the patient prone, in the semi孵 lateral position, or with the damaged lung (the source of the air embolism) down to increase capillary pressure in the lungs and prevent air bubbles from entering the blood stream (Wightman & Gladish, 2001). Pericardiocentesis, performed by a credentialed practitioner, is the treatment of choice for cardiac tamponade. To locate and stop bleeding into the pericardial sac, thoracotomy and median sternotomy may be performed. Blunt cardiac injuries may be treated medically with management of heart failure, external or internal pacing, and the use of antidysrythmics. Fluid and electrolyte balance is important in the management of all cardiac injuries. As with all critically injured patients, those with cardiac injuries should be continuously monitored and reevaluated (Urden et al., 1998).

Although other types of shock may be present in the trauma patient, such as cardiogenic and neurologic, hypovolemic shock is the most common. Management
requires identification and control of the source of blood loss. As blood volume diminishes, peripheral vasoconstriction begins in order to preserve blood flow to the vital organs, that is, the heart, brain, and kidneys. Tachycardia is, typically, the earliest vital sign change in response to hypovolemia. When hypovolemic shock is identified, management should begin with the traditional ABCs. Obvious hemorrhage should be controlled, venous access obtained, and intravenous fluid administration begun. Initial fluid resuscitation is the administration of one to 2 L of warmed fluid for the adult patient and 20 mL/kg in the pediatric patient (American College of Surgeons, 2004). Crystalloid products used for fluid resuscitation include normal saline and lactated ringers. Blood and blood products may also be used. Hotz et al. (2003, p. 26) states, “Administration of packed red cells or whole blood is indicated for the restoration of intravascular volume and oxygen carrying capacity.” Furthermore, urine output can be used to measure perfusion to the kidneys. The expected urine output for an adult patient is 0.5cc/kg/hr. The expected urine output in the pediatric population is 1cc/kg/hr. Decreases in urine output may be indicative of inadequate fluid resuscitation (American College of Surgeons, 2004). Acid-base balance must also be considered and metabolic acidosis is common. However, with proper fluid resuscitation, this will be corrected. Complications of fluid resuscitation in hypovolemic shock include hypothermia, thrombocytopenia, and coagulopathy. If resuscitation is initiated late or inadequately, multiple organ failure will develop due to hypoperfusion. Proper measures should be taken to prevent and correct these complications (Hotz et al., 2003).

Abdominal and Pelvic Injury

The organs of the gastrointestinal track are often air filled, making this body system more prone to primary blast injury than others. Casualties will present with abdominal pain, nausea, vomiting, hematemesis, and unexplained hypovolemia. Bowel perforation, hemorrhage, shear injury, hepatic and splenic lacerations, and testicular rupture (CDC, 2005c), in addition to mesenteric ischemia and infarct, have a higher incidence the closer the victim is to the blast’s epicenter. Hemorrhage and edema formation in the abdominal cavity may lead to abdominal compartment syndrome and further tissue death (DePalma et al., 2005). Small- and large-bowel rupture are likely to present days after initial injury due to progressive stretching and ischemia. Though the blast wave will cause some intra-abdominal injury, injuries to the liver, spleen, kidneys, and stomach are typically the result of blunt or penetrating trauma (Wightman & Gladish, 2001). Hepatic and splenic injuries are assessed and graded based on a severity scale of I through V, with Grade I indicating a less significant injury than Grade V. Hemodynamic instability may accompany hepatic and splenic injuries. Renal contusions and lacerations are typically the result of blunt trauma. Hematuria may or may not be present and often resolves without intervention. Bladder contusion, rupture, and combined injuries occur most frequently as the result of pelvic fracture. Pelvic fractures vary in severity and the amount of involvement of surrounding tissues, and may be open or closed. Anterior-posterior compression describes fractures of the pubic symphysis of varying severity, whereas lateral compression is a fracture of the sacroiliac joint with or without pubic rami fracture. A vertical shear injury occurs when the entire hemipelvis is disrupted and displaced. Open pelvic fractures may involve the vagina, rectum, or perineum. Because of the risk of internal and external hemorrhage, care must be taken to prevent hypovolemic shock. (Urdan et al., 1998). With disruption of the pelvic ring, there is a potential for venous and arterial injury, resulting in rapid and severe hemorrhage. Signs of hemorrhage include hypotension and flank, scrotal, and perianal ecchymosis. If pelvic injury is suspected, manual manipulation is used to assess instability. This is to be performed once because repeated manipulation may cause more damage and hemorrhage. Crush injuries, discussed with extremity injuries, are also commonly seen with pelvic disruption (American College of Surgeons, 2004).

Patients who present in hypovolemic shock, without signs of external hemorrhage, should have a focused abdominal sonography for trauma (FAST) performed as part of the primary or secondary survey. In the case of blunt abdominal hemorrhage, surgical intervention should occur as soon as possible (Wightman & Gladish, 2001). Diagnostic peritoneal lavage may be performed at the bedside if a FAST is unavailable. Abdominal and pelvic CT scans should also be performed to assess injury extent. Gastric tubes and urinary catheters are placed to decompress the stomach and bladder and monitor for signs of hematemesis and hematuria. Patients with significant abdominal injuries may require initial damage-control procedures, further resuscitation in the intensive care unit, and definitive surgical repair when the patient is further stabilized. The patient should be treated to prevent and correct signs and symptoms of hypovolemia and end organ failure. Gross hemorrhage predisposes the patient to intra-abdominal compartment syndrome, which can be assessed by monitoring abdominal pressures through a Foley catheter. Abdominal pressures of 10 to 20 are considered slightly elevated, 20 to 40 mildly elevated, and greater than 40 severely elevated. Mildly and severely elevated abdominal pressure requires surgical intervention to decompress the abdomen and prevent organ damage. Definitive pelvic stabilization occurs after the potential for
internal or external hemorrhage is ruled out or effect- 
vively treated (Urden et al., 1998). Pelvic splinting to 
stabilize the injury and decrease pelvic volume should 
be instituted to prevent hemorrhage. Internal rotation of 
the legs can reduce pelvic volume as well as applying 
traction and external splints (American College of Sur-
geons, 2004). Patients with severe abdominal and pelvic 
trauma should be referred to a center capable of caring 
for the injury.

Spinal Cord Injury

Spinal cord injuries may result from hyperflexion, hy-
perextension, rotation, vertical compression, and pene-
trating mechanisms. These injuries may also be com-
plete or incomplete. Hyperflexion injuries typically 
affect the cervical spine and are often deceleration 
injuries. Cord compression occurs from fractures and 
dislocation of the vertebrae. Hyperextension injuries 
stretch the spinal cord in a downward and backward 
manner, resulting in contusion and ischemia of the 
spinal cord that may or may not be associated with 
vertebral injury. A rotational injury may accompany a 
hyperflexion or hyperextension injury. The posterior lig-
aments of the spinal column tear, resulting in displace-
ment. Vertical compression causes burst fractures of the 
vertebrae; the cord is damaged as a result of fragments 
from the fracture. Penetrating injuries have the poten-
tial to transect the spinal cord, resulting in permanent 
injury. Following the primary cord injury, secondary in-
jury may result from ischemia and inflammation. Com-
plete injury is the loss of sensation and motor function 
below the level of the injury, leading to quadriplegia 
and paraplegia. If there is any sensory or motor func-
tion below the level of the injury, an incomplete injury 
has occurred. Brown-Sequard Syndrome, Central Cord 
Syndrome, Anterior Cord Syndrome, and Posterior Cord 
Syndrome are incomplete injuries. Damage to only one 
side of the spinal cord is termed Brown-Sequard Syn-
drome. Motor function is lost on the same side of the 
injury, whereas sensation is lost on the opposite side. 
Following a hyperflexion or hyperextension injury to the 
cervical spine, a hematoma may develop in the center 
of the spinal cord, resulting in Central Cord Syndrome. 
Motor and sensory dysfunction is more profound to the 
upper extremities than the lower. Pain, light touch, tem-
perature sensation, and motor function are affected by 
Anterior Cord Syndrome, which is caused by hyperflex-
ion injuries and disk herniation. These functions are 
lost below the level of the injury; however, position 
sense, pressure, and vibration sensation remain. Finally, 
Posterior Cord Syndrome occurs following a cervical 
spine hyperextension injury. In contrast to Anterior 
Cord Syndrome, position sense, pressure, and vibration 
sensation are lost and motor function, pain, tempera-
ture, and light touch sensations remain (Urden et al., 
1998).

Neurogenic shock and spinal shock may occur fol-
lowing a spinal cord injury. Neurogenic shock, due to 
the loss of a sympathetic response, results in a loss of 
vasomotor and cardiac sympathetic tone, leading to hy-
potension and bradycardia. The hypovolemic patient in 
neurogenic shock will not exhibit tachycardia. The com-
plete loss of reflexes initially following spinal cord injury 
is referred to as spinal shock. As spinal shock resolves, 
areas that were not damaged by the injury will regain 
function (American College of Surgeons, 2004).

Although loss of motor and sensory function may 
be of great concern to the victim, adherence to ABCs 
must occur before addressing psychosocial effects. If 
the diaphragm and intercostal muscles are affected by 
the injury, airway management is the priority. The vic-
tim may not recognize other injuries due to a loss of 
pain sensation. A cervical collar is placed to maintain 
spine immobilization, and remains on until spinal injury 
is ruled out. Before transfer, head and cervical spine 
immobilization, a backboard, and straps are required 
for complete spine immobilization. Fluid resuscitation 
is initiated as with other injuries; however, in the ab-
sence of hemorrhage, persistent hypotension may in-
dicate neurogenic shock. In this instance, vasopressors 
to maintain blood pressure are recommended. Therapy 
with methylprednisolone as a high-dose infusion is of-
ten initiated (American College of Surgeons, 2004). Use 
of methylprednisolone may improve outcomes by pre-
venting ischemia and improving metabolism and nerve 
conduction. Following injury, X-ray, CT, and MRI may be 
required to determine the extent of the injury. Definitive 
surgical management may also be necessary; the victim 
should be transferred to a medical center capable of pro-
viding these services (Urden et al., 1998).

Extremity Injury

Victims may exhibit secondary, tertiary, and quaternary 
musculoskeletal, soft-tissue, and vascular injuries fol-
lowing an explosion. Mechanisms include penetrating 
and blunt trauma. Closed and open pelvic, femoral, and 
tibial fractures are common, as well as joint injuries, 
contusions, and lacerations. Neurologic deficits in the 
affected limb may also occur. Penetrating extremity in-
juries and fractures near major blood vessels may cause 
hemorrhage from arterial disruption. Traumatic ampu-
tation may occur as a result of the injury. Surgical ampu-
tation may be required due to neurologic and vascular 
damage or to prevent hemorrhage. Reattachment of a 
severed limb is possible; however, the American Col-
lege of Surgeons (2004, p. 213) states that “a patient 
with multiple injuries who requires intensive resusci-
tation and emergency surgery is not a candidate for
Compartment syndrome is common, and may occur in the leg, forearm, foot, and gluteal region. Edema and inflammation, revascularization, and constricting dressing or splints will produce ischemia and necrosis (American College of Surgeons, 2004). A crush injury to the extremities and trunk may result in crush syndrome, the systemic effect following a localized crush injury. Muscle breakdown from the injury releases toxins leading to rhabdomyolysis, fluid retention, myoglobinuria, acidosis, hyperkalemia, and hypocalcemia. Hypovolemia and metabolic abnormalities may lead to cardiac arrhythmias and death. If untreated, rhabdomyolysis and myoglobinuria will lead to kidney failure (Briggs & Brinsfield, 2003).

Following management of ABCs, visual assessment of the affected extremity includes color, perfusion, open wounds, deformity, edema, and ecchymosis. Neurologic and pain assessment is performed by palpation. Dorsal pulses should be assessed bilaterally and frequently in the injured extremities. Splinting is performed as a temporary treatment. Any open wounds associated with fractures should be covered with sterile dressings. Further debridement and definitive treatment can occur with surgical exploration. Following injury or splinting, if dorsal pulses are not palpable, Doppler signals should be assessed. Pulse abnormalities, pallor, coolness, and paresthesias are indicative of potential arterial injury. If pulses are lost in these limbs, the pressure must be relieved by removing the splint or cast.

Loss of a distal pulse is a late sign of compartment syndrome necessitating surgical intervention, typically a fasciotomy of the affected extremity. If compartment syndrome is allowed to progress, rhabdomyolysis and myoglobin release will occur as in a crush injury (American College of Surgeons, 2004). Limb amputation may be necessary following large wounds with or without contamination, persistent hypotension, or prolonged entrapment, extrication, and compartment syndrome. In the event of a crush injury and subsequent crush syndrome, massive fluid resuscitation is necessary. Ensuing rhabdomyolysis releases myoglobin, potassium, phosphorus, and creatinine into the blood and leads to acute tubular necrosis and kidney failure. Metabolic acidosis and electrolyte imbalance occur and the patient is prone to cardiac arrhythmias and arrest. Victims with crush syndrome require copious fluid resuscitation to correct hypotension and to prevent renal failure from myoglobinuria. Hemodialysis may be required. Electrolyte imbalances and metabolic acidosis should be corrected as needed. The patient should be continuously monitored for cardiac arrhythmias (Briggs & Brinsfield, 2003). A center with orthopedic, vascular, and nephrology services should be used for definitive treatment.

Victims of blast injuries may also require psychosocial evaluation and treatment, as discussed in chapter 14. Explosions may also cause burn injuries, which are considered quaternary injuries. A discussion of burn management is presented in chapter 12. All blast injuries, regardless of mechanism and classification, may be life threatening. Adherence to ATLS protocols and the ABCs will provide optimal care to this patient population.

**EVENT MANAGEMENT**

The management of an explosion is similar to the management of any mass casualty incident. Explosions, particularly those that are the result of terrorism, force care to be provided in an austere environment. This may limit resources, transport, and access, thus impeding the immediate care of victims. Management elements of an explosion include search and rescue, triage, initial stabilization, definitive medical treatment, and evacuation. Depending on the severity of damage, some of the elements may not be necessary. The key objective of management is reducing mortality (Briggs & Brinsfield, 2003). A mass casualty incident resulting from an explosion can overwhelm local resources. The severity of damage, diversity and severity of injuries, and the number of casualties are the determining factors in whether aid is needed from outside communities (Briggs & Cronin, 2005). Further discussion of mass casualty incidents is presented in chapter 11.

Specific blast event management is divided into three phases: the preparatory phase, the response phase, and the recovery phase. The preparatory phase consists of identifying probable terrorist targets and explosion sites. Once targets are identified, planning for casualty collection points, prevention of damage to the surrounding area, entrance and exit routes, scene security, and media outlets occurs. First responders may be the victims of secondary attacks, and this possibility cannot be overlooked in planning. An explosion due to a terrorist act produces a crime scene with a need to preserve evidence. Preparatory planning takes this into account. Cooperation with federal agencies is necessary to involve disaster medical assistance teams and urban search and rescue teams. Resupply, finances, and personnel rotation must also be included in preparatory planning. Once a plan is in place, rehearsals, drills, and evaluations must take place (Krakover, 2005).

**THE DISASTER PARADIGM**

The response phase should use the American Medical Association’s DISASTER algorithm. This stands for Detect, Incident Command, Scene Safety and Security, Assess Hazards, Support Required, Triage and Treatment, Evacuation, and Recovery. An explosion is
Figure 13.2 Predicted emergency department casualties.

typically overt and does not necessarily require detection; however, nuclear, chemical, radiological, and biological materials may be present, requiring HAZMAT team involvement. Activation of the incident command system is necessary for effective event management. Prevention of subsequent attack and injury, structural collapse, and preservation of the crime scene provides scene security. Structural collapse, environmental hazards, and potential nuclear, biologic, and chemical threats are hazards to responders and their assessment is essential for responder and victim safety. The incident command system may require the support of local, state, and federal agencies as well as emergency medical systems, hospital systems, and regional trauma systems (Krakover, 2005). The number of casualties expected should be estimated by incident command. A simple formula is used to predict this:

\[
\text{Total Expected Casualties} = (\text{Number of casualties arriving in the first hour}) \times 2
\]

A graphical representation of the mass casualty predictor is presented in Figure 13.2. Following a casualty prediction, health care practitioners in the emergency department should also obtain information regarding the type of explosion, environmental hazards, and approximate number of casualties from EMS, law enforcement, and the incident command (CDC, 2005d). Triage of casualties occurs at three levels: on-site, medical, and evacuation. Triage is intended to do the greatest good for the greatest number. On-site triage recognizes victims with severe injuries requiring immediate treatment by first responders. Medical triage is performed by the most qualified medical personnel. Victims are identified as urgent, those needing life-saving intervention; delayed or expectant, those who do not require live-saving measures or those who are likely to expire despite intervention; minor or those who require minimal or no care, and deceased. Evacuation triage designates which victims require transfer to medical centers and provides the appropriate method of evacuation. Definitive medical care may be provided at local hospitals, if they are not affected by the blast, or outside hospitals, depending on degree of injury, availability of services, and number of casualties (Briggs & Cronin, 2005). In blast situations, triage may be “upside-down”; that is, the more severely injured patients arrive after the less injured because those with minor injuries will bypass medical triage and go directly to local emergency departments. Structural collapse will delay casualty arrival and increase severity of injury (CDC, 2005d). Triage is discussed in greater detail in chapter 9. The preparatory phase allows for predetermination of evacuation routes, which should be used in the response phase. Coordination and support will be necessary for success during the response phase. The recovery phase, also R in the algorithm, involves the treatment of victims, return to pre-event systems and infrastructure, decontamination, management of psychosocial impact, and prosecution of those responsible (Krakover, 2005).

SUMMARY

Predicting timing, location, and severity of disasters, including terrorist attacks and explosions, is impossible. The belief that all disasters are different, and therefore unnecessary to prepare for, is innately wrong. The care provided to victims of disasters is vastly different from the everyday care of patients. Consistency, based on an understanding of disaster management and the care of traumatic injuries, is essential for proper event management (Briggs & Brinsfield, 2003). Local management is required, even in the event that regional, state, or federal assistance is needed. Barbisch and Boatright (2004, p. 174) state that “regardless of the size or complexity of the event or how vast the support provided through federal response assets, a disaster or terrorist incident starts as a local event.” In the case of explosions and blast injuries, health care practitioners can expect standard blunt and penetrating injuries in addition to selected blast injuries of blast lung, tympanic membrane rupture, blast-related abdominal injury, and blast-related head injury (CDC, 2005c). Triage techniques and adherence to ABCs of ACLS, ABLS, ATLS, and ATC-CN protocols will provide the best treatment for the victims.
STUDY QUESTIONS

1. What are the characteristics of HE and LE explosives? Provide examples of each.
2. Describe the pressure differences exhibited during a blast wave.
3. What are the mechanisms of injury of a blast wave? Describe each.
4. Discuss the difference between primary, secondary, tertiary, and quaternary blast injuries. Where do blunt and penetrating traumatic injuries fall in this classification?
5. Describe the ABCs of ACLS, ABLS, ATLS, and ATCN. How do they differ? Which should be followed in the case of an explosion? What are the components of the primary survey? What are the components of the secondary survey?
6. Discuss the primary blast injuries in relation to body systems.
7. Discuss blunt and penetrating injuries in relation to the body systems. Which are life threatening? Which require immediate management?
8. Discuss the three stages of event management and planning. Discuss the DISASTER algorithm.
9. How can the emergency department predict the amount of casualties from an explosion? What information should the emergency department receive from the scene?

REFERENCES

Key Messages

- Psychiatric nurses can and do play a critical role on disaster response teams.
- Many events (such as 9/11) are primarily mental health disasters.
- Psychological triage identifies those at greatest risk for psychiatric complications.
- Crisis intervention and social support are key elements of psychological first aid.
- Acute stress disorder (ASD) in the immediate aftermath increases risk for later posttraumatic stress disorder (PTSD).
- Identification of psychiatric disorders and early intervention can prevent subsequent disability.
- Cognitive behavioral therapy may speed recovery and prevent PTSD when given over a few sessions beginning 2–3 weeks after trauma exposure.
- Management of psychosocial effects may continue for many years after impact.

Learning Objectives

When this chapter is completed, readers will be able to

1. Discuss the role of the mental health professional on the disaster team.
2. Describe the psychosocial training needs of all disaster responders.
3. Describe helpful interventions for use with survivors of a disaster.
4. Identify the symptoms that warrant an immediate mental health referral.
5. Describe the hallmarks of ASD.
6. Discuss the possible benefits and dangers of psychological debriefing.
8. Discuss the presentation of PTSD in children and adults.
9. Identify evidenced-based practices for the treatment of PTSD.
Management of Psychosocial Effects
Kathleen Coyne Plum and Tener Goodwin Veenema

The management of psychosocial effects begins with a sound plan to mitigate the adverse impact of the disaster on the emotional, cognitive, and behavioral capacity of the individual. Involvement of mental health professionals, such as psychiatric nurse practitioners and clinical nurse specialists, should begin with the development of the community or agency disaster plan. Assistance with problem solving, stress management, and "normalization" of the emotional response can prepare the individual for the challenges yet to be faced, and in some instances, prevent frustration from escalating to maladaptive or dangerous behaviors. Also, when symptoms become a diagnosable psychiatric disorder, early identification and treatment are essential if the individual's decline in social and occupational competence is to be contained and quickly reversed. Longer-term psychological recovery can take months to years, depending on the scope and nature of the disaster. Psychological debriefing, when used as an educational tool, can assist first responders and other naturally occurring groups to share feelings and coping strategies. Although most researchers have found positive outcomes, rigorous research on the effectiveness of debriefing is generally lacking, and where present, seems to contradict anticipated findings. Evaluation through a postdisaster review process is the key to understanding the effectiveness of mental health services for individuals and groups, as well as the strengths, weaknesses, and gaps in the response of the mental health services as a system.

A mental health disaster plan is as essential as any other part of a community disaster plan. The response of the public mental health system to the Twin Towers disaster was exceptionally rapid and extensive, primarily because of the planning that had occurred in anticipation of possible Y2K terrorism during the New Year's Eve celebration at Times Square in Manhattan. Within an hour of the first plane crashing into the World Trade Center, the mental health disaster command team was set up in Manhattan at the Port Authority. Mental health workers manned Ground Zero and the family assistance centers around the clock initially, and during peak times after that. Local and regional psychiatric centers that had initially cleared facility space to be used as temporary morgues, instead provided food and beds for rescuers who otherwise might not have had even minimal nourishment and rest during the first feverish days of search for survivors. In fact, seeing that rescuers do not deplete their psychological reserves, and that they get adequate sleep...
and food, is a stress reduction strategy that needs to be constantly promoted among the workers who become so absorbed in their mission that they fail to take care of their own basic needs. Within the Red Cross system, certified mental health disaster counselors have the authority and the obligation to recommend that volunteers showing signs of psychological distress take a break, and if warranted, can take them off duty against their wishes. In extreme cases, volunteers may be deemed unfit for work and sent home before their tour is up.

Because of the tremendous scope of the Twin Towers disaster, and the fact that there were so few of the physically injured to care for, 9/11 turned out to be primarily a mental health disaster. Experience with such disasters has served only to emphasize the importance of recruiting, screening, and training mental health professionals, paraprofessionals, and volunteers in order to have the personnel necessary to respond to the specific short- and long-term needs of those exposed to the disaster.

THE MENTAL HEALTH RESPONSE TEAM

Designation of a mental health coordinator is a crucial first step in the formulation of a team. This is the person who will manage the command center, decide what resources are needed, activate appropriate mental health agencies, and assign staff to locations such as neighborhood centers, Red Cross shelters (when requested), family assistance centers, schools, hospitals, and so on. This person also monitors field reports regarding the ongoing needs of victims, workers, and counselors, and adapts the plan as events unfold.

The mental health coordinator may also serve as a consultant to agencies or designate a member of the administrative team to provide this function. Based on experience in Oklahoma City, the consultant should be someone other than direct line staff. The immediate responders deployed by the coordinator may include mobile crisis teams, case managers, professionals, and volunteers who have been preapproved. Red Cross Disaster Mental Health Services counselors monitor the level of stress among Red Cross workers and clients; act to reduce high levels of stress; prevent further serious short- and long-term emotional trauma; and provide opportunities for healthy emotional responses (American Red Cross, 1995). A field coordinator may supervise the staff providing direct services to victims, and provide reports to the command coordinator.

Psychiatric nurses and psychiatrists are particularly well suited as members of the medical team, as they can also be alert to organic mental disorders caused by conditions such as head injuries, toxic exposures, pre-existing illnesses, dehydration, or hyper-/hypothermia. Because nurses have a tradition of practice in homes, in schools, and other natural settings, they tend to be readily accepted by members of the community. Agencies and staff that will be activated for counseling and treatment upon referral from the on-site counselors also need to begin preparations for the influx of individuals and the type of psychiatric symptomatology they are most likely to see, based on the estimates of the command coordinator.

Paraprofessionals and volunteers can and do play an extremely vital role in disaster response and recovery. They may be indigenous workers known to the community affected by the disaster and may share ethnic or religious backgrounds. In responding to the disappearance and subsequent discovery of a murdered 6-year-old in a rural community, psychiatric intensive case managers were critical in maintaining a bridge with other children in the community. In the ensuing aftermath, it was also the case managers who provided that consistent, familiar link for children and families in the neighborhood needing referrals for additional services.

Following demobilization, the mental health coordinator conducts a review of the mental health response both separately and in conjunction with the entire disaster response team—medical, rescue, public safety, communications, and transportation. Reviewing the adequacy of the predisaster plan in light of the actual response not only helps to strengthen future planning but also brings a sense of closure to the participants. This procedural review is in addition to the psychological defusing or debriefing that may be provided to workers at demobilization.

RECRUITMENT, SCREENING, AND TRAINING

One major task of the mental health coordinator in the planning phase is to recruit and prescreen potential volunteers and staff for credentials, so that they can be a part of the team from the very beginning of the event.
Not everyone, however, is suited for disaster work! Temperament and personal preference must also be taken into account. Those who cannot tolerate the uncertainty and chaos inherent in disaster work ought to consider being available for counseling referrals in a hospital or clinic setting, rather than being part of the immediate response team in the field. Matching the skills and aptitude of individuals with the phase of disaster response is crucial that mental health professionals are aware of their own strong emotional reactions to the disaster and the impact it would have on their work, and that they too have access to support and counseling. Perhaps most important, mental health workers need to be culturally competent to work with the population they are serving (i.e., know the language, spiritual beliefs, and rituals surrounding loss and bereavement) and need to be briefed about local referral resources. When needed, the mental health professionals on the team can also provide consultation to volunteers and paraprofessionals in instances where a greater knowledge of psychopathology is indicated in the assessment or management of adverse responses.

### Psychological Triage

One of the most important roles of the mental health professional in the immediate aftermath of a disaster is to identify which individuals are most at risk for psychiatric complications, and to make referrals for further mental health evaluation and treatment when indicated.

---

1. Mental health interventions must be taken to the survivors in a disaster. Most victims will not seek help, and many will not even accept offers of help when made available to them.
2. Survivors and the bereaved are particularly susceptible to efforts that appear voyeuristic. All volunteers should have support and training so as to avoid inadvertent re-traumatization.
3. Never separate children from their families. Preserving family integrity is extremely reassuring to all children.
4. Limit exposure to the dead and mutilated. Reduce the number of people exposed to the event, as this exposure is significantly associated with psychiatric symptomatology.
5. Give accurate, truthful information to victims. Information for children should be tailored to their cognitive and developmental ages, but should never be false or misleading.
6. Protect victim privacy and limit exposure to the media. Suggest the designation of a spokesperson, so as to remove the burden to individuals.
7. Use naturally occurring support systems. Connections to family, friends, and neighbors are perceived to be highly supportive by victims.
8. Avoid “medicalizing” reactions. Reassure victims that even very strong reactions are normal, and that they are not mentally ill, or “losing their minds.”
9. Minimize retraumatization. Interviews with police, fire, and other officials can be draining and intimidating. Suggest officials conduct interviews together, whenever possible, especially for children, who should also be accompanied by a parent. Do not force individuals to recount details of the traumatic event.
10. Mandatory psychological debriefing is clinically contraindicated. Voluntary debriefing should proceed only after workers have been debriefed, and there is no further risk of traumatization.

---

Chapter 14 Management of Psychosocial Effects

---

257
If psychological triage is not done, and symptoms are delayed 6 months after the disaster or persist for at least 6 months without treatment, the prognosis is likely to be worse (Alexander, 1990).

Psychiatric difficulties seem to follow a dose-related trajectory—those closest to the event are at greatest risk. Targeting interventions to those at greatest risk is both more efficient and more effective than attempting to provide mental health interventions to everyone who has been exposed. The following characteristics increase the likelihood of psychiatric morbidity and are ranked from most to least likely (Norwood, Ursano, & Fullerton, 2000):

1. Threat to one’s life
2. Infliction of physical injuries
3. Exposure to the dead and mutilated
4. Witnessing unexpected and violent death
5. Learning of the unexpected and violent death of a loved one
6. Learning one has been exposed to chemical or biological toxins
7. Causing death or severe harm to another (such as in military action)
8. Knowledge that the infliction of pain and suffering was deliberate (such as in Oklahoma City and 9/11)

**Mental Health Referrals**

Reactions to stress and bereavement should be assessed in greater detail for the presence of a mental disorder if they are significantly distressing to the individual or impair an important aspect of social or occupational functioning. Referrals to a mental health professional ought to be made when one or more of the following symptoms are present (DeWolfe, 2000):

- **Disorientation**—dazed; memory loss; inability to give date or time, state where he or she is, recall events of the past 24 hours, or understand what is happening
- **Depression**—pervasive feelings of hopelessness and despair, unshakable feelings of worthlessness and inadequacy, withdrawal from others, inability to engage in productive activity
- **Anxiety**—constant on edge, restless, agitated, inability to sleep, frequent frightening nightmares, flashbacks and intrusive thoughts, obsessive fears of another disaster, excessive ruminations about the disaster
- **Psychosis**—hearing voices, seeing visions, delusional thinking, excessive preoccupation with idea or thought, pronounced pressure of speech (e.g., talking rapidly with little content continuity)

_Inability to care for self_—not eating, bathing or changing clothes, inability to manage activities of daily life

**Suicidal thoughts or plans**

**Problematic use of alcohol or drugs**

**Domestic violence, child abuse, or elder abuse**

Even if a referral is not accepted at the time it is initially made, the trust that has been established early in the aftermath can be crucial to later follow-up (see Case Study 14.1).

Factors that may influence whether trauma exposure progresses to PTSD include one’s natural resiliency, genetic loading, the type of trauma, whether the trauma is natural or man-made, past traumas, and psychiatric comorbidities (Matthews & Mossefin, 2006).

**ACUTE STRESS DISORDER**

Although a variety of psychiatric disorders may be seen in the aftermath of a disaster, within the first month of a traumatic event, acute stress disorder (ASD) is the disorder most likely to be encountered by the disaster response team. Again, those in closest proximity to the event are at greatest risk. Although lack of social supports, history of childhood traumas, and poor coping skills may increase likelihood of the disorder, ASD can develop in a child or an adult having no predisposing conditions, particularly if the stressor is extreme. Because the likelihood of developing PTSD is elevated for those having ASD, assessment of individuals for the presence of ASD is key to identifying those at high risk for future complications.

According to the *Diagnostic and Statistical Manual of Mental Disorders* (text revision; DSM–IV–TR), 80% of motor vehicle crash survivors and victims of violent crimes who initially met the criteria for ASD, were subsequently diagnosed with PTSD (American Psychiatric Association, 2000). Not surprisingly, however, the prevalence of ASD following exposure to a traumatic event varies greatly, depending on the severity and persistence of the trauma. In the few studies available, rates ranging from 14% to 33% were found following involve ment in motor vehicle accidents or witnessing of a mass shooting.

Characteristic of the disorder is the development of anxiety, dissociation, and other symptoms occurring within 1 month after the trauma, lasting a minimum of 2 days. If symptoms persist longer than 4 weeks post-trauma, a diagnosis of PTSD should be considered. In considering the diagnosis of either PTSD or ASD, the individual must meet the following criteria:

1. Experienced, witnessed, or been confronted with an event that involved actual or threatened death or
serious injury, or a threat to the physical integrity of self or others.
2. Responded with intense fear, helplessness, or horror.

Although dissociation may be a feature of PTSD, it is a hallmark of ASD when a person experiencing a distressing event (or within 4 weeks of the event has three or more of the following dissociative symptoms:

- a subjective sense of numbing, detachment, or absence of emotional responsiveness
- a reduction in awareness in his/her surroundings (e.g., being in a “daze”)
- derealization
- depersonalization
- dissociative amnesia (inability to recall an important aspect of the trauma)

In addition, at least one symptom from each of the three symptom clusters required for PTSD is also present:

- the traumatic event is persistently reexperienced (recent recollections, images, flashbacks, etc.)
- reminders of the trauma are avoided (people, places, activities, etc.)
- hyperarousal in response to stimuli reminiscent of the trauma (hypervigilance, insomnia, exaggerated startle response, motor restlessness, etc.)

If symptoms of despair and hopelessness are sufficiently severe, an additional diagnosis of major depressive disorder may be warranted. If the symptom pattern does not meet criteria for ASD, however, a diagnosis of adjustment disorder should be considered in lieu of PTSD.

**PSYCHOLOGICAL FIRST AID**

Once exposure to a disaster has already occurred, efforts must then be directed toward the reduction of psychological harm. Individuals showing signs of ASD should be removed from ongoing trauma, if possible; encouraged to rest; and assisted in connecting with available sources of social supports. No known interventions can prevent ASD; however, based on recent research, treatment of ASD within 2 weeks of the event with cognitive-behavioral therapy (CBT) can reduce the prevalence of symptoms of PTSD 2–6 months after the event (Bryant, Harvey, Dang, Sackville, & Basten, 1998).

Because most survivors who express early symptoms of distress are likely to recover normally, the goal of the immediate mental health response is to prepare survivors and the bereaved for the emotional challenges that lie ahead, and to identify those individuals and families needing additional follow-up and referral. Education about the normal reactions to extreme stress and traumatic bereavement is an important strategy at both the community and individual levels. Other steps that can be taken immediately to reduce potential psychological harm include:

- **The prevention of re-traumatization**—limiting the number of persons with whom victims must interact in order to receive services, as well as reducing the amount of red tape required. “Telling the story” can be a source of trauma for some individuals; therefore, forcing someone to tell his or her story is contraindicated.
- **Prevention of new victims**—limiting the number of people exposed to the sights, the sounds, and the smells of a disaster site, whenever possible. Those who do not need to be at the disaster site should be discouraged from witnessing any of the horror of the aftermath.

Crisis intervention is still the mainstay of disaster counseling. Crisis intervention is a technique used to assist persons whose coping abilities have been overwhelmed by a stressful event. Most survivors at some point in the evolution of a disaster experience a level of stress so overwhelming that usual coping is inadequate to meet the need. Two key tools of the crisis/disaster worker are active listening and problem solving.

Active listening allows the disaster worker to establish a sense of respect and trust and to better understand the survivor’s situation and needs. DeWolfe (2000) lists several tips for active listening:

- **Allow silence.** Silence gives the survivor time to reflect and become aware of feelings. “Being with” the survivor and his/her experience is very supportive.
Attend nonverbally. Eye contact, head nodding, and carrying facial expressions let survivors know you are in tune with them.

Paraphrase. Repeating portions of what the person has said conveys interest, understanding, and empathy. Paraphrasing also clarifies meaning and checks for misunderstandings.

Reflect feelings. If the survivor’s tone of voice or nonverbal gestures suggest anger, sadness, or fear, the worker may state, “You sound/appear angry, scared, etc.; does that fit for you?” This helps the survivor to identify and articulate his/her emotions.

Allow expression of emotions. Expression of intense emotions through tears or angry venting is an important part of healing; it often helps the survivor work through feelings so that he/she can better engage in constructive problem solving. Workers should stay relaxed, breathe, and let the survivor know that it is okay to feel.

Because survivors are often so overwhelmed by their situation, it is difficult for many to know where to start. Thus, counselors may advise survivors not to make any new or big decisions while undergoing a crisis. While some are immobilized by the stress, others may feel pressured to take some action. Helping individuals to prioritize their energies can be very beneficial, as some might find themselves spending inordinate amounts of time on things they cannot control, while not taking necessary action in matters where they can make a difference to themselves and their families.

Counselors at the site of Family Assistance Center in Manhattan found that both they and the survivors had varying tolerances for not being in control, and so there was no “cookie-cutter” approach to help survivors cope with the trauma (see Case Study 14.2). Guiding survivors through the problem-solving steps to prioritize and focus action also builds trust and confidence. DeWolfe (2000) has adapted the problem-solving process for use in a disaster situation:

Identify and define the problem. Ask survivors to describe the problems/challenges they are facing right now. Selecting one problem that is relatively solvable is helpful, in that immediate success can bring the survivor some sense of control and confidence.

Assess the survivor’s functioning and coping. Ask the survivor how he or she has coped with stress in the past, and how he or she is doing right now. Through observation, asking questions, and reviewing the magnitude of the survivor’s problems and losses, the worker develops an impression of the survivor’s ability to address the current challenges. Based on this assessment, the worker may make referrals, point out coping strengths, and facilitate the survivor’s engagement with social supports.

Evaluate available resources. Ask who might be able to help with this problem, and what resources/options might help. Use existing sources of assistance and support when they are available, and refer to relief agencies when they are not.

Develop and implement a plan. Ask what steps they will take to address the problem. Encourage the survivor to say aloud what he/she plans to do and how. Offer to check in later to see how they are doing. If the worker agrees to perform a task, it is very important to follow through. Only promise what one can do—not what one would like to do.

Social Support

Social support networks can provide important affective and material aid that mitigates the adverse effects of disaster trauma (Bolin, 1985). Thus, mobilizing the natural social support system of family, friends, ministers, and co-workers can be one of the most helpful interventions in the aftermath of a disaster. Because disruption of one’s natural supports is inherent in most disasters, however, this can require the development of innovative and creative approaches.

Following the 1989 San Francisco earthquake, a hotline was hurriedly set up to respond to the crisis. The majority of the callers were women (81%), often calling about their children (19%) or themselves (71%). Common concerns were anxiety and fearfulness, sleeping problems, depression, gastrointestinal problems, or their work (Blaustein et al., 1992). More than half were referred to support groups or therapists, or sent written psychoeducational material. In Oklahoma City, crisis and referral services were also provided by a telephone hotline. In addition to the hotline, 21 support groups were established in the first 2 years after the bombing, consisting of groups for survivors, parents who lost young children, parents who lost adult children, adult siblings of victims, widows and widowers, state employees directly affected by the bombing, downtown workers and residents, rescuers and responders, school personnel, displaced persons, employee groups with multiple losses, and homeless persons who were in the downtown area during the bombing (Call & Pfef-ferbaum, 1999).

Social isolation is one of the psychological threats inherent in most disasters, as roads may be blocked and telephone services interrupted. During an ice storm in western New York in 1991, a local radio talk show host stayed on the air for days, giving information and providing a link to the outside world for those with battery-operated radios. The situations described by callers helped other listeners to know that they were not alone in the challenges of staying warm, getting hot food or beverages, removing debris, and keeping basements dry. Stories of material assistance given to...
neighbors by neighbors were both abundant and inspirational, and helped to maintain community morale as some people remained without power for up to 2 weeks.

The mutual support provided by the trapped Somerset, Pennsylvania, coal miners in 2002 played an important role in their survival. They worked as a team to assist the person most vulnerable at the moment, whether that threat was physical (hypothermia) or psychological (hopelessness and despair). This disaster also illustrates how the community supported one another and the rescuers throughout the ordeal.

The bonds that develop as a result of a disaster can be particularly strong. The bereaved families from the plane that crashed near Somerset, Pennsylvania, on 9/11 responded with reciprocal gestures of support to the coal mining community that had so recently responded to their profound loss with compassion and assistance. Thus, survivors of a disaster can draw great comfort and emotional strength by sharing their experiences with one another, even if not previously acquainted.

CRITICAL INCIDENT STRESS MANAGEMENT

In the early 1980s, Mitchell suggested the use of Critical Incident Stress Management (CISM) as a crisis intervention program to mitigate the psychological distress among emergency services personnel and assist them in returning to normal duties. It is a common misconception that psychological debriefing and CISM are synonymous terms. In fact, CISM is a comprehensive program that not only includes psychological debriefing, but also a variety of other crisis intervention strategies for emergency services personnel. CISM strategies (Mitchell & Everly, 2000) can include some or all of the following, depending on the scope of the disaster and the needs of first responders:

- Preincident education/mental preparedness training
- Individual crisis intervention and on-scene support
- Demobilization after large-scale events
- Defusing
- Critical Incident Stress Debriefing (CISD)
- Significant other support services for families and children
- Follow-up services and professional referrals when necessary

Psychological Debriefing

Psychological debriefing is the most well known of the CISM interventions, and the most controversial. It has been defined as "a systematic process of education, emotional expression and cognitive reorganization accomplished through the provision of information and meaningful integration and group support through identifying shared common experience" (Fullerton, Ursano, Vance, & Wang, 2000, p. 260). Historically, debriefing occurred in the battlefield, or immediately following sensitive military missions or national security events (such as with reconnaissance teams, intelligence officers, undercover operatives). Debriefing now also occurs as part of routine critical incident review of procedures in the civilian world of police officers, firefighters, and medical teams.

Typically in this country, CISD is not a form of treatment or therapy; rather, it is a psychoeducational approach for those who may be at risk for development of psychiatric disorders in the future. It can be useful, therefore, as a tool to identify group members who may need additional assistance or referral. Most commonly, CISD refers to the group intervention model developed by Mitchell. This model is typically applied within 24 to 72 hours, and covers seven phases:

1. Introduction
2. Facts
3. Thoughts
4. Reactions
5. Symptoms
6. Teaching/information
7. Reentry

CISD has been used primarily for rescuers who are exposed to traumatic events in the course of their work. In fact, debriefing is most helpful when conducted in a group setting (rather than with individuals), and when the members are part of a naturally occurring group, such as rescue squads, fire companies, or emergency room/intensive care unit staffs.

Defusing is a crisis intervention procedure that is similar to debriefing, in which small group discussion takes place within a few hours (6–10 is ideal) of the event (Mitchell & Everly, 2000). It too is usually conducted in groups, and has three main segments: an introduction, exploration, and information. This process may also help a group decide whether further psychological debriefing is needed. Sometimes a defusing is all that is necessary, but more typically, it reduces psychological discord and tension so that the team can properly set up a formal CISD group session.

The Debriefing Controversy

In general, psychological debriefing has not been found to reduce psychological distress or prevent PTSD (Schwarz & Rowalski, 1992; Wilson, Raphael, Meldrum, Bedosky, & Sigman, 2000). Specifically, individual,
single-session debriefing can no longer be recommended according to the Cochrane Review by Rose, Bisson, and Simon (2002), and upheld in the 2006 update (Rose, Bisson, Churchill, & Wessely). In their reviews of 15 randomized control trials, not only did single session, individual debriefing fail to reduce distress or prevent the onset of PTSD in the longer term (1 year), some trials reported a significantly increased risk of PTSD among those receiving debriefing. It is hypothesized that this type of debriefing has a negative effect on some people because of secondary traumatization. Another hypothesis is that individual debriefing may represent a medicalization of normal distress, therefore increasing the expectancy of developing symptoms among those who otherwise would not have done so. Finally, it may be that because shock and denial are normal and protective responses to an overwhelming event, interventions that challenge dissociative and distancing defenses during this time period may be counterproductive.

The Cochrane Review does not include group debriefing, crisis intervention, or “postvention,” that is, psychological intervention in schools following the suicide of a classmate. The implications for practice are that routine use of individual debriefing in the aftermath of trauma cannot be recommended in military or civilian life, and compulsory debriefing (as practiced in the United Kingdom and Australia after some types of work-related traumatic events in order to reduce litigation related to subsequent PTSD), is contraindicated. However, the use of resources to identify and treat those with recognizable psychiatric disorders—such as ASD, depression, and PTSD—ought to continue, with an emphasis on early detection of those at risk of developing psychological disorders. Follow-up assessment should be increasingly viewed as important, and the use of screening and treatment programs need to be developed and brought to the most vulnerable groups where they live or work. Rescuers should be debriefed as a group, in which participation is voluntary and occurs only when the group is no longer exposed to traumatic conditions.

MANAGING TRANSITIONS

Demobilization is one of the first major transitions to occur in a major disaster. Mitchell and Everly (2000) conceptualize demobilization as a transitional intervention that allows for psychological and physiological decompression following disengagement from a large-scale disaster. Demobilization consists of a 10-minute informational lecture followed by 20 minutes of rest and food. Demobilization gives workers a way to bring closure to a very intense working situation, and prepare to reenter their normal lives; however, in the case of large-scale disasters such as 9/11, their lives will reflect the “new normal.” Mental health intervention becomes most crucial 1 to 2 months after a disaster. This is the time when psychological distress may become most apparent—after immediate, basic needs are met, the social supports begin to wear down, and public interest has dissipated. In fact, Norris and Thompson (1995) recommend that mental health workers not add to the chaos of the emergency period, but direct their energies toward planning, underwriting, and advertising later services for the resource-depleted individuals.

In Oklahoma City, the transition from acute response (provided by the American Red Cross) to sustained response (provided by the state’s Project Heartland) was fraught with some difficulties (Call & Pfeiferbaun, 1999). As a result, the authors recommend that the postimpact counseling and the death notification center be directed by the state agency responsible for developing and maintaining the postdisaster plan, with support from other agencies as agreed upon in the predisaster plan. Although tension among individuals and agencies is not uncommon in a disaster response, better planning can make lines of responsibility clearer, and reduce confusion at the time of transition to the sustained mental health response.

WHEN GRIEF AND STRESS GO AWRY

Mental health services will remain in place long after the initial impact. After the rescuers and disaster workers have demobilized and returned to their homes and routines, grief, and trauma counselors face the task of promoting the healing process and treating those who develop psychiatric symptoms that have not abated with time. In Oklahoma City, counselors were still providing services to survivors, more than 5 years after the bombing. More than 30 years after the Attica uprising, family members and survivors were receiving psychological services for persistent or previously undetected PTSD and traumatic grief symptoms.

The hallmark for diagnosing a psychiatric disorder is that the symptoms are significantly distressing, or cause impairment in social, occupational, or other daily-life functioning. This is more difficult to assess in a disaster, as normal daily-life functioning is substantially disrupted because of the event. Practitioners often have to rely on the individual’s subjective report or that of the family that the symptoms experienced are not consistent with family/cultural norms, and are causing significant distress or impairment in daily functioning. Many types of psychiatric disorders can be seen in the aftermath of a disaster. One of the most common is PTSD; others include adjustment disorders, substance use disorders, major depression, complicated
bereavement, and generalized anxiety disorders. Marital discord and domestic violence can be exacerbated in an environment of extreme stress, and all clinicians should be alert to the hallmarks of spousal, child, or elder abuse. Among children, other psychiatric difficulties encountered postrumia include depression and separation anxiety. In addition, adolescents may display antisocial behaviors consistent with a conduct disorder (such as fighting, destruction of property, stealing, running away) in the months or years following traumatic stress, and thus, the connection to the traumatic event is often missed. While anniversaries can be a time to share emotions and focus on the future, they can also be a time in which distressing symptoms are easily reactivated.

**TRAUMATIC GRIEF (COMPLICATED BEREAVEMENT)**

Grief can be determined to be traumatic when it follows a loss that is sudden, violent, or is accompanied by extreme and intense emotional distress. In such cases, the grief can be unrelenting and overwhelming. Those experiencing a loss through sudden or violent death are often left with a feeling of unreality about the loss. Involvement with protracted medical or legal investigations can delay the grieving process. Feelings of guilt tend to occur when the death is sudden, as does a need to blame someone for what happened. The sense of helplessness is often profound, as it represents an assault on one’s sense of power and orderliness. Not uncommonly, too, this helplessness can be linked with an incredible sense of rage (Worden, 1982). The complications of grief usually present in one of three ways:

- **Chronic**—prolonged, extensive; person not able to get back to life
- **Delayed**—the pain is not experienced until some time later, and a minor event triggers an intense grief reaction
- **Masked**—as a physical symptom (e.g., headache, GI distress) or disturbance of conduct or behavior (e.g., delinquency, depression)

In normal grieving, there is no loss of self-esteem, but in abnormal grieving, feelings of worthlessness are common. Diagnosis of a mental disorder is made according to the presenting symptoms—generally a mood or anxiety disorder, or if masked, a conduct disorder or psychological factor affecting a medical condition. Diagnoses, such as major depression, are usually not given unless the symptoms are still present 2 months after the loss, and the following criteria can be used to distinguish between the “normal” depression associated with bereavement and Major Depression (American Psychiatric Association, 2000):

- Guilt about things other than actions taken or not taken by the survivor at the time of the death.
- Thoughts of death other than the survivor feeling he or she should have died with the deceased person.
- Morbid preoccupation with worthlessness.
- Marked psychomotor retardation.
- Prolonged and marked functional impairment.
- Or hallucinatory experiences other than thinking he or she hears the voice of, or transiently sees the image of, the deceased person.

Because complicated bereavement is an even greater risk among the traumatically bereaved, some cases symptoms may warrant a diagnosis of PTSD. In addition to major depression and PTSD, the traumatically bereaved may develop a panic or anxiety disorder, alcohol or other substance use, or worsening of health problems, particularly cardiovascular and autoimmune disorders (Shear et al., 2001).

Treatment with medications for depression or anxiety have been found to be beneficial, and can prevent subsequent disability. Psychotherapies and medications used for the treatment of major depression and PTSD have also been found to be useful in the treatment of the traumatically bereaved. In addition, there are both well-established (Worden, 1982) and developing (Shear et al., 2001) therapies that are specific to the treatment of complicated and or traumatic bereavement:

- **“Traditional” Grief Therapy**—a form of psychotherapy that focuses specifically on resolving the conflicts of separation and facilitating the completion of the grief tasks. Therapy is usually conducted on a one-to-one basis over 8–10 visits, but can be done in a group setting, or in special instances, with a family unit.
- **Traumatic Grief Therapy**—a form of cognitive behavioral therapy currently undergoing randomized controlled testing, that includes information about bereavement, telling the story of the death and its aftermath, carefully managed imaginal exposure to the death, in vivo exposure to avoided situations, and focus on positive memories of the deceased.

**POSTTRAUMATIC STRESS DISORDER (PTSD)**

Posttraumatic stress disorder is a response to a recognizable, serious stressor that is characterized by specific behaviors. At present, in the general population prevalence rates range between 3% and 6% (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). A diagnosis of
PTSD requires that several criteria be met. The first criterion relates to the nature of the traumatic event and the response it evokes:

The person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others. The person’s response involved intense fear, helplessness, or horror. In children, this may be expressed instead by disorganized or agitated behavior.

The second criterion relates to the traumatic event and the development of symptoms that fall into the three categories of “reexperiencing the event,” “avoidance and psychic numbing,” and “increased arousal.” Finally, the disturbance must cause “clinically significant distress or impairment in social, occupational, or other areas of functioning” (American Psychiatric Association, 2000).

Unlike other psychiatric disorders, which are usually linked to psychosocial and biological causes, PTSD occurs as a result of trauma experienced by otherwise normal individuals. PTSD usually appears in the first few months after a trauma has been experienced; however, this may not always be the case. In certain cases, years may have passed before the disorder appears. Likewise, PTSD’s duration can vary, with symptoms resolving over time in some individuals and persisting for many years in others. Clinically, PTSD is specified as being “acute” if the duration of symptoms is less than 3 months, “chronic” if the duration of symptoms is 3 months or more, and “delayed onset” if the onset of symptoms is at least 6 months after the stressor (American Psychiatric Association, 2000). The diagnosis of PTSD cannot be made unless the duration of the disturbance is more than 1 month.

In a long-term follow-up study of young adults who as teenagers had survived a shipping disaster—the sinking of the ship Jupiter in Greek waters—of the 217 survivors, 52% had developed PTSD at some time during the follow-up period (Bolton, O’Ryan, Udwin, Boyle, & Yule, 2000). About one third of those survivors who developed PTSD recovered within a year of onset (30%), another third were still suffering from the disorder 8 years after the disaster. The number of individuals who will develop PTSD will depend on how traumatic the event was for them and on the support and intervention they receive afterward.

PTSD in Children

The clinical presentation of PTSD in children can be extraordinarily heterogeneous with a bewildering array of symptoms. Describing children’s responses to trauma, Terr (1991) presents four specific symptoms character-istics of childhood PTSD: repeatedly perceiving memories of the event through visualization, engaging in behavioral reenactments and repetitive play related to the event, fears related to the trauma event, and pessimistic attitudes reflecting a sense of hopelessness about the future and life in general. The behavioral presentation of a child or adolescent suffering from PTSD or symptoms of PTSD may also include problems with verbalization, and extremes of disconnections (no close relationships) or false connections (perceiving close relationships where none exist) (van der Kolk, 2001). Additionally, the diagnosis of PTSD cannot be made based solely on the child’s affective presentation (e.g., crying, sadness, expressions of terror) (van der Kolk, 1999, 2001). The DSM–IV–TR criteria specify that there must be an indication that the disturbance causes significant distress in other spheres of the child’s life, such as social or educational function. PTSD often results in impairment of the child’s ability to function in social groups or family situations, including school phobia, decreased academic performance, withdrawal from normal activities, and family discord. It is the disturbance in function that is the hallmark of PTSD, and differentiates the diagnosis from the more common reactions to stress and disasters.

PTSD rarely occurs in isolation. Children with PTSD may be more likely to have comorbid conditions because traumatic insults occur in developmental stages that are particularly sensitive to disruptions in neurobiological maturation. Developing coping skills, interpersonal relations, and the achievement of developmental milestones such as language acquisition, self-regulation, security, and trust may be disrupted by trauma. Other related psychological disorders commonly occurring in children, as well as adults, with PTSD include depression and feelings of guilt and hopelessness, dissociation with authority, acute stress disorder, and generalized anxiety disorder. Concomitant diagnoses may include eating disorders, substance abuse, and problems with memory and cognition.

In recent years, a great deal of research has been aimed at development and testing of reliable assessment tools. A combination of findings from structured interviews and questionnaires with physiological assessments is generally considered to be the most effective method of diagnosing PTSD. Van der Kolk (2001) suggests that examining PTSD symptoms rather than diagnoses is more appropriate for children because many children who experience posttraumatic symptoms do not technically earn the PTSD diagnosis.

Evidence-Based Practices in the Treatment of PTSD

Treatment for PTSD typically begins with a detailed evaluation and development of a treatment plan that meets...
the unique developmental needs of the individual. Generally, PTSD-specific treatment is begun only when the individual is safely removed from the trauma or crisis situation. In persons who are currently experiencing violence (acts of war), abuse (physical, sexual, or emotional), or a disaster, immediate removal from the situation is the first step in managing the crisis. Persons who are severely depressed or suicidal, experiencing extreme panic or disorganized thinking, or in need of drug or alcohol detoxification, need to have these crisis problems addressed as part of the initial treatment phase (Treatment of PTSD, a National Center for PTSD Fact Sheet, National Center for Posttraumatic Stress Disorder, 2001). According to the National Center for Posttraumatic Stress Disorder (2001), therapeutic approaches commonly used by expert clinicians in this field to treat PTSD include: CBT involves working with cognitions to change emotions, thoughts, and behaviors. Exposure therapy is one form of CBT unique to trauma treatment that uses careful, repeated, detailed imagining of the trauma (exposure) in a safe, controlled context to help the individual face and gain control of the fear and distress that was overwhelming in the trauma. Therapists work up gradually to the most severe trauma using relaxation techniques and either starting with less upsetting stressors or by taking the trauma one piece at a time in an approach called desensitization. Along with exposure, CBT for trauma includes learning skills for coping with anxiety (such as breathing techniques and biofeedback) and negative thoughts (“cognitive restructuring”), anger management, preparing for stress reactions (“stress inoculation”), handling future trauma symptoms, and communication. According to the American Psychiatric Association (2004), CBT has been found to be effective in speeding recovery and preventing PTSD in cases of motor vehicle and industrial accidents, as well as instances of rape and interpersonal violence.

Pharmacotherapy (medication) can reduce the anxiety, depression, and insomnia often experienced with PTSD, and in some cases may help relieve the distress and emotional numbness caused by trauma memories. The American Psychiatric Association Practice Guideline for the Treatment of Patients with Acute Stress Disorder and Posttraumatic Stress Disorder (2004) now recommends use of selective serotonin reuptake inhibitors (SSRIs) in the treatment of PTSD “with moderate clinical confidence” (Level II). Tricyclic antidepressants may be recommended in some cases (Level III). Medication treatments were also found to be effective in reducing core symptoms as well associated depression and disability in a recent review of 35 short-term randomized controlled trials (Stein, Ipser, & Seedat, 2006). These studies further establish the status of SSRIs as first-line agents in the psychopharmacologic treatment of PTSD. According to Stein, Zungu-Dirwayi, van der Linden, and Seedat (2005); however, the existing evidence base does not provide sufficient data to suggest particular predictors of response to treatment, nor has use of medication with pediatric and geriatric subjects been clearly established.

Eye movement desensitization and reprocessing (EMDR) is a relatively new treatment of traumatic memories that involves elements of exposure therapy and CBT, combined with techniques (eye movements, hand taps, sounds) that create an alteration of attention back and forth across the person’s midline. While the theory and research are still evolving with this form of treatment, there is some evidence that the therapeutic element unique to EMDR, attentional alteration, may facilitate accessing and processing traumatic material.

Group treatment is often an ideal therapeutic setting because trauma survivors are able to risk sharing traumatic material with the safety, cohesion, and empathy provided by other survivors. As group members achieve greater understanding and resolution of their trauma, they often feel more confident and able to trust. As they discuss and share coping of trauma-related shame, guilt, rage, fear, doubt, and self-condemnation, they prepare themselves to focus on the present rather than the past. Telling one’s story (the “trauma narrative”) and directly facing the grief, anxiety, and guilt related to trauma enable many survivors to cope with their symptoms, memories, and other aspects of their lives.

Brief psychodynamic psychotherapy focuses on the emotional conflicts caused by the traumatic event, particularly as they relate to early life experiences. Through the retelling of the traumatic event to a calm, empathic, compassionate and nonjudgmental therapist, the survivor achieves a greater sense of self-esteem, develops effective ways of thinking and coping, and more successfully deals with the intense emotions that emerge during therapy. The therapist helps the survivor identify current life situations that set off traumatic memories and worsen PTSD symptoms.

Brief trauma/grief-focused psychotherapy has been found to be effective in decreasing PTSD symptoms and in halting the progression of depression among adolescents 5 years after a catastrophic disaster (Goenjian et al., 2005). This is consistent with the 1998 meta-analysis by Sherman, which found that psychotherapeutic treatment reduces PTSD and general psychiatric symptomatology, and that these effects are maintained even after treatment has been terminated. Bisson and Andrew (2005) found evidence that individual trauma-focused cognitive behavioral therapy, stress management and group trauma-focused cognitive behavioral therapy are effective in the treatment of PTSD, with individual trauma-focused cognitive behavioral therapy having the greatest effect. According to their review, other
nontrauma focused psychological treatments did not significantly reduce PTSD symptoms. Matthews and Mossefin (2006) have summarized the evidence supporting psychotherapy models in PTSD using the American Psychiatric Association Practice Guideline for the Treatment of Patients with Acute Stress Disorder and Posttraumatic Stress Disorder as follows:

**Recommended with substantial clinical confidence (Level I)**
- Cognitive behavioral therapy
- Psychoeducation
- Supportive techniques

**Recommended with moderate clinical confidence (Level II)**
- Exposure techniques
- Eye movement desensitization and reprocessing
- Imagery rehearsal
- Psychodynamic therapy
- Stress inoculation

*May be recommended in some cases (Level III)*
- Present-centered group therapy
- Trauma-focused group therapy

**Not recommended (no evidence)**
- Psychological debriefings
- Single-session techniques.

**SUMMARY**

The mental health response to a disaster must be a well-coordinated effort that draws on a variety of professionals, paraprofessionals, and volunteers who have been prescreened and specially trained for this work. In the immediate aftermath, the goal of mental health intervention is to facilitate normal coping, to treat those with immediate needs, and to begin to identify those at risk for psychiatric disorders in the ensuing weeks, months, or years. Although mental health interventions have not been shown to prevent psychiatric disorders once exposure to a traumatic event has occurred, research continues to search for strategies that can mitigate harmful effects. Cognitive behavioral approaches are most likely to be beneficial, and psychological debriefing, a somewhat controversial technique, is now changing in response to research, particularly regarding time frames and target populations. Management of the psychosocial effects of disaster will continue long after the initial impact. Psychiatric disorders among children may present with symptoms that differ from those of adults, or may not present until some time later. Major depression and PTSD can be disabling consequences of exposure to disaster among those of any age group, and thus, early diagnosis and treatment are critical to the prevention of future disability.

**STUDY QUESTIONS**

1. What factors determine risk for psychiatric complications in the event of a disaster, and why?
2. What is the role of mental health coordinator in disaster planning, response, and review?
3. Predisaster planning for mental health services should include what topics?
4. What immediate psychiatric symptoms warrant referral to a mental health professional?
5. What techniques can medical professionals use to provide psychological assistance to adults in the immediate aftermath of a disaster?
6. Under what circumstances might psychological debriefing be appropriate? When is debriefing contraindicated?
7. What is traumatic grief, and how is it treated?
8. What are the manifestations of PTSD in adults and children? What are the common treatment options?

**INTERNET ACTIVITIES**

Go to the American Academy of Child and Adolescent Psychiatry Web site, www.aacap.org. Click on “Facts for Families,” and then Grief #8, “Children and Grief.” What are the warning signs that a child is having serious problems coping with grief after a disaster?

Go to Lichtenstein Creative Media at www.theinfinitemind.com/mind192.htm and the report on the “New Normal” after the September 11 Disasters. Scroll down to Dr. Robert Ursano’s definition of “normal.” How does he define it, and what are the implications of the “new” normal?

Go to the National Center for Posttraumatic Stress Disorder at www.ncptsd.org, and on the left, go to NCPTSD, Facts, Disasters. Then scroll down and click on “Domestic Violence.” Is there any support for the concern about an increase in domestic violence in the aftermath of a disaster? Based on those findings, what steps, if any, should be taken in the aftermath of a disaster?

Go back to the home page and NCPTSD, Facts, Disasters. This time scroll down and click on “Pharmacology.” How soon should treatment begin? What agents should the prescriber consider? What other factors should be considered in the decision to use medication?
REFERENCES


Schwarz, E. D., & Kowalski, J. M. (1992). Malignant memo-
ries: Reluctance to utilize mental health services after a disaster. Journal of Nervous and Mental Disorders, 180(12), 767–772.


Stein, D. J., & Zungria-Diwary, N., Van Der Linden, G. J. H., & See-


Mental Health Services, Substance Abuse and Mental Health Services Administration.


CASE STUDY

14.1 Acute Anxiety Reaction in a 9-Year-Old Child

Kathleen Coyne Plum, PhD, RN-CS, NPP

Six weeks following a flash flood in rural upstate New York, the county Crisis Outreach Counselor is contacted by a mother concerned about her 9-year-old daughter, "Elise M." It is raining hard this late summer morning, with much thunder and lightning—not unlike the morning mother and daughter awoke to a house rapidly filling with water on the first floor. They were able to evacuate safely, but not without difficulty, as Elise was very afraid of the water. One week later, a neighboring community also experienced flash flooding, in which a young person drowned.

Mrs. M. reports that since returning home, Elise has been preoccupied, and anxious much of the time, especially if it rains, however lightly. She spends most of her time with her mother, and has withdrawn from her usual friends. This morning, Elise’s anxiety reaches crisis proportions; she is crying uncontrollably and hyperventilating such that her fingers feel numb (making her even more anxious). She cannot/will not cooperate with her mother’s requests for her to get dressed for daycare. The Crisis Outreach Counselor assists the girl to breathe deeply and slowly, while imagining a pleasant and safe place. As she calms down, they talk for a little while, and the girl and her mother agree to accept a crisis appointment at the county clinic for evaluation of her anxiety.

Fortunately, Mrs. M. had previously encountered the Crisis Outreach Counselor at the Red Cross disaster shelter, and having noticed how restless, dazed, and clingy Elise was at the time, the counselor had offered Mrs. M. his business card. That she and Elise knew the person who would be coming to their home greatly facilitated the call for help; and, that he would accompany them to the clinic made possible the referral for evaluation and subsequent treatment.

CASE STUDY

14.2 Mental Health Relief Services Following the World Trade Center Disaster, Fall 2001

Cathy Peters, RN, MS, NP

Twenty years ago, my first nursing position was at Lenox Hill Hospital in Manhattan. I was apprenticed by a supportive, knowledgeable staff, and spent my off-duty hours visiting museums and galleries, playing tennis in Central Park, and exploring the greatness of New York City. Each New Year’s Eve my friends and I would celebrate at Windows on the World, a restaurant on the 107th floor of the World Trade Center. What a life! After 5 years, I returned to upstate New York, but my ties to New York City remain strong. Consequently, it was very poignant for me to return to New York as a disaster mental health worker in the fall of 2001. On September 12, I volunteered (along with many others in Rochester) at our local Red Cross chapter. When I was offered training, plus a disaster relief assignment in New York in October, I accepted without hesitation. My employer granted me a 2-week leave, and I left for disaster mental health training in Philadelphia. There I met dozens of volunteers from all over the United States. It was exhilarating! We shared our information about our professional work and our hopes for the nation. The Red Cross training
was intensive, thorough, and included both didactic and role-play methods, to prepare for the challenges ahead. After 2 days, our group traveled to New York by train. Once in Penn Station, we took the bus to the area headquarters in Brooklyn, checked in, and received our assignments.

New York was subdued, even solemn, everywhere except Times Square. There I found groups of busy tourists and many brightly lit patriotic displays. Elsewhere, the crowds were serious and silent, especially near Ground Zero. Vast numbers of people, two or three abreast, walked quietly, respectfully, past memorial displays. In November there was a police line marking the perimeter of Ground Zero, so viewing was from a considerable distance. It was shocking to see steel girders bent like tree branches.

Our team arrived close to the 2-month anniversary of the disaster. Community politics had begun to emerge, as well as the realization of the recovery work to be done. I was fortunate to also witness glimpses of renewed empowerment among New Yorkers. Friends and I stopped by the centuries-old Trinity Church, on the periphery of Ground Zero. Although covered with rubble after the attack, the church remained intact, and I arrived to find a celebration. After the necessary cleanup, the church reopened in early November. The grounds were manicured, the exterior gently cleaned, and the interior was buffed to a high polish. People hugged and sang in joyous tones, a bishop presided, and I was honored to be part of the festivities. The experience bred confidence and hope.

The next day, I joined a team of volunteers at one of the Red Cross Service Centers. Although an experienced mental health professional, this was my first disaster relief experience. Consequently, I, and others in my position, functioned in the capacity of a "disaster mental health technician." On the suggestion of our supervisors, each of us wrote "FLEXIBILITY" across the cover of our training manuals, and this proved to be an invaluable suggestion! Information and services were continually evolving. Excellent communication, and a flexible approach among and between workers (and clients), was essential. A hierarchy of more experienced staff supported us. Some clients spoke little, if any, English. Written materials were provided in several languages. Clients who were fluent in English would translate for each other. The lines were long. Many were in need of information and emotional or financial assistance. Many had small businesses in lower Manhattan and had lost not only their source of income, but also customers from the World Trade Center. Some drew pictures of their deceased customers who had also become friends. Others had lost family members and colleagues and came to talk.

Our team worked many 12–14 hour days. We closed our doors for the day only after the last client was seen. Food and beverages were provided for everyone. An amazing array of snacks were donated and distributed, along with teddy bears, crayons/coloring books, flashlights/batteries, coupons, telephone calling cards, and educational materials. Although few children were brought to the service center, parents were given bears and books to take home. No one left empty handed.

Each client had the opportunity to discuss his/her circumstances and make requests. Financial assistance was based on need. All clients were assessed for mental health issues and encouraged to take printed materials even if not in apparent distress. These materials focused on emotional responses to a disaster, when to seek help, and how adult and children responses may differ. Some people actually requested a mental health referral after an initial meeting with a member of our team.

The goal of disaster mental health is to assess, refer, and to provide a measure of comfort in the process. Our services extended to survivors, family members and friends of the deceased, as well as our disaster relief team. It’s easy for professionals to become traumatized vicariously in the process of helping others. Our team members remained supportive of one another. Each evening we would process the events of the day before leaving the service center. We collectively agreed that these efforts helped us to keep our focus on disaster relief, while respecting our own mental health needs. Group leaders encouraged us to rest on off-duty hours, eat well, drink water, and keep in touch with home. Our donated calling cards were put to very good use!

As a disaster mental health relief worker, I followed the nursing process of observation, assessment, intervention, and outcome evaluation. Initially, an informal history was taken, with inquiry about a client’s perceived needs, their eating and sleeping patterns, their support network, and their short-term priorities. Sometimes information about past trauma emerged. I always explored a client’s repertoire of past and present coping skills. This was one more way to gauge mental health and to help determine their needs. Where appropriate, medical and psychiatric histories were explored with clients in greater detail.

Advocacy was a huge part of the work in New York. Given the scope of the disaster and baseline stress levels of many people there, the development of posttraumatic stress disorder (PTSD) was a major concern. Many clients were reassured to learn the common responses to traumatic events. For our purposes we categorized them as physiological (e.g., increased heart rate and blood pressure, headache, fainting, and chills), emotional (e.g., anxiety, panic, denial, fears, nightmares), cognitive (e.g., trouble concentrating, feeling disoriented, easily startled), and behavioral (e.g., avoidance of people or places and impulsivity). We discussed that children may experience the same reactions as adults and may exhibit symptoms such as behavioral regression, poor school performance, and dangerous play.
We provided lists of referral sources and highlighted those most appropriate for each client. We also were encouraging further professional contact if the symptoms persisted beyond 1 month, if the symptoms interfered with daily functioning, or if there were underlying medical or psychiatric problems.

We advised clients to remain close to supportive family members and friends, structure their time so that they were not overly busy or unoccupied, avoid alcohol and drugs (unless prescribed by their health care provider), and avoid making any sudden, major life changes. Most clients were seen only once, although some did return for additional information. Consequently, the resources available to the client gauged the “outcome evaluation” piece before and after their visit(s) to the service center. Our priorities were to assess and refer.

Our approach was calm and respectful. No one, under any circumstances, was forced to tell his/her “story” related to September 11. If stories did emerge, clients were supported in expressing themselves, but guided in a way that did not overwhelm them. In some cases, contact was made with a client’s doctor (with permission), and the client was sent from the center directly to their doctor’s office. The unique features of each case were taken into consideration. Given the intensity of disaster mental health work, our assignments lasted 2 weeks instead of the traditional 3-week Red Cross assignment. In addition to the daily group debriefings mentioned above, we were each provided with a formal 1:1 debriefing session before leaving our assignment. All were encouraged to attend at least one debriefing session once returned home (services continue to be offered at our local Red Cross chapter). Although each of these opportunities was helpful, it has taken months for me to process the experience in New York. It takes time to gain perspective.

Figure 14.1 September 11 collage of World Trade Center disaster.
© Cathy Peters (March 2002); 2003 recipient of the Sigma Theta Tau International Nursing Art Media Award

After about 6 months, I sorted through the piles of magazines and newspapers that I had been saving related to the September 11th disaster. I began to clip select stories and pictures. Eventually, these clips became a collage, featured in Figure 14.1. Composing the collage was an act of hope and healing. Through the layering process, I literally pieced together the tragedy in a way that is meaningful to me. The process became an opportunity to move beyond the sadness of the fall. This collage is homage to the people of New York and their great city.
Key Messages

- Pediatric injury and illness patterns following exposure to explosive, radiologic, biological, and chemical agents may be different from those in adults.
- Treatment for pediatric exposure to radiologic, biological, and chemical agents may be different than those for adults.
- Nurses must be prepared to care for children at the disaster scene, in the emergency department, in the hospital, and at shelters or refugee camps; long-term considerations in children’s health also must be considered.
- Pediatric-specific resources are available to assist nurses and other health care professionals in disaster preparedness, mitigation, response, recovery, and evaluation.

Learning Objectives

When this chapter is completed, readers will be able to

1. Discuss the epidemiology of disaster-related injuries and illnesses in children.
2. Compare and contrast the physical and psychosocial differences between children and adults exposed to natural disasters, public health emergencies; and explosive, radiologic, biological, or chemical agents.
3. Describe the assessment and treatment of children following natural disasters and exposure to nuclear, biological, or chemical agents in the field, emergency department, and hospital setting.
4. Discuss the care of children living in shelters or refugee settings following a disaster.
5. Apply pediatric-related disaster resources to one’s own disaster preparedness plans.
Unique Needs of Children During Disasters and Other Public Health Emergencies

Lisa Marie Bernardo

Infants, children, and adolescents have unique physiological and psychosocial needs during and after disasters and public health emergencies. Their injury and illness patterns following exposure to radiologic, biological, and chemical agents may be different from those patterns assessed in adults. Treatment options for adults may be inappropriate, untested, or unavailable for children. Children with special health care needs also require refinements to their care. Nurses and health care professionals must be aware of pediatric considerations during disaster preparedness, mitigation, response, recovery, and evaluation efforts, and must be prepared to modify their approaches accordingly. This chapter discusses the epidemiology of disaster-related injuries and illnesses in the pediatric population. The physiological and psychosocial aspects of children applicable to disaster and public health emergencies are described. Injury and illness patterns following natural, explosion, radiologic, biological, and chemical disasters are discussed, and current treatment recommendations are offered. Interventions from field through emergency department and hospitalization care are addressed. Pediatric-related resources for disaster planning are included.

In 2005, the United States Census Bureau estimated that there were 73,509,780 children younger than 18 years of age residing in this country (U.S. Census Bureau, 2005). It is likely, then, that children and families will be involved in natural or man-made disasters or public health emergencies at home, school, work, or play. Probably the earliest report of the effects of a natural disaster on children was published in 1956; the authors outlined the psychological effects of a Vicksburg, Mississippi, tornado on children who were in a movie theater when the tornado struck (Block, Silber, & Perry, 1956). In 1943, Anna Freud wrote about the psychological effects of war on children (Freud & Burlington, 1943).

One of the earliest reports alerting health care professionals to biological warfare and its resultant illnesses in children was that of R. Nopar (1967). This article, written more than 30 years ago, outlines the ramifications of exposure to biological agents due to acts of
Earthquakes. One of the earliest published reports on natural disasters affecting children was the 1933 earthquake along the Newport-Inglewood fault in southern California; this earthquake resulted in $40 million in damage to buildings, with schools being particularly hard hit (Steinberg, 2000). Because school classes were not in session when the earthquake hit, schoolchildren were not injured; however, the schools’ extensive damage resulted in public outcry regarding safety of schools and the passing of the Field Act of 1933 (Steinberg, 2000). This act imposed seismic safety standards on school buildings and was quickly followed by the Riley Act, which imposed similar standards for all new buildings (Steinberg, 2000).

The Chi-Chi earthquake struck Taiwan on October 9, 1999, killing 2,347 people and injuring 8,722 (Liang et al., 2001). Children 0–9 years had among the lowest mortality rates (12.65/100,000; Liang et al., 2001). This mortality rate was lower than expected, possibly because the earthquake struck at midnight, when families were at home and could protect their children (Liang et al., 2001).

An earthquake struck Duzce, Turkey, at 7 p.m. on November 12, 1999, a time when families were preparing dinner, washing their children, and heating their homes (Ad-El, Engelhard, Beer, Dudkevitz, & Benedek, 2001). Consequently, 27 adults and 13 pediatric patients were treated for burn injuries, most of which were deep and deep partial thickness burns to the lower extremities due to hot liquids, usually water, spilled during the quake (Ad-El et al., 2001). Two of the pediatric patients sustained 30% and 40% total body surface area burns and were transferred to a burn unit; the remaining patients were treated as outpatients, as the local hospital was destroyed in the earthquake (Ad-El et al., 2001).

In the days following this earthquake, dermatologists identified 33 skin disorders in 185 homeless survivors aged 1 through 76 years (Oztas, Onder, Oztas, & Atahan, 2000). In the younger age groups, parasitic infestations, such as pediculosis capitis or scabies, were common, which was probably due to frequent contact with other children and a lack of hygienic conditions (Oztas et al., 2000).

Two published reports focus exclusively on pediatric patients sustaining injuries from earthquakes in Turkey. An earthquake hit Marmara, Turkey, on August 17, 1999. Six hundred and sixty-five patients were treated at Uludag University Hospital in Bursa during the first 4 days following the earthquake; 40 were younger than 15 years old, and their mean age was 10.2 years (range 3.5 months to 15 years; Donmez, Meral, Yavuz, & Durmaz, 2001). Five children died in the emergency department; 4 were transferred; 11 were treated as outpatients, 20 were diagnosed with crush syndrome (Donmez et al., 2001). Patients requiring extrication were trapped an average of 17.9 hours (range 3 to 98 hours); 11 (55%) had one extremity crush injury, and 9 (45%) had more than one extremity crush injury, and 9 (45%) had more than one extremity crush injury. Fifteen (75%) required fasciotomy, two (10%) had one extremity amputation, and two (10%) had bilateral amputation (Donmez et al., 2001). Only one child with a positive blood culture died from sepsis, Staphylococcus hominis, Pseudomonas aeruginosa, and Actinobacter baumanii were present in three children (Donmez et al., 2001). Acute renal failure occurred in one (14.3%) of the children with one extremity injury and six (65.7%) of the children with multiple extremity injuries; none of the children who received intravenous fluids in the field experienced acute renal failure (Donmez et al., 2001).

From this same earthquake, 33 pediatric patients were treated at the Marmara University (Iskit et al., 2001). All children, except for three, were evacuated in...
an average of 30.04 hours (range 1 to 110 hours), and 78% arrived at the hospital within the first 3 days. Crush injuries and crush syndrome were the most common injuries sustained in these children, 15 children had crush injuries, with 10 in acute renal failure when they presented to the hospital (Iskit et al., 2003). The presence of acute renal failure may indicate failure to provide adequate intravenous fluids at the rescue site.

Many published reports of earthquake victims and survivors do not separate characteristics of children from adults. However, the conclusion is drawn that children are victims based on the age ranges and mean ages of the victims. For example, the Bam earthquake on December 26, 2003, killed over 43,000 people. The 798 victims treated in Chamran Hospital the first 48 hours after the earthquake had an age range of 1.5 months to 70 years (mean age = 30.5 years; Emami et al., 2005). From the same earthquake, 210 patients who received treatment for musculoskeletal injuries at Shariati Hospital were studied. In this group, the patients’ ages ranged from 7 to 70 years (mean age = 30.2 years; Naghi et al., 2004).

The December 26, 2004, earthquake off the northwest coast of Sumatra, Indonesia, triggered a tsunami that killed an estimated 230,000 persons in India, Indonesia, the Maldives, Somalia, Sri Lanka, and Thailand (Centers for Disease Control and Prevention [CDC], 2006). This earthquake was followed by a second on March 28, 2005. International relief measures were evaluated at 7 months after the tsunami and 3 months after the second earthquake. Among published reports about the tsunami, no specific breakdown of morbidity and mortality between children and adults in any of the affected geographic areas was found.

Hurricanes. Hurricane Hugo claimed the lives of seven children, or 11% of the total fatalities (35), in 1989 (Holbrook, 1991). Hurricane Marilyn struck the U.S. Virgin Islands in 1995. In the designated pediatric disaster treatment area, pediatric patients numbered 75–100 per day, fully one-third of all patients seeking emergency care (Damian et al., 1997). Children were treated for acute and chronic illnesses and injuries; five critically ill children were evacuated to San Juan, Puerto Rico (Damian et al., 1997). Health conditions treated included burns, punctures, and lacerations; dehydration; chronic illness exacerbations; and uncommon illnesses such as dengue fever and ciguatera poisoning (Damian et al., 1997).

On September 15, 1999, Hurricane Floyd struck North Carolina. Among 252 families attending an ambulatory pediatric clinic that experienced major flooding, 8% had children who were forced to change schools because of the flood (Curry, Larsen, Mansfield, & Leonardo, 2001). Eighteen percent of the families reported loss of medicines and medical devices, 13% had someone in their home develop a new health problem, and 9% had a family member who suffered a worsening of a preexisting illness (Curry et al., 2001).

In August 2005, Hurricane Katrina ravaged the Gulf Coast, displacing thousands of American citizens and crippling the infrastructure of cities and states. This Category 5 hurricane disrupted utilities, food-distribution systems, health care services, and communications in Louisiana and Mississippi (Daley, 2006). A geographic area of approximately 90,000 square miles was affected by the hurricane, resulting in the displacement of approximately 1 million persons (Jablecki et al., 2005). With the Gulf Coast region in a disaster situation, Hurricane Rita struck, compounding the devastation and taxing relief efforts. Vast areas of Mississippi, Texas, Louisiana, and Florida were affected by these hurricanes, and rebuilding and recovery will take years to complete.

Surveillance for infectious and communicable diseases following these hurricanes is ongoing. Among evacuees from the New Orleans area, methicillin-resistant Staphylococcus aureus (MRSA) was found in approximately 30 pediatric and adult patients at an evacuation facility in Dallas, Texas (Jablecki et al., 2005). Approximately 1,000 cases of diarrhea and vomiting were reported among adult and child evacuees in Mississippi and Texas; norovirus was found to be the main culprit (Jablecki et al., 2005). Other infectious agents included nontyphoidal Salmonella and nontoxigenic Vibrio cholerae O1 (Jablecki et al., 2005). A single case of pertussis was documented in a 2-month-old infant rescued from a rooftop in New Orleans and evacuated to Tennessee. The infant received antibiotic therapy, and no additional cases were reported (Jablecki et al., 2005).

Floods. In 1997, Grand Forks, North Dakota, experienced a severe flood. There were 33 identified cases of postdisaster carbon monoxide poisoning, involving 18 incidents; patients ranged in age from 7 to 76 years (Daley, Shirely, & Gilmore, 2001). All incidents were related to the use of gasoline-powered pressure washers in basements (Daley et al., 2001).

Heat and Cold. Extreme cold and heat play critical roles in pediatric illnesses and injuries. During 1999–2001, Mongolia experienced consecutive dzuds (severe winters characterized by extreme cold and heavy snowfall resulting in mass debilitation and death of livestock). Researchers (CDC, 2002a) compared children living in geographic areas affected and unaffected by the dzuds. Regardless of area, children aged 6–23 months were anemic, and there was a high prevalence of growth
stunting in children of all ages, indicative of chronic malnutrition. The only difference found in children affected by the dzuds was a higher prevalence of growth stunting in children younger than 24 months.

In 1996, a blizzard struck the east coast of the United States. One pediatric emergency department observed its census 72 hours before the storm, 36 hours during the storm, and 72 hours after the storm (Attia, 1998). After the storm, there was a significant increase in the triage acuity of the patients, and the admission rate increased to 22% (Attia, 1998).

The July 1995 heat wave that struck Chicago, Illinois, resulted in the deaths of over 700 people, the most ever recorded from a natural disaster of this kind (Klinnenberg, 2002). Most heat wave–related deaths were concentrated among low-income residents and elderly African Americans (Klinnenberg, 2002, p. 20). Klinnenberg (2002) reports on only two pediatric heat-related deaths—those of two young boys left for an hour and a half in a day care owner’s car. Their body temperatures were 107 and 108 degrees. Hundreds of children riding in school buses sustained heat exhaustion while stuck in traffic jams; they were removed from the vehicles; hosed down with water by firemen; and treated at the scene by paramedics; those with worsening conditions were transported to the local emergency department, with localized heat exhaustion while stuck in traffic jams; they were removed from the vehicles; hosed down with water by firemen; and treated at the scene by paramedics; those with worsening conditions were hospitalized (Klinnenberg, 2002).

Public Health Emergencies

One of the most notorious public health emergencies in modern times is the 1918 influenza pandemic. In the United States alone, during the 17 weeks of its outbreak, the Spanish influenza killed 670,000 people, with some 25 million citizens becoming ill from the disease; worldwide, in the 10 months of the pandemic, Spanish influenza killed between 21 and 40 million people (Iezzoni, 1999). Spanish influenza was responsible for killing more Americans than all of the wars of the 20th century combined (Iezzoni, 1999). While infants and children were stricken and succumbed to this disease, the age group with the highest mortality was the 15–40-year-olds (Iezzoni, 1999). Symptoms of the Spanish influenza were coughs that produced greenish sputum; severe nosebleeds; fever of 104–105 degrees; cyanotic skin turning purple or deep mahogany brown; and pneumonia. It was a savage, swift, and terrifying death (Iezzoni, 1999, p. 16). There was no known cure; however, children at New York City’s Roosevelt Hospital were housed on the hospital’s screened roof, wrapped in blankets and hot water bottles; and left to breathe in the cold, salty air. While the public deemed the treatment to be “barbarous and cruel,” mortality rates did drop in patients receiving this treatment (Iezzoni, 1999). In Alaska, Eskimos were severely affected by the influenza; in York, Alaska, everyone died. Among three villages, 750 people died, with approximately 25% freezing to death before help arrived. Over 300 children remained, most of whom were orphans and required care (Iezzoni, 1999).

In Bhopal, India, in 1984, there was an unintentional release of cyanide into the air from the Union Carbide plant. Between 16,000 and 30,000 died following the exposure; it is known that thousands of children died, but no exact numbers are reported (Lapierre & More, 2002). Irani and Mahashur (1986) studied 411 children affected by the methyl isocyanate gas. Four of eight newborns exposed to the gas developed pneumonia, and two subsequently died. Of the 164 children who remained within one-half to 2 kilometers of the plant after the gas’s release, cough, eye involvement, and breathlessness were most often reported as the initial symptoms, while 47 children who were 8–10 kilometers away from the site had no initial symptoms. Both groups reported late symptoms of cough and breathlessness; however, the group closest to the site had a higher proportion of symptoms.

Cyr (1988) reported on 345 children exposed to a farmer’s insecticide spraying. Sixty-seven children were transported to the local emergency department, with local decontamination treatment administered. No children were hospitalized or suffered ill effects.

In March, 2003, a worldwide outbreak of severe acute respiratory syndrome (SARS) was reported and followed by the World Health Organization and by the CDC. As of March 26, 2003, a total of 1,323 suspected or probable SARS cases had been reported to the WHO (CDC, 2003b). The CDC identified the causative agent as a previously unrecognized coronavirus, while the WHO found similar results including a different virus, human metapneumovirus (CDC, 2003b). It is believed that the infection spreads by droplets (CDC, 2003b). While the exact number of children affected by SARS is not reported, age ranges of infected people reported by country are as follows: Thailand, 1–49 years; United States, 8 months–78 years (CDC, 2003b). While little information has been published on pediatric patients infected with SARS during 2003, infants and children accounted for a smaller proportion of affected individuals; they also experienced a much milder disease course and better outcomes compared to adults (Lee & Krilov, 2005).

Since 1997, avian influenza (H5N1) has been an emerging public health threat. The first confirmed human death from avian influenza was a 3-year-old with Reye’s syndrome (Lee & Krilov, 2005). From 1997 through 2002, only a handful of people died, including children. In 2003 and onward, the death rate from avian influenza has increased dramatically. At this time, avian influenza is transmitted from direct contact with infected fowl. Current public health concerns are the mutation of the influenza virus into one that transmits from human to human. Thai and Vietnamese children...
infected with avian influenza consistently presented with fever and cough (Crose & Chokephaibulkit, 2004). Leukopenia and thrombocytopenia were present; those children who developed pneumonia that progressed to acute respiratory distress syndrome subsequently died (Crose & Chokephaibulkit, 2004).

Historically, large-scale exposure to radiation occurred following the detonation of atomic bombs in Japan, fallout from atomic bomb tests, nuclear reactor accidents (e.g., Chernobyl), and the release of material from radiotherapy devices (Mettler & Voelz, 2002). Such releases resulted in thousands of children and adults being exposed to high levels of radiation and suffering from long-term consequences, such as various types of cancers. Children and adolescents, as well as the fetus, are particularly susceptible to developing malignant thyroid cancer (Wawelkeno et al., 2004). A follow-up study of 1,629 adolescents living in Israel who were children at the time of the Chernobyl accident in 1986 was conducted to measure their neurobehavioral and cognitive performances on standardized tests of cognitive ability and attention (Joseph, Reisfeld, Tirosh, Silman, & Rennert, 2004). There were no differences in cognitive abilities and attention among the adolescents regardless of their level of exposure to the radiation (high contamination, low contamination, no contamination).

Children have been diagnosed with anthrax, with several cases reported from the Middle East and France in the past 10 years or so. In most instances, the source of the anthrax was contaminated meat (White et al., 2002), and the infection resulted in anthrax meningitis, intestinal anthrax, and cutaneous anthrax (from a wool thread tied around the umbilicus after birth). Refer to White, Hemseg, and Dukes (2002) for further details.

In 2001, 11 people in the United States were diagnosed with confirmed or probable cases of cutaneous anthrax (Inglesby et al., 2002). One of these victims was a 7-month-old infant who probably contracted the spores at his mother’s workplace (Freedman et al., 2002). The previously healthy infant experienced severe systemic illness, despite early antibiotic therapy and hospitalization that included microangiopathic hemolytic anemia with renal involvement, coagulopathy, and hyponatremia (Freedman et al., 2002). The previously healthy infant experienced severe systemic illness, despite early antibiotic therapy and hospitalization that included microangiopathic hemolytic anemia with renal involvement, coagulopathy, and hyponatremia (Freedman et al., 2002). The previously healthy infant experienced severe systemic illness, despite early antibiotic therapy and hospitalization that included microangiopathic hemolytic anemia with renal involvement, coagulopathy, and hyponatremia (Freedman et al., 2002). The previously healthy infant experienced severe systemic illness, despite early antibiotic therapy and hospitalization that included microangiopathic hemolytic anemia with renal involvement, coagulopathy, and hyponatremia (Freedman et al., 2002).

Unfortunately, the infant survived.

Smallpox is a deadly disease that has plagued humanity for hundreds of years. In most outbreaks, children were most often infected because adults were protected by immunity from vaccine-induced or previous smallpox infection (Henderson et al., 1999). Large outbreaks in schools were uncommon because the smallpox virus is not transmitted until the rash appears; by this time, infected children were confined to bed because of their symptoms (Henderson, 1999).

Acts of Terrorism

Pediatric injuries and illnesses are found in acts of terrorism. Among 94 children treated for penetrating chest injuries in Turkey over a 6-year period, 7 (7.4%) had bomb (shrapnel) injuries; the patients’ mean age was 11.51 years (Inci, Ozcelik, Nizam, Eren, & Ozgen, 1996). From 1991 to 2001, 260 patients in Turkey presenting for treatment of terrorism-related open globe injuries were studied (Sobaci, Akyon, Mutlu, Karagul, & Bayraktar, 2005). The patients’ ages ranged from 9 to 47 years (mean age = 22.6 years), with the vast majority being young males. Mine and hand grenades accounted for 62.5% of the injuries, leaving 6.5% of the patients handicapped (Sobaci et al., 2005).

In 1995, during an intentional release of sarin in a Tokyo subway, 16 children (no fatalities) were exposed to the chemical (American Academy of Pediatrics, 2000). Nakajima et al. (1998) distributed a questionnaire to 1,743 people living in the geographic area on the day of and the day following the sarin release. Four hundred and seventy-one subjects (27%) indicated that they experienced any of the questionnaire’s symptoms. The percent of respondents reporting symptoms in each pediatric age group were as follows: 11.1% in the 0–4-year age group; 10.2% in the 5–9-year age group; 34.1% in the 10–14-year age group; and 39% in the 15–19-year age group (Nakajima et al., 1998). The proportion of subjects experiencing symptoms increased with age, indicating that older children and adolescents were in the subway or out of doors going to school or work when the sarin was released, compared to the very young children who were in their homes and were not exposed to the sarin.

That same year, 19 children (11.3% of the 168 fatalities) died in the bombing of the Alfred P. Murrah Federal Building in Oklahoma City on April 19, 1995 (Quintana et al., 1997). Sixteen of the children who died were seated by the window of the day care center at the time of the explosion. Among the 19 dead children, 90% sustained skull fractures, with 79% sustaining cerebral evisceration; 37% suffered abdominal or thoracic injuries; 31% had amputations; 47% had arm and 26% had leg fractures; 21% were burned; and 100% had extensive cutaneous contusions, avulsions, and lacerations (Quintana et al., 1997). Forty-seven children sustained nonfatal injuries, with seven requiring hospitalization (Quintana et al., 1997). Again, hospitalized children sustained severe skull and brain injuries, extremity fractures, amputations, and burns (Quintana et al., 1997).

During 2000–2001, 138 children under 18 years of age were hospitalized for injuries sustained in terrorist attacks were compared with 8,363 children hospitalized for non-terror-related injuries (Aharonson-Daniel, 2005).
Waisman, Dannon, & Peleg, 2003). There were equal proportions of males and females injured by terrorism, while a higher proportion of males sustained non-terror-related injuries. Those injured by terrorism were significantly older (mean = 12.3 years) compared with those sustaining non-terror-related injuries (mean = 6.9 years). Most terror-related injuries occurred on the road (54%), while non-terror-related injuries occurred in the home (40%). Explosions accounted for 67% of the terror-related injuries, while falls accounted for 53% of the non-terror-related injuries. Sixty-five percent of victims of terror sustained multiple injuries, while 65% of the non-terror victims sustained single injuries. Injury Severity Scores (ISSs) were significantly higher in the terror-related compared to the non-terror-related injury group (25% vs. 3%). A higher proportion of children in the terror group died (5%) compared to the non-terror-related group (1%). Overall, children in the terror-related injury group had higher utilization of operating room, intensive care unit, hospitalization days and rehabilitation services compared to the non-terror-related injury group (Aharonson-Daniel et al., 2003). This comprehensive article poignantly articulates the burden and costs of terrorism on society and its children.

Ten children (age range 5.5–17 years) sustaining injuries during five separate suicide bomber attacks in Israel from 2001 to 2003 were reported (Weigl, Bar-On, & Katz, 2005). Eight of the 10 children survived. All of these children sustained multiple small-fragment injuries, resulting in the need for laparotomies, wound debridements and other surgical procedures (Weigl et al., 2005). The small fragments included nails, ball bearings, and shrapnel fragments (Weigl et al., 2005).

Premeditated shootings at schools by students are acts that defy comprehension. School shootings at the Jonesboro School (Jonesboro, Arkansas) on March 24, 1998, resulted in 3 children and 2 schoolteachers requiring emergency treatment for gunshot wounds; 4 children and 1 teacher died from this horrible act (Skaggs, 1999). On May 21 of the same year, a 15-year-old student in Springfield, Oregon, allegedly opened fire on students in the cafeteria, killing 2 and injuring 22 (Mikka, 1999). Emergency medical services quickly and appropriately triaged and transported the wounded students to the local hospitals, dividing the number of injured students equally in terms of severity of injuries and need for operative management (Mikka, 1999). Selected commonalities among the 37 school shootings since 1974 reveal that the 41 shooters involved preplanned the attack; attacked out of revenge or to settle a grievance; and came from a wide range of family backgrounds, academic performances, and social groups (Twenmlow, Fonagy, Sacco, O’Toole, & Vernberg, 2002). Stein (2002) reviewed 45 mass shootings in English-speaking countries; while complete demographic data were not consistently available, the ages of the shooting victims ranged in age from months to the late seventies.

In Beslan, Russia, a gang of armed terrorists seized School Number One in Beslan, in North Ossetia, Russia, and held 1,100 students, teachers, and parents as hostages. Over a 53-hour siege, hostages were executed, threatened with being shot, denied food and water, and forced to drink urine and to urinate and defecate where they sat (Parfitt, 2004). During the standoff, a bomb in the sports hall unintentionally detonated, and hostages ran through the debris, the terrorists shooting at them while the security forces fought back (Parfitt, 2004). More than 360 people died; half of them children (Parfitt, 2004).

Acts of War

There is very little published literature on the effects of war on pediatric morbidity and mortality (Peam, 2003). Many times, the poor of society suffer the most during times of war and turmoil. Children raised in poverty tend to have low nutritional status, an increased exposure to infectious and communicable diseases, low rates of immunization, high levels of intestinal parasites, and limited access to health care (Seaman & Maguire, 2005). Morbidity and mortality plague the pediatric population during mass population movement, due to war, famine, drought, or a combination of these factors, predisposing children, adults, and elderly to overcrowding, inadequate sanitation, malnutrition, and diseases against which immunity is lacking (Greenough, 2002). Measles, diarrheal illness, upper respiratory infections (Greenough, 2002; Seaman & Maguire, 2005), and malaria (Seaman & Maguire, 2005) are the leading causes of morbidity and mortality in displaced pediatric populations. In overcrowded refugee camps, unsanitary conditions, disrupted infrastructures, and the promiscuous defecation of children (Burkle, 1999) contribute to the high rate of communicable diseases. Sadly, in these situations, children under 5 years of age have a disproportionately higher crude mortality rate from infectious diseases compared with older children and adults (Greenough, 2002). For example, between August and December, 1990, a cholera epidemic affected Mozambican refugees in Malawi; the mortality rate was higher in children younger than 4 years of age compared with other ages (Swerdlow et al., 1997). Over an 8-week period in 1991, there were 301 recorded deaths of Kurdish refugees; 199 (66%) of these deaths occurred in children, for a mortality rate of 30.5/1,000 (Yip & Shart, 1993). More than 10% of refugee infants died during this time (Yip & Sharp, 1993). Among the 199 children who died, those who were under 5 years of age died from diarrheal disease, dehydration, and malnutrition, whereas older children and adults died from exposure to cold, war casualties, and unintentional injuries (Yip & Shart, 1993).
In the 1979 invasion of Afghanistan by the Soviets, over 5 million refugees fled the country into Pakistan and Iran (Bhutta, 2002). Most of the pediatric casualties of this prolonged war were due to ballistics or land mines; the Soviets specifically targeted children by shaping mines as colorful toys or “butterflies” (Bhutta, 2002). Malnutrition, disease, and death in the Afghan pediatric population are among the highest in the world; in addition, physical trauma from land mines and artillery, and psychological trauma from experiencing death and destruction, plague Afghan children (Bhutta, 2002).

In Iraq, following the Gulf War, the water supply was contaminated with infectious agents, resulting in bacterial infections, including infantile diarrhea, cholera, and other diseases (Al-Awqati, 1999). Infant mortality drastically increased, with excess mortality of close to 1 million children due to contaminated water and severe malnutrition, exacerbated in part by the United Nations embargo (Al-Awqati, 1999).

During the Iraq-Iran war (1980–1988), the chemical warfare agent mustard gas was used by Iraq. Momeni and Aminjavaheri (1994) reported on 14 children exposed to mustard gas who were treated in their Department of Dermatology. Their time of treatment was between 18 and 24 hours following mustard gas exposure. The nine boys ranged in age from 9 months to 14 years, and the five girls ranged in age from 13 months to 9 years. Hospitalization ranged from less than 5 days to 12 days. The children’s first symptoms were coughing and vomiting; 78% of the patients had facial symptoms, such as conjunctivitis, photophobia, and erythema (Momeni & Aminjavaheri, 1994).

The vestiges of war creep into worldwide childhood morbidity and mortality. Antipersonnel land mines are the sixth preventable major cause of death in the world’s children, with pneumonia, gastroenteritis, malaria, measles, and HIV being the first five causes (Peam, 2003). Injuries sustained by land mines include avulsion of both feet or lower limbs, shrapnel to the pelvis and abdomen, unilateral or bilateral blindness and conductive deafness (Peam, 2003). Long-term health care needs from land mine–sustained injuries are overwhelming to the children, their families and society.

Children exposed to the violence of war tend to exhibit regressive or aggressive behaviors (Peam, 2003). The risk is that over time, violence becomes a way of life, making them immune to consequences of violence (Peam, 2003). This risk is particularly acute in child soldiers, typically boys aged 8 to 18 years, who are bonded into a like-group, armed and prepared to carry out horrific acts. These child soldiers are abducted from their families, exposed to drugs, and expected to commit heinous acts (Seaman & Maguire, 2005). As they grow older, these child soldiers will suffer from their experiences of dehumanization; will have difficulty accepting schooling and rehabilitation; and will sustain posttraumatic stress disorder (Peam, 2003). Young girls who are mothers find themselves stigmatized and neglected upon returning to their communities following war or conflict (Seaman & Maguire, 2005). Much work through international agencies needs to be done for all children affected by war and its aftermath.

**Complex Emergencies**

“Complex emergencies today represent the ultimate pathway of state disruption” (Burkle, 1999, p. 422). These emergencies represent catastrophic public health emergencies, in which over 70% of the victims are civilians, mostly children and adolescents (Burkle, 1999). Selected characteristics of complex emergencies include administrative, economic, political, and social decay and collapse; high levels of violence; cultures, ethnic groups, and religious groups at risk of extinction; catastrophic public health emergencies; vulnerable populations at greatest risk; primarily internal wars with major violations of Geneva Conventions and Universal Declaration of Human Rights; increased competition for resources between conflicting groups; increased migrations of refugees or internally displaced populations; and other long-lasting and widespread effects (Burkle, 1999, p. 423). Complex emergencies disproportionately affect a country’s pediatric population. In Bosnia alone, 3,000 children and adolescents were killed by snipers (Burkle, 2002). Over 100,000 abandoned or unaccompanied children reside in Somalia and Rwanda; half of the residents in refugee camps were born there (Burkle, 2002, p. 47). In countries experiencing complex emergencies, girls are more likely to not receive proper food or education and be abused, harassed, or raped; young boys are taken out of the camps to be soldiers (Burkle, 2002).

**Physiologic Considerations in Pediatric Care Following a Disaster or Public Health Emergency**

Children have physiologic differences that, compared with adults, have implications for the signs, symptoms, and severity of illness or injury following disasters or public health emergencies. The body systems likely to be affected in disasters and public health emergencies are reviewed in terms of their anatomy, physiology, and postexposure considerations (Brohl, 1996).

**Pulmonary**

Children have faster respiratory rates than do adults because of their higher metabolic rate, as well as greater minute ventilation. Potentially, infants and children can inhale a higher dosage or amount of toxic substances.
Sarin and chlorine have high vapor densities, making them more concentrated closer to the ground; infants and small children, then, would breathe in a higher concentration of these chemicals compared with adults (Bearer, 1995). Their greater minute ventilation places children at risk of exposure to all types of radioactive gases (Chung & Shannon, 2005), particularly those from a nuclear power plant disaster; fallout settles quickly to the ground, and children are likely to inhale a higher concentration of this radioactive material (American Academy of Pediatrics, 2003). Oxygen consumption in infants is 6 to 8 mL/kg/min compared with 3 to 4 mL/kg/min in adults (Chameides & Hazinski, 1998); children exposed to noxious chemicals or vapors would require early oxygen administration.

Tachypnea is a nonspecific sign of respiratory distress (Zaritsky, Nadkarni, Berg, Hickey, & Schexnayder, 2001). Mild tachypnea, along with earlier and increased frequency of pulmonary involvement, was observed in children and adolescents exposed to mustard gas, probably due to the delicacy of the pediatric epithelial tissues (Momeni & Aminjavaheri, 1994). Breathing is primarily diaphragmatic or abdominal in children less than 7 or 8 years of age. Crying children are more prone to swallowing air, which causes gastric distention and hampers respiratory excursion (Bernardo & Schenkel, 2002). Following a disaster situation, where children are separated from parents, in pain and frightened, crying and gastric distention can result, compounding respiratory-related problems.

Infants and young children have cartilaginous and thus compliant chest walls. This anatomic feature has both medical and trauma implications. When a child is in respiratory distress, suprasternal, supraclavicular, infracostal, or substernal retractions result from the child’s increased work of breathing. Respiratory distress could result from exposure to biologic or chemical agents, as well as dust and particles from blasts or collapsed buildings. Kinetic energy from blasts, earthquakes, or other forces is easily transmitted to the underlying pulmonary and cardiac tissues, resulting in pulmonary and cardiac contusions. Such contusions may not be readily diagnosed or apparent immediately after injury; therefore, health care professionals must have a high index of suspicion for these injuries.

Cardiovascular

The child’s estimated blood volume is 80 mL/kg, which is larger than an adult’s on a milliliter per kilogram basis. Therefore, small amounts of blood loss can impair perfusion and decrease circulating blood volume. Children have greater cardiac reserves and catecholamine responses compared with adults, allowing them to compensate for fluid losses from hemorrhage, diarrhea, or lack of oral intake. However, shock and cardiopulmonary failure can result quickly in children exposed to biological or chemical agents, or in those sustaining kinetic energy or burn trauma. Tachycardia may be a nonspecific sign for cardiopulmonary distress (Zaritsky et al., 2001). Skin perfusion is an important indicator of cardiopulmonary perfusion, as skin perfusion may be compromised during early stages of shock (Zaritsky et al., 2001). Early in compensated shock, children’s vital signs will remain in their age range, or slightly elevated. Hypotension is not observed until the child has lost 20% to 25% of his or her circulating blood volume (Chameides & Hazinski, 1998). If fluid stores are not replaced aggressively with oral or intravenous fluids, cardiopulmonary decompensation results and uncompensated shock ensues. Therefore, children sustaining physical trauma from wounds; experiencing vomiting or diarrhea from a biologic agent or from residing in overcrowded shelters or camps; or who are entrapped or without food and water for hours or days are at risk for dehydration and subsequent cardiopulmonary failure, if untreated.

In the months following the 2004 tsunami and earthquake, mild or moderate anemia among children aged 6 months to 59 months ranged from 31.8% to 54.5% and did not differ significantly between displaced and nondisplaced children (CDC, 2006).

Integumentary

The skin of infants and children is thinner and more permeable compared with the skin of adults. They also have less subcutaneous fat than adults. Infants and children have a higher body area to weight ratio, predisposing them to greater heat loss through conduction, convection, radiation, and evaporation. Skin permeability and larger area-to-weight ratio may result in a greater exposure to and absorption of dermal toxicants (American Academy of Pediatrics, 2000). The rapid onset of dermatologic symptoms and dominance of facial involvement in children following exposure to mustard gas may have been accounted for because of these integumentary as well as pulmonary characteristics (Momeni & Aminjavaheri, 1994).

Infants less than 6 months of age do not have fine-motor coordination to shiver and are unable to keep themselves warm; nonshivering thermogenesis occurs where brown fat is broken down to produce warmth (Bernardo & Schenkel, 2002). Shivering is a high-energy-consuming, nonproductive muscular activity initiated for thermogenesis (Bernardo & Henker, 1999). Shivering may not be possible in injured or ill children receiving sedation or neuromuscular blocking agents (Bernardo & Henker, 1999).

Convection, conductive, and radiant heat loss will occur during entrapment when exposed to floodwaters and when exposed to prolonged rainfall during
During and following cold water skin decontamination, convective, conductive, and radiant heat losses will result due to infants’ and children’s higher body surface area-to-weight ratio. Therefore, access to heating sources, such as heat lamps, blankets, intravenous fluid warmers, and perhaps the use of tepid water for skin decontamination are needed to prevent hypothermia in the pediatric population. These warming measures are not only needed following skin decontamination but also to prevent iatrogenic hypothermia and maintain normothermia due to traumatic injuries.

Musculoskeletal

The long bones of children continue to grow throughout childhood and into adolescence. Physical injury to the growth plate, or physis, can result in growth arrest or deformity. Such injury could occur in children sustaining blast injuries. Among children in Turkey, entrapment following earthquakes resulted in crush injuries, crush syndrome, and subsequent acute renal failure (Donmez et al., 2001; Isik et al., 2001), children exposed to a bomb detonation sustained long bone fractures and traumatic amputations (Quintana et al., 1997). Among 75 children sustaining peripheral nerve injuries, electromyographic (EMG) findings showed regeneration in brachial plexus damage in 100% of the children at a mean follow-up time of 3.5 months and 62.5% in a mean follow-up time of 7.7 months (Uzun, Savrun, & Kuzultan, 2005). Compared with adults sustaining peripheral nerve injuries, children had higher rates of being buried in debris, having compartment syndrome, sustaining peripheral nerve injuries in the lower extremities and total axonal damage at the first EMG follow-up (Uzun et al., 2005). Brachial plexus regeneration was the most favorable for children and adults, and both groups had similar rates of peripheral nerve regeneration (Uzun et al., 2005).

Young bones are compliant, thereby affording less protection to underlying body organs (e.g., lungs, heart, brain) when external forces are applied, leading to significant internal injuries in the absence of bone fractures (Lynch & Thomas, 2004). Similarly, children’s abdominal organs are relatively large and have relatively less protective tissues compared to adults; solid and hollow organ injury from blunt and penetrating trauma forces are likely (Lynch & Thomas, 2004). Along with the large size, the organs in the abdominal compartment are close in proximity, and injuries to several organs can occur from a single penetrating or blunt force (Lynch & Thomas, 2004).

Cognitive

Protecting oneself from danger is of utmost importance during a natural or man-made disaster. Unfortunately, young children may not be able to recognize danger or to protect themselves from it (Bernardo, 2001). Following the release of a chemical or biological agent, children may not have the ability to decide in which direction they should evacuate the area (American Academy of Pediatrics, 2000). Such may have been the case in the children exposed to mustard gas; these children may not have realized or been informed of the danger of the gas, not protected their faces, and sustained heavy injury to their faces and eyes (Momeni & Aminjavaheri, 1994).

Nutritional Requirements

Children have a greater growth rate and subsequent higher protein and calorie requirements compared with adults (Burkle, 2002). In complex emergencies, where displaced populations are without adequate food sources, protein-energy malnutrition can result. Protein-energy malnutrition describes the syndromes characterized by malnutrition and micronutrient deficiency diseases, such as marasmus, kwashiorkor, and marasimic kwashiorkor (Burkle, 2002). Protein-energy malnutrition is diagnosed when the child’s arm muscle circumference is less than the fifth percentile or less than 80% of the reference standard (Burkle, 2002). Children who are malnourished are at risk for secondary infections, which can lead to complications and death (Burkle, 2002). Children at risk for protein-energy malnutrition must receive the rations that meet their requirements for caloric intake, protein, and essential vitamins (Burkle, 2002).

A survey conducted at 7 months after the 2004 tsunami and 3 months after the 2005 earthquake found that among children aged 6 months to 59 months, global acute malnutrition (GAM) ranged from 7.8% among displaced children in Banda Aceh to 17.6% among displaced children in Simeulue (CDC, 2006). Severe acute malnutrition (SAM) was highest in Simeulue (3.4% among displaced children) and 1.9% among nondisplaced children (CDC, 2006). These malnutrition levels were below the WHO emergency threshold in Banda Aceh and Aceh Besar but were elevated in Simeulue, a finding that may reflect preexisting malnutrition in this locale (CDC, 2006). Food and drinking water were provided to the majority of the population, although improvements to prevent contamination of drinking water were needed.

Genetic

Exposure to various nuclear, biologic, and chemical agents, as well as exposure to natural and man-made disasters, can have genetic implications for children and their future offspring. Following the aftermath of Hurricane Gilbert in Jamaica on September 12, 1988,
there was an increase in the incidence of neural tube defects (spina bifida, meningocele, myelomeningocele, and encephalocele) in babies born 10–18 months after the hurricane (Duff, Cooper, Danbury, Johnson, & Serjeant, 1991). The incidence increased from a baseline of 1–4/10,000 live births in 1980–1988 to 3–9, peaking at 5–7/10,000 live births from July 1989 through March 1990 (Duff et al., 1991). During this same time period, there was a rise in the megaloblastic change in sickle cell patients, probably due to folate deficiency. This increased incidence of neural tube defects was also probably due to folate deficiency, due to its postdisaster nutritional scarcity (Duff et al., 1991).

Mutagenicity and carcinogenicity of mustard gas have been reported, and children exposed to mustard gas should be followed over time (Momeni & Aminjavaneri, 1994). Following the Gulf War in 1991, unusually high levels of birth defects and rare physical abnormalities in babies fathered by military personnel serving in the Persian Gulf were reported (Doucet, 1994, p. 184). Abnormally high rates of miscarriage and illness in the veterans’ partners also were documented (Doucet, 1994). Reported medical conditions in newborns included rare blood disorders, severe respiratory diseases, malformed internal organs, fused fingers, and club feet (Doucet, 1994). Potential multiple causes of these health maladies include the stress of war; infections from sandflies; experimental medication against Iraqi chemical and biological weapons; possible exposure to chemical and biological weapons; fumes from the oil spills and fires; and exposure to depleted uranium shells (Doucet, 1994). The incidence increased from a baseline of 1–4/10,000 live births in 1980–1988 to 3–9, peaking at 5–7/10,000 live births from July 1989 through March 1990 (Duff et al., 1991). During this same time period, there was a rise in the megaloblastic change in sickle cell patients, probably due to folate deficiency. This increased incidence of neural tube defects was also probably due to folate deficiency, due to its postdisaster nutritional scarcity (Duff et al., 1991).

Newborns and young infants are susceptible to infections due to their underdeveloped immune systems. Therefore, sepsis would be encountered in newborns and infants exposed to biological agents (Nopar, 1967).

The thyroid gland is sensitive to the carcinogenic effects of radiation exposure (Rubino, Cailleux, DeVathaire, & Schlumberger, 2002). This is because the thyroid gland concentrates iodine very efficiently, and exposure to radioiodines results in the localization of radioactive iodine in the thyroid gland (Waselenko et al., 2004, p. w-66). The primary route of radioiodine exposure for children close to its release is inhalation, while for children farther from its release, ingestion of contaminated food and liquids (particularly milk) is the primary route (Waselenko et al., 2004). Radioactive iodine can be absorbed and secreted in human breast milk, placing breast-fed infants at risk for exposure (American Academy of Pediatrics, 2003). Young age is a risk factor for developing thyroid cancer following radiation exposure; this risk is maximal when radiation exposure occurs in children less than 5 years of age (Rubino et al., 2002). Furthermore, females have a higher incidence of thyroid cancer, both spontaneous and following radiation exposure, compared with males (Rubino et al., 2002). Other risk factors for developing thyroid cancer are a high radiation dose and personal or familial history of radiation-associated tumors (Rubino et al., 2002). Children can be exposed to radioiodines through inhalation or through the ingestion of contaminated food (Food and Drug Administration, 2001a). Children have a greater risk for developing cancer when exposed to radiation in utero (Markenson & Reynolds, 2006).

Children are routinely immunized against the communicable and infectious diseases of childhood. Children are not routinely immunized against smallpox, a deadly disease. Routine smallpox vaccination ceased in the United States during the 1970s; today, 100% of children and 80% of adults are susceptible to this disease (Henderson, 1999). Due to this low level of immunity, physicians, nurses, and health care professionals are not likely to have seen this disease, it may be mistaken, in its early stages, for varicella (chicken pox) (Nopar, 1967), thus leading to the undetected spread of the virus.

Following the tsunami, a measles vaccination campaign was enacted, targeting all children aged 6 months to 15 years. Among eligible children aged 12 months to 59 months, the percentage receiving measles vaccination ranged from 37.3% of displaced children in Aceh Besar to 58.2% of nondisplaced children in Banda Aceh (CDC, 2006).

Soil-transmitted helminth infections, primarily ascariasis and trichuriasis, were found among children in Aceh Besar and Simeulue, where approximately 75% of school-aged children in Aceh Besar and Simeulue, where approximately 75% of school-aged children and half of children aged 6 months to 59 months were infected (CDC, 2006). Helminth infection was significantly lower among children in Banda Aceh than among children in the other two districts (CDC, 2006).
CHILDREN WITH SPECIAL HEALTH CARE NEEDS

Children with special health care needs will require additional considerations during mass casualty or disaster care. These considerations include decontamination procedures following radiation or chemical exposure for children using wheelchairs, ventilators, or oxygen; and decontamination procedures for children with gastrostomy tubes, tracheostomy tubes, indwelling bladder catheters, and indwelling central venous catheters. Replacement supplies would be needed once the cutaneous decontamination is completed. Such supplies may not be readily available, so provisions must be made to secure these items or have comparable clean or sterile supplies on hand.

PSYCHOSOCIAL CONSIDERATIONS IN PEDIATRIC CARE

Disasters and public health emergencies are stress-producing events whose impact can last a lifetime. Children are vulnerable to the stresses of evacuation; living in a shelter; and losing their homes, schools, parents, pets, and loved ones. The psychosocial changes resulting from a disaster are related to children’s developmental stage/age; cognitive level; family’s proximity and relocations to the disaster; and direct exposure to, or child’s situation during, the disaster (Conway, Bernardo, & Ton-Tala, 1990). Furthermore, children’s understanding of natural disasters may be influenced by their magical belief system, religious beliefs, and level of moral development (Belter & Shannon, 1993). The parents and families of children may die or become incapacitated and thus unable to care for their children, or children and families may become separated in shelters or treatment facilities, leading to substantial psychosocial problems (Cieslak & Henretig, 2003).

The effects of children’s culture on psychosocial responses to disasters should not be overlooked. Children and families who lose their homes in disasters or acts of war must move to another location, which may mean a different culture, customs, or other life patterns to which they must adjust (Capozzoli, 2002). Such changes occur not only in foreign countries but in the United States as well, where rural families may need to adapt to customs and cultures of urban living, and vice versa.

Children who witness destruction and violence can lose the notion that their home, school, and community are safe places to live and that people are trustworthy. Such notions can create a loss of security, bringing with it fear, anxiety, and horror (Jagodic & Kontac, 2002). Following the 2004 tsunami, many of the children involved feared for their lives, escaped death, and suffered the loss of their families, homes, and communities (Kostelny & Wessells, 2006). Because of the loss of parental and community security, these children were placed at additional risk for sexual exploitation, trafficking, recruitment into armed groups, and dangerous labor (Kostelny & Wessells, 2006).

Young children watching television re-broadcasts of disaster events may believe the event to be happening again and again. Following September 11, 2001, children and adolescents have reported being significantly more worried about coping with stress as compared to before that day (Hagan, 2005). Furthermore, children who witness these intentional acts of violence may experience a greater degree of psychopathology (Hagan, 2005). War, in particular, exposes children to ongoing man-made violence, injury, destruction and death (Hagan, 2005). In-depth discussions of the psychological and emotional experiences of children following a disaster can be found in chapters 3 and 10.

PEDIATRIC CARE DURING DISASTERS

One of the earliest attempts at addressing the needs of pediatric patients during disasters occurred during 1967–1968 by the American Academy of Pediatrics Committee on Disaster and Emergency Medical Care. The committee’s recommendations were published in 1972, and appear to be the first organized recognition of the special needs of children during disasters and emergency medical care. The publication outlined first aid and rescue; transportation by ground and air; qualification of emergency medical services personnel; communication systems; standards for pediatric emergency department, including its location, personnel, administration, records, facilities, and functions of the emergency department area; and equipment, supplies, and medications (American Academy of Pediatrics, 1972). By today’s standards, these recommendations are very rudimentary; however, they laid the foundation for the highly specialized pediatric emergency care that is delivered today.

Pediatric Disaster Triage

In a natural disaster, it is assumed that children would constitute the same proportion of victims as is found in the community; for example, if one-third of the community consists of children, then one-third of the victims conceivably would be children. A higher proportion of children involved in a disaster would occur if the event included a predominantly pediatric setting, such
emergency medical services (EMS) arriving on-scene following a disaster or mass casualty event must have pediatric equipment, supplies, and medications to effectively treat the ill or injured children. The Emergency Medical Services for Children (EMS-C) Program has developed equipment guidelines for the prehospital care of pediatric patients. Scene safety, field command, and search and rescue attempts are enacted in accordance with predetermined EMS disaster plans.

In civilian mass casualty triage in the prehospital setting, those patients with the highest severity of illness or injury are treated first, while the “walking wounded” and the “worried well” are treated last. Prehospital triage criteria are the primary and secondary trauma surveys—assessing airway, breathing, circulation, and disability and then conducting a brief head-to-toe assessment. This information is documented on a triage tag that remains with the patient.

There are numerous pediatric-specific trauma triage scales, including the Pediatric Trauma Score, Children’s Trauma Tool, and Triage-Revised Trauma Score (Lynch & Thomas, 2004). For triage during disasters, there is one method currently available. The JumpSTART Pediatric Multiple Casualty Incident Triage is a method that focuses exclusively on the triage of children during mass casualty events and is modeled after the Simple Triage and Rapid Treatment (START) program (Romig, 2002). Currently, it is the only objective triage system that addresses the needs of children (Markenson & Redlener, 2004). JumpSTART helps rescuers to categorize pediatric patients into treatment groups quickly and accurately (Romig, 2002). Additional information about JumpSTART can be obtained from Lou Romig, MD, at http://www.jumpstarttriage.com.

Triage of patients during a mass casualty event following an earthquake poses special problems, such as multiple scenes, limited medical resources, an uncertain time to definitive care, delayed evacuation, and lack of outside assistance for at least 48–72 hours (Benson, Koenig, & Schultz, 1996). The Secondary Assessment of Victim Endpoint (SAVE) triage was developed to direct limited resources to the subgroup of patients expected to derive the most benefit from their application (Benson et al., 1996). The SAVE triage system assesses survivability in relation to injuries and, on the basis of trauma statistics, applies this information to describe the relationship between expected benefits and consumed resources (Benson et al., 1996). Further details on the SAVE triage are reported in Benson and associates, 1996.

Prehospital Treatment

Prehospital considerations in pediatric treatment include attention to airway, breathing, circulation, and disability (neurologic). Application of oxygen, infusion of intravenous or intraosseous fluids and maintenance of thermoregulation are initiated at the scene, or where it is safe, and during the transport to the hospital emergency department. Pediatric advanced life support, pediatric trauma life support, and pediatric disaster life support protocols are enacted. EMS and public safety responders must be aware of the magnitude of a mass casualty or disaster situation affecting large numbers of children and of their triage and treatment times. Pediatric intubation, intravenous or intraosseous access, and medication calculation and administration are difficult enough when one critically ill or injured child is involved; multiply that stress and attention to detail by 10 or 20 additional patients, and EMS is quickly overwhelmed. Therefore, in mass casualty situations, EMS protocols should focus on basic treatment, such as jaw-thrust and bag-valve-mask ventilation, medication administration via inhalation or intramuscular routes (if indicated) or other basic treatments.

Special considerations are given for patients found in collapsed structures. Patients trapped for prolonged periods of time following earthquakes or building collapses are at an increased risk for contracting an infectious disease. While entrapped, the patient may be contaminated with waterborne and airborne infectious agents, and may be exposed to their own or others’ vomit and feces (Goodman & Hogan, 2002). Documenting the approximate duration of entrapment allows emergency department personnel to anticipate the treatment needs of the patients. For example, in prolonged entrapment, exposure to infectious agents, and crush injuries would be anticipated. The emergency department would prepare to administer warmed, humidified oxygen and warmed intravenous fluids; administer antibiotics; and prepare for operative management.

Emergency medical services must have guidelines in place that outline the destination of ill and injured children—that is, designated hospital emergency departments that have the capabilities to care for critically ill and injured children are utilized. Through effective communications, EMS implements its mass casualty plan to avoid overloading one hospital with patients (Floyd, 2002). Referral patterns to designated and alternative hospitals during mass casualty situations should be followed to allow for appropriate treatment (Floyd, 2002). Most importantly, EMS must plan and practice to prepare themselves accordingly, with proper safety equipment and protection. Responders’ first instincts are to pick up children and transport them while...
## 15.1 Primary Survey of the Pediatric Trauma Patient

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airway/cervical spine</td>
<td>Assess for patency; look for loose teeth, vomitus, or other obstruction; note position of head. Suspect cervical spine injury with multiple trauma; maintain neutral alignment during assessment; evaluate effectiveness of cervical collar, cervical immobilization device, or other equipment used to immobilize the spine. Open cervical collar to evaluate neck for jugular vein distention and tracheal deviation.</td>
</tr>
<tr>
<td>Breathing</td>
<td>Auscultate breath sounds in the axillae for presence and equality. Assess chest for contusions, penetrating wounds, abrasions, or paradoxic movement.</td>
</tr>
<tr>
<td>Circulation</td>
<td>Assess apical pulse for rate, rhythm, and quality; compare apical and peripheral pulses for quality and equality. Evaluate capillary refill; normal is less than 2 seconds. Check skin color and temperature. Note open wounds or uncontrolled bleeding.</td>
</tr>
<tr>
<td>Disability (neurologic)</td>
<td>Assess level of consciousness; check for orientation to person, place, and time in the older child. In a younger child, assess alertness, ability to interact with environment, and ability to follow commands. Is the child easily consoled and interested in the environment? Does the child recognize a familiar object and respond when you speak to him or her? Check pupils for size, reactivity, and equality.</td>
</tr>
<tr>
<td>Expose</td>
<td>Remove clothing to allow visual inspection of the entire body.</td>
</tr>
</tbody>
</table>


holding them. Children must be considered as potentially contaminated before EMS and public safety responders hold or touch them, thereby preventing themselves from becoming secondary victims (Hohenhaus, 2005).

### Emergency Department Treatment

In a disaster or mass casualty situation, all hospitals may be called on to care for ill or injured children of varying degrees of symptom severity. Therefore, all hospital emergency departments need to be prepared to treat children; likewise, pediatric hospitals must be prepared to treat injured or ill parents and adult family members. As part of their pediatric disaster planning, hospitals should anticipate a lack of prehospital triage; establish protocols for care; create pediatric antidote kits; and anticipate the need for extra personnel (Hohenhaus, 2005).

When injured children arrive at the emergency department, they are triaged according to their severity of injury, with those in most critical condition receiving care first. Children with special needs who cannot talk or ambulate should be triaged similar to infants (Hohenhaus, 2005). Triage under disaster circumstances is generally carried out by physicians and nurses to quickly ascertain the numbers of ill or injured children, their severity of injury, and the resources that will be needed to care for them.

After the appropriate level of triage is assigned, emergency health professionals—generally physicians, nurses, and surgeons—complete the primary and secondary surveys of the injured child (Tables 15.1 and 15.2). These surveys allow for the rapid detection of life-threatening injuries and the initiation of life-saving treatment.

As soon as possible, parents and family members should be permitted to see their children. Emergency personnel should explain to the parents beforehand what they will see and why; such explanations prevent any surprises (Bernardo & Schenkel, 2002). Parents may believe they need permission to touch or talk to their children; they should be encouraged to touch, talk to, and be with their children (Bernardo & Schenkel, 2002). Tell children what will happen before it happens. Children do not like surprises any more than adults do. Prepare them by using feeling terms; that is, “This will feel cold; this will feel heavy; this will smell sweet” (Bernardo & Schenkel, 2002).

The Joint Commission on Accreditation of Healthcare Organizations requires that all patients receive a pain assessment and appropriate pain-relief measures. Various pain scales are available to measure pain in preverbal and verbal children; nurses should administer
## Secondary Survey of the Pediatric Trauma Patient

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head, eye, ear, nose</td>
<td>Assess scalp for lacerations or open wounds; palpate for step-off defects, depressions, hematomas, and pain.</td>
</tr>
<tr>
<td></td>
<td>Reassess pupils for size, reactivity, equality, and extraocular movements; ask the child if he or she can see.</td>
</tr>
<tr>
<td></td>
<td>Assess ears and nose for rhinorrhea or otorrhea.</td>
</tr>
<tr>
<td></td>
<td>Observe for raccoon eyes (bruising around the eyes) or Battle’s sign (bruising over the mastoid process).</td>
</tr>
<tr>
<td></td>
<td>Palpate forehead, orbits, maxilla, and mandible for crepitus, deformities, step-off defect, pain, and stability; evaluate maxillas by asking child to open and close mouth; note open wounds.</td>
</tr>
<tr>
<td></td>
<td>Inspect for loose, broken, or chipped teeth as well as oral lacerations.</td>
</tr>
<tr>
<td></td>
<td>Check orthodontic appliances for stability.</td>
</tr>
<tr>
<td></td>
<td>Evaluate facial symmetry by asking child to smile, grimace, and open and close mouth.</td>
</tr>
<tr>
<td></td>
<td>Do not remove impaled objects or foreign objects.</td>
</tr>
<tr>
<td>Neck</td>
<td>Open cervical collar and reassess anterior neck for jugular vein distention and tracheal deviation; note bruising, edema, open wounds, pain, and crepitus.</td>
</tr>
<tr>
<td></td>
<td>Check for hoarseness or changes in voice by asking child to speak.</td>
</tr>
<tr>
<td>Chest</td>
<td>Obtain respiratory rate; reassess breath sounds in anterior lobes for equality. Palpate chest wall and sternum for pain, tenderness, and crepitus.</td>
</tr>
<tr>
<td></td>
<td>Observe inspiration and expiration for symmetry or paradoxical movement; note use of accessory muscles.</td>
</tr>
<tr>
<td></td>
<td>Reassess apical heart rate for rate, rhythm, and clarity.</td>
</tr>
<tr>
<td>Abdomen/pelvis/genitourinary</td>
<td>Observe abdomen for bruising and distention; auscultate bowel sounds briefly in all four quadrants; palpate abdomen gently for tenderness and stability; assess pelvis for tenderness and stability.</td>
</tr>
<tr>
<td></td>
<td>Palpate bladder for distention and tenderness; check urinary meatus for signs of injury or bleeding; note priapism and genital trauma such as lacerations or foreign body.</td>
</tr>
<tr>
<td></td>
<td>Have rectal sphincter tone assessed, usually by physician.</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>Assess extremities for deformities, swelling, lacerations, or other injuries. Palpate distal pulses for equality, rate, and rhythm; compare with central pulses.</td>
</tr>
<tr>
<td></td>
<td>Ask child to wiggle toes and fingers; evaluate strength through hand grips and foot flexion/extension.</td>
</tr>
<tr>
<td>Back</td>
<td>Logroll as a unit to inspect back; maintain spinal alignment during examination; observe for bruising and open wounds; palpate each vertebral body for tenderness, pain, deformity, and stability; assess flank area for bruising and tenderness.</td>
</tr>
</tbody>
</table>

plans for this should be written into hospitals’ disaster plans (Conway et al., 1998). Plans should be in place for the activation of support personnel with specialized knowledge in children’s mental health needs, such as child life specialists, child psychologists, psychiatrists, and counselors (Conway et al., 1990). Reuniting families can be operationalized on an EMS level or county level through EMS trip reports or other locator systems.

Children and families may be discharged to home or to shelters directly from the emergency department. When they are discharged, families should be given listings of community resources, such as local mental health services, disaster aid services, and hospital/clinic psychiatric services (Conway et al., 1990), thus allowing families the opportunity to follow up with these resources as needed. Families can be given pamphlets or other materials on anticipatory guidance for what their children will experience and how they can promote their children’s coping.

**Inpatient Treatment**

Community hospitals may become overwhelmed with injured patients following a disaster. The hospitals themselves may be damaged and unsafe for patients and personnel and they may have to close their doors. Hospitals that remain open may be caring for large numbers of injured children, and they may not have the resources or staffing available to do so adequately. In general, the inpatient care of children requires a higher staff-to-patient ratio, especially in the infant population. Infants and children cannot care for themselves, making their care more labor intensive than an adult population. Staff will already be spread thin to care for many patients, including adults and the elderly, who also have special health care needs. Parents and family members themselves may be hospitalized and unavailable to provide physical comfort or emotional support. Children may be taken by air transport to specialty hospitals miles away, and uninjured parents may not be able to visit because of impassable roads or the lack of transportation or money. Caring for children under such austere conditions will be challenging for nurses and health care professionals. In each hospital’s disaster plan, provisions for the care of large numbers of injured children should be made to assure adequate supplies and staffing.

**Care in Shelters**

In the event of a disaster, families may need to evacuate their homes and go to community-designated shelters or stay with friends or relatives outside of the disaster area. The decision to evacuate to a shelter or alternate safe housing may be based on weather advisories, requests from public safety officials, or self-identified need.

Families that have lived through a natural disaster, such as a hurricane, would likely evacuate to a shelter in the event of a similar situation. Rincon, Linares, and Greenberg (2000) found otherwise in a study conducted 7 years after Hurricane Andrew. In their survey of 325 caregivers whose children were receiving treatment in a pediatric emergency department, Rincon and colleagues (2001) reported that only 37% of families living in Dade County during Hurricane Andrew would go to a shelter, versus 49% of families who were not living in Dade County at that time. Ninety-six percent of those living in Dade County during Hurricane Andrew who would not go to a shelter in the event of a hurricane evacuation advisory had at least one child under 13 years of age; similarly, 97% of those not living in Dade County during Hurricane Andrew who would have at least one child under 13 years of age (Rincon et al., 2001). Health care and public safety professionals need to be aware that families with children may not evacuate during a disaster and may not be accounted for among families going to shelters or hospitals for care. These families may still require health care and would have to be reached through alternative means, such as door-to-door or on-site clinics.

Tetanus prophylaxis is administered to those sustaining injuries such as wounds and fractures; however, there is no need for a mass vaccination program (Greenough, 2002). Tetanus immune globulin is administered to individuals who have never received the tetanus immunization series and who have highly contaminated wounds (Greenough, 2002).

After a disaster, families and children will require mental health services and counseling. Qualified child psychologists, psychiatrists, social workers, and counselors should provide this treatment. To meet children’s psychosocial needs following a disaster, health care professionals must consider the children’s developmental levels, their caregivers, and their families when conducting assessments and providing treatment (Mohr, 2002). Also critical to treatment is an assessment of the nature of the child’s exposure to the disaster, the severity of the disaster, and the duration of the trauma or crisis (Mohr, 2002).

**Care in Refugee Camps**

In war-torn countries, fleeing refugees may be placed in refugee camps until they are free to return to their towns or leave their country. Life in refugee camps provides its own set of circumstances that contribute to the potential for the spread of infectious diseases. Nurses and health care professionals must collaborate with public health officials to conduct surveillance for infectious disease
outbreaks in these camps. While births and deaths are expected in refugee camps, mortality rates in displaced populations exceeding 4/10,000/day in children young than 5 years is cause for grave concern and investigation (Noji, 2005).

Measles should be suspected in areas where it is endemic and childhood immunization rates are low; signs of measles include fever, cough, mouth sores, and rash (Greenough, 2002). Children under 5 years of age who pass rice water stools with or without vomiting should raise the suspicion of cholera in epidemic areas (Greenough, 2002). Shigellosis is suspected in children with painful bloody stools and fever (Greenough, 2002).

Measles immunization is the only vaccine necessary, especially for young children living in underimmunized areas (Greenough, 2002, p. 29). A measles vaccine program, second in priority to the provision of food, can save children at risk for starvation (Burkle, 2002). Vitamin A alone can decrease the mortality rate in starving children up to 50% (Burkle, 2002, p. 50). The current evidence demonstrates that measles vaccination, vitamin A, and insecticide-treated nets can be given to children aged 6 months to 5 years (up to ages 12–14 years can be recommended) (Noji, 2005). Ideally, 80% of the refugee camp population should receive measles immunization (Noji, 2005). Should meningococcal meningitis be confirmed in an ill person, especially in geographic areas where such epidemics have occurred, a vaccination program is warranted, especially for families and close community contacts (Greenough, 2002). In young children, though, immunity duration is short and does not prevent the spread of the bacteria by carriers (Greenough, 2002). Mass vaccination is not warranted for typhoid and cholera, as the likelihood of contracting these diseases will occur before the series of immunizations are administered (Greenough, 2002). Treatment of infectious diseases requires a multifaceted approach. Children with bacillary dysenteries should be treated with trimethoprim/sulfamethoxazole (Greenough, 2002). Any outbreak of diarrheal diseases should signal the need to chlorinate the water supplies (Greenough, 2002).

Adequate food must be delivered and distributed to families in refugee camps. In refugee settings, the elderly and unaccompanied minors are at risk for decreased access to food and efforts should be made to get food to these individuals (Burkle, 2002). The most vulnerable to nutritional deficiencies include pregnant women, breast-feeding mothers, young children, people with disabilities and the elderly (Noji, 2005). Children are placed in feeding programs depending on their nutritional needs and are not discharged until they reach more than 90% of their reference standard (such as mid upper arm circumference) (Burkle, 2002). The WHO oral rehydration solution is administered when indicated. The results of a double-blinded, randomized, controlled clinical trial indicated that the addition of Benefiber to the WHO oral rehydration solution facilitated recovery from acute watery diarrhea in children (Alam et al., 2000). Benefiber supposedly enhances the colonic absorption of salt and water, thereby improving the course of the diarrheal illness. General food rations should be at 2,100 kcal per person per day and should include sufficient proportions of protein, fat and micronutrients (Noji, 2005).

Even in refugee settings, children’s developmental needs must be met. This includes encouraging children to play; play can help to reduce stress and should be considered a priority along with physical care, treating dehydration, and malnutrition (Raynor, 2002). Play becomes even more important to children in refugee camps (or shelters), where a sense of safety and stability have been lost (Raynor, 2002). Children can use play to express their thoughts and feelings about the disaster; Raynor (2002) describes in detail how to initiate play with children who have been displaced following a disaster. In refugee settings, interventions to help children must take into account the parents’ stresses as well as traditional healing practices of the community (Burkle, 2002).

PEDIATRIC CARE DURING PUBLIC HEALTH EMERGENCIES

Exposure to Nuclear and Radiologic Agents

Children, like adults, can be exposed to nuclear agents through an attack on a nuclear power plant; they can be exposed to radiologic agents through the release of a “dirty bomb” or an unintentional release. The decontamination and treatment of patients exposed to radiologic contaminants are discussed elsewhere in this book (refer to chapter 20). This section outlines pediatric-specific recommendations for care.

Prehospital Treatment

In the prehospital setting, radioactive contamination can be quickly detected using Geiger counters or dose-rate meters (Mettler & Voelz, 2002). A high index of suspicion for radioactive agents must be maintained. Pediatric advanced life support protocols always take precedence over radiation issues. EMS personnel can remove the victims’ clothing, resulting in the elimination of 90% of the contamination (Jarrett, 1999). EMS personnel must wear protective clothing and gloves, in accordance with their agencies’ policies and procedures;
Parents may not be permitted to see their children until life-threatening conditions are treated and decontamination procedures are completed. Keeping parents apprised of their children’s condition is helpful in allaying their anxiety, letting children know that their parents are waiting for them will be comforting to frightened children. Hospitalization is recommended in significant systemic irradiation, disease, or trauma (Fong, 2002).

**Definitive Treatment.** Should children be exposed to the detonation of a nuclear weapon or the release of radioactive material from a nuclear reactor, or when iodine is a byproduct of the release, potassium iodide or iodate would be administered to prevent radioiodine from accumulating in the thyroid gland. Potassium iodide (KI) should be administered immediately or at least within 8 hours post exposure (Chung & Shannon, 2005). When administered within 4 hours of exposure, potassium iodide reduces radioiodine uptake by 50% by saturating the thyroid gland with nonradioactive iodine (Waselenko et al., 2004). Potassium iodide should be administered with caution in children and adolescents with a known or reported allergy to iodide, as severe allergic reactions have been reported (American Academy of Pediatrics, 2003). Therefore, newborns who receive KI should have ongoing monitoring of their thyroid function by measuring thyroxine-stimulating hormone activity (American Academy of Pediatrics, 2003). Because both radiiodine and KI are secreted into human breast milk, lactating women who receive KI should not breast-feed their infants because of the risk of additional exposure to radioiodine from breast milk (American Academy of Pediatrics, 2003). Public health officials will determine when it is safe to resume breast-feeding and when it is safe to consume produce and milk following a radiologic exposure (American Academy of Pediatrics, 2003).

Potassium iodide is prepared in tablets, making it easier to store. Infants and children, though, cannot swallow tablets. When dissolved in water, the fluid is too salty to drink (Food and Drug Administration, 2002). To disguise the salty taste of the potassium iodide, the tablet can be crushed and mixed with raspberry syrup, low-fat chocolate milk, orange juice, or flat soda (cola) (Pelsor, Sadrieh, & Machado, 2002). Nurses or parents can crush one 130-mg potassium iodide tablet into small pieces; add 4 teaspoons of water to the crushed tablet to dissolve it; then add 4 teaspoons of one of the aforementioned fluids to the mixture (U.S. Food and Drug Administration, 2002). Each teaspoon contains 16.25 mg of potassium iodide. This mixture will keep up to

---

**Emergency Department Treatment.**

Before patients arrive, the emergency department must prepare patient care areas to limit the spread of radioactive contamination; security must be in place to prevent unauthorized access. Triage includes a radiologic survey to assess dose rate, documentation of prodromal symptoms and collection of tissue samples for bodosimetry (Waselenko et al., 2004). Emergency personnel should don personal protective equipment, but a respirator is not necessary (Mettler & Voelz, 2002). Staff should wear a “duckbill” mask or a similar device to prevent the inhalation of radioactive dust as it is removed from the patients. As in the prehospital setting, life-saving interventions are initiated prior to surface decontamination. Airway, breathing, and circulation are maintained, along with physiologic monitoring as needed (CDC, 2005). Major trauma, burns, and respiratory injuries are treated (CDC, 2005). Additional blood samples for CDC, noting the lymphocyte count, and human leukocyte antigen are obtained and repeated periodically (CDC, 2005). Samples from the orifices and contaminated areas are collected (Fong, 2002). Children should be given age-appropriate explanations of what is happening to them and what they will feel (“I am going to tickle your nose with this cotton swab”). Wounds that are contaminated with radioactivity are rinsed with saline and treated with aseptic technique; contaminated burns are gently rinsed and treated with usual burn wound care (Mettler & Voelz, 2002). The water used for skin decontamination should be contained and disposed of at a later time; if the water cannot be collected, it can be flushed down standard drains (Jarrett, 1999). Local water purification plants should be notified of this event and shut down; if the water cannot be collected, it can be flushed down standard drains (Jarrett, 1999). If decontamination occurs out of doors, hot water should be available in the event of near-freezing weather; separate facilities should be established for men and women (Fong, 2002). Infants and young children should remain with their mothers or female caregivers; older children should be decontaminated with the appropriate gender. Contaminated items are placed in labeled plastic bags and properly disposed (Jarrett, 1999; Mettler & Voelz, 2002) or held for law enforcement. Open wounds should be covered until decontamination is completed (Jarrett, 1999).

---

**When entering highly contaminated areas, respirators must be worn. Surface decontamination can be undertaken in the absence of physical injuries; in the presence of life-threatening injuries, such injuries are stabilized prior to surface decontamination (Mettler & Voelz, 2002). If decontamination occurs out of doors, hot water should be available in the event of near-freezing weather; separate facilities should be established for men and women (Fong, 2002). Infants and young children should remain with their mothers or female caregivers; older children should be decontaminated with the appropriate gender. Contaminated items are placed in labeled plastic bags and properly disposed (Jarrett, 1999; Mettler & Voelz, 2002) or held for law enforcement. Open wounds should be covered until decontamination is completed (Jarrett, 1999).**
7 days in the refrigerator (Food and Drug Administration, 2002). The recommended daily dose for potassium iodide in children 4 years to 18 years of age is 65 mg (4 teaspoonsful); for children 1 month through 3 years of age, 32 mg (2 teaspoonsful); and for newborns and infants less than 1 month of age, 16 mg (1 teaspoonful) (U.S. Food and Drug Administration, 2002). This daily dosing should continue until the risk of exposure has passed or until other measures, such as evacuation, sheltering, and control of the food and milk supply, have been implemented successfully. Recommendations for continued KI administration should be made by the Environmental Protection Agency, the Nuclear Regulatory Commission, or other government agencies involved with assessing the environmental impact of the radiiodine release (American Academy of Pediatrics, 2003). Overall, the benefits of potassium iodide treatment exceed the risks of overdosing, especially in children; however, particular attention to dose and duration of treatment should be afforded infants and pregnant women (U.S. Food and Drug Administration, 2002).

For children exposed to cesium-137 and thallium, Prussian blue is administered. Prussian blue enhances the excretion of these agents in the stool, thereby decreasing radiation exposure (Chung & Shannon, 2005). The dosage for Prussian blue is 3–10 g/day by mouth (0.21–0.32 g/kg/day) (Columbia University Mailman School of Public Health National Center for Disaster Preparedness, 2005). Complications and side effects from the radiation exposure will require the standard treatment.

Following exposure to plutonium, curium and americium, chelation with pentate calcium trisodium (CaDTPA), pentate zinc trisodium (Zn-DTPA), or dimercapto-propane-1-sulfonic acid (DMPS) can be administered (Chung & Shannon, 2005). Ca-DTPA and Zn-DTPA chelate with metals and are excreted in the urine (Chung & Shannon, 2005). These medications are administered by inhalation or intravenous routes at a dosage of 14 mg/kg IV, up to a maximum of 1 g (Chung & Shannon, 2005).

Children are one of the groups at high risk for psychological effects following terrorist attacks and subsequent exposure to radiation (Mettler & Voelz, 2002; Waseelenko et al., 2004). Counseling should be in place to help children cope with the situation and its long-term effects (Fong, 2002; Waseelenko et al., 2004).

### Exposure to Biological Agents

Children may be exposed to biological agents while at school, at home or in the community (Rosenfield & Bernardo, 2001). For the most part, signs and symptoms of biological diseases are the same in children and adults; refer to chapter 16 for detailed explanations of these diseases. Anthrax and smallpox, though, have different treatment regimes for children and are outlined in Table 15.3. Nurses and health care professionals should contact their local health department for current treatment recommendations or refer to the Website for the Centers for Disease Control and Prevention (www.cdc.gov).

In 2002, a Subject Matter Experts Meeting was convened to further the work of the National Pharmaceutical Stockpile Program, now known as the Strategic National Stockpile (SNS). While early on pediatric concerns were not fully addressed, in recent years more pediatric-specific items have been added to the SNS. Equipment and certain pharmaceuticals are now included. One problem with pediatric-specific pharmaceuticals is that the SNS may only stock items licensed by the U.S. Food and Drug Administration that are used only for their FDA-approved indications. In some instances, FDA indications are lacking for medications used in children exposed to chemical or biologic agents; the SNS does not contain therapeutic agents for all indications for children (Markenson & Reynolds, 2006). One approach would be to allow the SNS to include medications for indications that may not be FDA-approved for children provided there is evidence for its use under proper medical supervision (Markenson & Reynolds, 2006). See Table 15.4.

Health care professionals will experience difficulties in detecting, then treating, children exposed to biological agents. First, physicians will fail to diagnose a disease caused by a biological agent, as such diseases occur rarely or not at all in the United States (Nopar, 1967). Second, if two or more biological agents are dispersed, there may be confusion when diagnoses are attempted (Nopar, 1967). Third, the method of dispersing the biological agent will affect how it enters the body; for example, Q fever, psittacosis, and smallpox can be spread by aerosol attack, while others may occur via natural routes, such as mosquitoes (Nopar, 1967). A high index of suspicion must be maintained by health care professionals when treating children who present with unusual signs and symptoms of infectious or communicable diseases.

### Prehospital Treatment

In the prehospital setting, it is unlikely that emergency medical services personnel will be able to diagnosis a disease caused by exposure to a biological agent. Emergency medical services will treat children based on their severity of illness, stabilizing the airway, assisting with breathing and restoring circulatory volume. Pediatric advanced life support protocols would be followed, and in mass casualty settings, triage would occur with rapid transport of those with the highest illness severity. Emergency medical services personnel would don personal protective equipment, such as masks and gloves, as part of their standard procedures.
## 15.3 Pediatric Signs and Symptoms Following Exposure to Anthrax and Smallpox

<table>
<thead>
<tr>
<th>BIOLOGICAL AGENT/DISEASE</th>
<th>SIGNS AND SYMPTOMS</th>
<th>DIAGNOSIS AND TREATMENT</th>
<th>MEDICATION ADMINISTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cutaneous anthrax</strong></td>
<td>Initial painless papulovesicular lesion surrounded by massive interstitial edema; eschar develops within 2 to 5 days (Freedman et al., 2002). Systemic symptoms include fever and leukocytosis (in delayed treatment and development of bacteremia) (Freedman et al., 2002).</td>
<td>Serum polymerase chain reaction and skin biopsy (Freedman et al., 2002). Hospitalize; monitor electrolyte and hemotological status; administer intravenous antibiotics (Freedman et al., 2002).</td>
<td>Initial Treatment: Ciprofloxacin or doxycycline. Intravenous therapy with multiple antimicrobial agents is recommended (Centers for Disease Control and Prevention, 2001). In young children under 2 years old, initial therapy should be intravenous and combination therapy with additional antimicrobials considered (Centers for Disease Control and Prevention, 2001). Treatment: Following improvement, begin oral therapy with one or two antimicrobial agents (including either ciprofloxacin or doxycycline) for the first 7–10 days (Centers for Disease Control and Prevention, 2001). Remaining time until 60 days: Amoxicillin is administered for the completion of the remaining 60 days of therapy (Centers for Disease Control and Prevention, 2001). Amoxicillin dosing in children &gt; 40 kg: 500 mg every 8 hours; children &lt; 40 kg: 15 mg/kg every 8 hours (total 45 mg/kg/day) (U.S. Food and Drug Administration, 2001b).</td>
</tr>
<tr>
<td><strong>Systemic (inhalation) anthrax</strong></td>
<td>Fever, myalgia, fatigue, headache, malaise 5 to 6 days postexposure (Kare, Roham, &amp; Hardin, 2002; Nopar, 1967). Nonproductive cough for 2 to 3 days, severe respiratory distress, cyanosis, chest pain, diaphoresis, shock, and death over 24 to 36 hours (Kare et al., 2002; Nopar, 1967).</td>
<td>Chest radiograph (reveals bilateral widened mediastinum; Kare et al., 2002; Nopar, 1967). Hospitalize; support respiratory effort; administer antibiotics.</td>
<td>Initial Treatment: Intravenous ciprofloxacin 10 mg/kg/dose every 12 hours (maximum 400 mg/dose) or 15 mg/kg/dose every 12 hours orally (maximum 500 mg/dose) (Centers for Disease Control and Prevention, 2001), or intravenous doxycycline 2.2 mg/kg/dose every 12 hours orally (maximum 100 mg/dose) (Centers for Disease Control and Prevention, 2001), plus one or two additional antimicrobial agents (Centers for Disease Control and Prevention, 2001).</td>
</tr>
<tr>
<td><strong>Smallpox</strong></td>
<td>Fever and toxemia, 7–8 days postexposure, with eruption of viral exanthema; 7–17 days of incubation, abrupt fever, malaise, headache, prostration, backache, with eruption of maculopapular rash on the mouth and oropharynx, face, forearms, trunk, and lower extremities (Rajagopalan, 2002). In 1–2 days, the rash becomes vesicular and pustular, with a characteristic dense facial eruption; crusting occurs on day 6–9 postexposure (Rajagopalan, 2002). In the variola major type of smallpox, complications in children include blindness, scarring, and bony deformities (Kortepeter, Rowe, &amp; Elizbe, 2002).</td>
<td>High index of suspicion for the disease. Support airway, breathing, and circulation. Collect specimens of aspirated material from the pustules; send for electron microscopy examination (Hardin, 2002). Isolation pattern(s); observe universal precautions. Report to local public health agencies (Hardin, 2002). Administer smallpox vaccine and vaccinia immune globulin (Hardin, 2002).</td>
<td>Administration of smallpox vaccine and VIIG. No contraindication to vaccination is likely to be recognized during an outbreak of smallpox (Bronze, Huycke, Muchado, Yoskuhi, &amp; Greenfield, 2002).</td>
</tr>
</tbody>
</table>
Recommended Dosing for Selected Pediatric Exposures

<table>
<thead>
<tr>
<th>DISEASE EXPOSURE</th>
<th>MEDICATION</th>
<th>DOSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation anthrax postexposure prophylaxis</td>
<td>Amoxicillin</td>
<td>80 mg/kg/day in 3 divided doses; maximum 500 mg/dose</td>
</tr>
<tr>
<td>Inhalation anthrax</td>
<td>Ciprofloxacin</td>
<td>10–15 mg/kg every 12 hours; not to exceed 1 gram/day</td>
</tr>
<tr>
<td>Tularemia treatment</td>
<td>Ciprofloxacin</td>
<td>15 mg/kg every 12 hours; not to exceed 1 gram/day</td>
</tr>
<tr>
<td>Tularemia prophylaxis</td>
<td>Gentamicin</td>
<td>IV or IM 6–7.5 mg/kg/day in 3 divided doses (every 8 hours)</td>
</tr>
<tr>
<td>Tularemia prophylaxis</td>
<td>Ciprofloxacin</td>
<td>15–20 mg/kg every 12 hours; not to exceed 1 gram/day</td>
</tr>
</tbody>
</table>


for universal precautions. Children and their families may need to be kept together or separated, depending on the location and duration of the exposure to the biological agent.

Emergency Treatment. In the emergency department, attention is turned toward pediatric life support protocols to maintain the child’s airway, breathing, and circulation. Personal protective equipment, such as masks and gloves, are worn. Depending on the symptoms, blood, urine, and other cultures may be obtained, as well as blood specimens for laboratory analysis. Pharmacologic therapy may be initiated. Emergency department staff would alert their local public health agency of any symptoms that are suggestive of intentionally released biological agents.

Children may be separated from their parents and family members if they are deemed to be contagious. If children are quarantined, parents may not be able to visit. Young children may experience separation anxiety and they may not respond to staff members. Nurses and health care professionals must be able to distinguish separation anxiety and fear of abandonment from a worsening neurologic status. Children who are quarantined require extra staff for their care because they cannot care for themselves, and their health condition must be closely monitored. Plans for the care of quarantined children and families must be included in community and hospital disaster planning.

Definitive Treatment

Anthrax. At this time, anthrax vaccine adsorbed (AVA) is licensed for use in individuals 18 to 65 years of age (Inglesby et al., 2002). While no data are available for children, it is likely that the AVA would be safe and effective in children, based on experience with other inactivated vaccines (Inglesby et al., 2002). The American Hospital Formulary Services recommends that ciprofloxacin and other fluoroquinolones not be used in children younger than 18 years of age because of a link to transient arthropathy in a small number of children (Inglesby et al., 2002). However, Inglesby and associates (2002) recommend that ciprofloxacin be used as a component of combination therapy for children diagnosed with inhalation anthrax, weighing the risk of arthropathy versus anthrax infection. Postexposure prophylaxis or mass casualty exposure requires the use of monotherapy with fluoroquinolones (Inglesby et al., 2002).

The American Academy of Pediatrics recommends that doxycycline not be used in children less than 9 years of age because of retarded skeletal growth in infants and discolored teeth in infants and toddlers (Inglesby et al., 2002). Because of the serious nature of anthrax infection, however, Inglesby and colleagues (2002) recommend that ciprofloxacin, instead of ciprofloxacin, be used in children if antibiotic susceptibility testing, exhaustion of drug supplies, or adverse reactions preclude the use of ciprofloxacin.

In a contained casualty setting, children with inhalation anthrax can receive intravenous antibiotics; in a mass casualty setting and as postexposure prophylaxis, children can receive oral antibiotics (Inglesby et al., 2002). Doxycycline is dispensed in a tablet that children may not be able to swallow; however, it can be ground and mixed with food or drink to make it palatable. Palatable foods and drinks for mixing doxycycline include chocolate pudding, chocolate milk, low-fat chocolate milk, simple syrup with sour apple flavor,
Comparison of Mustard Gas Exposure in Children and Adults

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>CHILDREN</th>
<th>ADULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of clinical manifestations</td>
<td>4–18 hours</td>
<td>8–24 hours</td>
</tr>
<tr>
<td>First symptoms</td>
<td>Cough, vomiting</td>
<td>31.52%</td>
</tr>
<tr>
<td>Face, neck symptoms (conjunctivitis, photophobia, erythema)</td>
<td>78%</td>
<td>42%</td>
</tr>
<tr>
<td>Genitalia involvement</td>
<td>Early</td>
<td>Late</td>
</tr>
<tr>
<td>Appearance of bullae</td>
<td>92.85%</td>
<td>Not reported</td>
</tr>
<tr>
<td>Severity of ophthalmic manifestions</td>
<td>Children (78%) Adolescents (69%)</td>
<td>11%</td>
</tr>
<tr>
<td>Pulmonary and gastrointestinal symptoms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Apple juice with table sugar, and low fat milk (Yu et al., 2002). Amoxicillin can be used in the 60-day antimicrobial prophylaxis period in infants and children when the anthrax involved in the exposure is determined to be susceptible to penicillin (Centers for Disease Control and Prevention, 2001).

Smallpox. Routine smallpox vaccination ceased in the United States in 1972, and the immune status of those who were vaccinated is not clear (Inglesby et al., 2002). Persons with potential or actual exposure to smallpox must receive the smallpox vaccination and vaccinia immune globulin (VIG), both of which are maintained at the Centers for Disease Control and Prevention (Hardin, 2002). Those at risk for complications following smallpox vaccine administration are persons with eczema or other exfoliative skin disorders; patients with leukemia, lymphoma, and generalized malignancy who are receiving chemotherapy or large doses of glucocorticoids; patients with human immunodeficiency virus infection; those with hereditary immune deficiency disorders; and pregnant women (Henderson et al., 1999). As of March 25, 2003, persons with diagnosed cardiac disease are temporarily deferred from receiving the smallpox vaccination (CDC, 2003). If any of the aforementioned groups have been in close contact with a patient diagnosed with smallpox, or the individual is at risk due to occupation, VIG, if available, may be given simultaneously with smallpox vaccine administration in a dose of 0.3 mL/kg of body weight (Henderson et al., 1999). While Cidofovir has been used in the treatment of smallpox, the pediatric dose has not been established (American Academy of Pediatrics, 2000).

Botulinism. While there is a licensed trivalent equine botulinum antitoxin available through the CDC, its administration is unlikely to reverse the disease in children who are symptomatic (Henretig, Cieslak, & Eitzen, 2003). Botulism Immune Globulin Intravenous (human), a pentavalent investigational vaccine, is available through the California Department of Health Services for administration in infantile botulism.

Avian Influenza. Of the four medications licensed for treatment, only Zanamavir (Relenza) is approved for treatment in patients 7 years of age and older (Lee & Krilov, 2005). The dose in children 7 years of age or younger is 10 mg (two inhalations) via Diskhaler every 12 hours for 5 days, starting within 48 hours of symptom onset (Lee & Krilov, 2005). However, Zanamavir is not approved for prophylaxis against influenza A (Lee & Krilov, 2005). Amantadine (Symmetrel) and Oseltamivir (Tamiflu) have pediatric dosages for treatment and prophylaxis (see Lee & Krilov, 2005, p. 50), but they are not approved.

Exposure to Chemical Agents. Exposure to chemical agents is likely to occur in public places, such as a school, mass gathering, or mass transportation location. Emergency medical services and public safety agencies may be able to identify quickly the involved chemical agent and initiate appropriate treatment. Children’s signs and symptoms may differ from those of adults, and, as in biological agent exposures, a high index of suspicion for chemical exposure is needed. For example, when exposed to a cholinergic agent (nerve agent), children may be less likely to present with miosis and glandular secretions, and they may only exhibit neurologic symptoms (Rotenberg & Newmark, 2003). The comparison of signs and symptoms of mustard gas exposure in children and adults is outlined in Table 15.5. Chemical agents are generally dispersed to incapacitate; these agents can be life threatening to children with chronic illnesses, and, if inhaled, chemical agents may cause life-threatening pneumonitis (Markenson & Reynolds,
294 Part II  Disaster Management

2006). Chapter 7 addresses chemical exposures; the pediatric considerations are given here.

Prehospital Treatment. Upon arrival at the scene of a chemical release, emergency medical services, in conjunction with hazardous materials teams, assess the situation and identify potentially exposed individuals. Based on their findings, skin decontamination may be warranted. As in radiological exposures, males and females are decontaminated separately, and young children will stay with their mothers, while older children go through same-gender decontamination. In chemical exposures, emergency medical services personnel will wear special protective equipment that covers their entire bodies, and their faces may not be visible through their masks. Young children may become frightened and uncooperative at the sight of such heavily dressed, anonymous emergency care providers. Having their clothes cut from their bodies and removed by strangers, then being cleansed with cold, odorous solution (0.5% sodium hypochlorite [dilute bleach]) that may irritate the skin, or soap and water, and continue naked through a line of other naked strangers will cause considerable anxiety and distress. This anxiety will be especially pronounced in a school or other situation where parents or family members are not readily available. As in any situation where there is a predominance of children, additional health care providers will be needed to assist children through the decontamination process. Words of encouragement and praise (“You are doing a great job”) will be much appreciated. As with adults, decontamination is completed before the initiation of pediatric advanced life support protocols. Although 0.5% sodium hypochlorite is recommended for decontamination, it can irritate the skin of infants and young children, thus allowing for increased permeability of the skin to the chemical agent (Henretig et al., 2003). There is little documented experience with 0.5% sodium hypochlorite in infants and young children, and soap and water may just be as effective in decontamination efforts (Henretig et al., 2003).

In nerve agent exposure, atropine and pralidoxime can be administered through autoinjectors, called Mark-I kits (Meridian Medical Technologies, Bristol, TN). Kits with atropine and pralidoxime are approved for use in adults but can be used in older children (Markenson & Reynolds, 2006). In 2004, the FDA approved the Atropen (Meridian Medical Technologies, Bristol, TN), a pediatric formulation of atropine. There is no pediatric equivalent to the Mark 1 kit, as the Atropen is atropine only, and no pralidoxime in a pediatric dosage has been approved.

Emergency Treatment. Upon arrival in the emergency department, patients’ field decontamination should be complete, and the emergency personnel can focus on initial assessment, stabilization, and definitive treatment. Should decontamination be initiated at the emergency department, patient flow should be controlled. Those nurses and physicians trained in decontamination and fitted for the requisite personal protective equipment conduct the decontamination. This can be accomplished inside or outside of the emergency department. Emergency personnel should expect the same reactions to decontamination in young children. Protective masks as well as gas masks impede communication and make verbal communication difficult. Parents and family members may not be able to see their children prior to decontamination and stabilization; social services and other supportive personnel should be readily available to assist parents while they are waiting.

Definitive Treatment. Each class of chemical agents has its own treatment (see chapter 19). Treatment specific to children is presented here. Most of the pediatric pharmacologic treatments for nerve agent exposure are off-label uses, with pralidoxime chloride for organophosphate poisoning and diazepam and lorazepam for related seizures (Rotenberg & Newmark, 2003). Exposure to nerve agents (e.g., sarin, tabun, soman) and household organophosphates (sevin) requires supportive measures and the administration of atropine and pralidoxime (2-PAM). Pediatric doses are as follows: for malathion/sevin exposure, starting doses for infants and children under 2 years of age is 0.5 mg, for children 2–10 years the dose is 1.0 mg. The dose of pralidoxime chloride is 15 mg/kg. For malathion, children younger than 2 years receive 0.5 mg, children 2–8 years old receive 1.0 mg, and children older than 8 years receive 2.0 mg. Pralidoxime chloride is 15 mg/kg and diazepam dose, should convulsions occur, is 0.2–0.5 mg/kg. Sevin: 0.05 mg/kg of atropine initially and again at 5–10 minute intervals; diazepam for seizures is 0.2–0.5 mg/kg (Sidell, Patrick, & Dashnell, 2000).

For lactating women exposed to nerve agents, special precautions should be enacted. Because even a small exposure to nerve agents may take hours to manifest, mothers should pump and discard their breast milk until public health and safety determinations are made (Rotenberg & Newmar, 2003). Following a chemical exposure, children will require mental health counseling because of the invasive nature of skin decontamination and the signs and symptoms of the chemical exposure. Parents should be aware of the need for long-term monitoring for delayed neurologic effects from the chemical exposure. Children may be reluctant to return to the area where the exposure occurred, such as a school or shopping mall. Long-term follow-up and counseling are necessary.

For children exposed to vesicants (blister agents, such as sulfur mustard), the skin is washed with a soap and water solution (Lynch & Thomas, 2004). An
adsorbent powder can be sprinkled on the skin, allowed to adsorb the mustard, then removed with a moist cloth (Lynch & Thomas, 2004). Airway maintenance is paramount, and endotracheal intubation and mechanical ventilation may be indicated in children with severe exposure to mustard. Eye exposure requires copious flushing with water or normal saline (Lynch & Thomas, 2004). Thorough eye examinations should be performed, and corneal lesions are treated with antibiotics and mydriatic-cycloplegic medication; petroleum jelly applied to the eyelids will prevent them from adhering together (Lynch & Thomas, 2004).

Cyanide poisoning is treated with attention to airway and cardiopulmonary management. Cyanide poisoning is treated with a specific antidote of amyl nitrite perles, sodium nitrite, and sodium thiosulfate.

ETHICAL AND LEGAL CONSIDERATIONS IN PEDIATRIC DISASTER CARE

The Emergency Medical Treatment and Active Labor Act (EMTALA) is an antidiscrimination statute, whereby all individuals who present to a hospital emergency department must receive the same medical screening examination for their signs and symptoms using the same personnel, protocols, and thoroughness regardless of their ability to pay for such treatment (Mitchiner & Yeh, 2002). The term “all individuals” applies to ill or injured children presenting to an emergency department, with or without a parent or guardian; under EMTALA they, too, must receive a medical screening examination and stabilizing treatments.

Parental consent is assumed if the patient is not competent to provide consent and an emergency exists. Although no uniform legal definition of “emergency” exists, preserving life, preventing permanent disability, alleviating pain and suffering, and avoiding eventual harm have been used as guidelines for emergency treatment without consent. (Guertler, 1997, p. 311)

To delay or deny care because of the lack of parental consent would be a violation of EMTALA. While attempts to locate a parent or guardian are made, emergency care continues. Once life-threatening conditions are stabilized, children may be transferred, should special care be required (Hodge, 1999). To transfer unstable patients, or to transfer patients for economic reasons is a violation of EMTALA (Hodge, 1999).

How EMTALA will function or be enforced in a community during a nuclear, biological, or chemical exposure is not known. Conceivably, EMTALA would apply to children seeking emergency care without parental consent (e.g., chemical exposure during school hours). How EMTALA will be enforced in the event of a biological exposure, where one hospital is designated the “clean” hospital and one is the “quarantined” hospital is unclear. Under EMTALA, “if an individual arrives at a hospital and is not technically in the emergency department but is on the premises (including the parking lot, sidewalk, or driveway) of the hospital and requests emergency care, he or she is entitled to a medical screening examination” (Mallon & Bukata, 1999, p. 19). During a public health emergency, though, EMTALA does not allow a community to designate hospitals that are “clean” and “exposed”, all hospitals would have to assess, stabilize, and screen any patient who appears on hospital property (Bentley, 2001). As written EMTALA includes no exception provision where a mayor, governor, or other official could waive its rules for the best interests of the public’s health (Bentley, 2001). As a possible compromise, hospitals may be able to comply with EMTALA by providing medical screening examinations at sites elsewhere on the hospital campus (e.g., clinic; Mallon & Bukata, 1999). This action may prevent patients from being turned away. Hospital triage nurses would not be permitted to turn away or refuse to triage patients based on their exposure to nuclear, biological, or chemical agents. To do so would be in violation of the state’s emergency health powers act. See chapter 4 for further discussion.

PEDIATRIC DEATH FOLLOWING DISASTERS AND PUBLIC HEALTH EMERGENCIES

In the aftermath of natural and man-made disasters, children may die from injury and illness. These deaths may occur at the scene, in the emergency department, or during hospitalization. While the death of one child is traumatic for parents and health care professionals, large numbers of children, including entire families, dying during or after a disaster is overwhelming for everyone, including nurses and health care professionals. Nothing in professionals’ education prepares them for attending to thousands of dead and dying all at one time or for living in or returning to communities that no longer exist. Among 3,218 middle and high school students surveyed 7 weeks after the Murrah Building bombing in Oklahoma City, over one third reported the loss of someone they knew (Pfefferbaum et al., 2000). Following the 2004 tsunami, tens of thousands of children became orphans and displaced citizens in a matter of minutes. Similarly, following Hurricanes Katrina and Rita, children found themselves without homes, families, homes, and communities. Nurses and health care professionals found themselves without homes, hospitals,
and families, too, and remained on duty to care for pa-
tients and others left behind.

There are times when children will die in the pre-
hospital and emergency department setting, despite the
prehospital and emergency teams’ best efforts. Dur-
ing a pediatric resuscitation, parental presence can be
incorporated into care. Should parents choose to be
present for their children’s resuscitation, ideally, one
nurse should stay with them and explain what is hap-
p pening; this contact may not be possible during a disas-
ter situation. The Emergency Nurses Association advo-
cates parental presence during pediatric resuscitation.

Such presence may be beneficial to the child as well as
family members. Offering parents and family members
time to grieve after the child has died may be difficult
in a disaster situation, where rooms, supplies, and staff
are scarce. Under these circumstances, emergency per-
sonnel can only do what is in the best interests of all
involved.

Existing guidelines (Lipton & Coleman, 2000) out-
line bereavement practices for health care professionals
to help them plan for and assist families following the
sudden death of their child. Having guidelines in place
to help health care professionals cope with the work of
caring for many dead and dying children and families
is imperative. It may be difficult to enact these guide-
lines when multiple victims die, but they are a starting
point for further disaster planning and discussion for
prehospital and emergency care professionals.

PLANNING FOR DISASTERS—
PEdiATRIc-SPEcIFIC CoNSIDErATIONS

National initiatives have been undertaken to improve
the care of children in natural and man-made disasters.
In 1995, the Health Resources and Services Ad-
imistration, the National Highway Traffic Safety Ad-
imistration, and the Federal Emergency Management
Agency (FEMA) identified seven goals to meet children’s
needs in disasters. In 1998, these seven goals were de-
veloped by the Emergency Medical Services for Children
Program into the document, Consensus Recommenda-
tions for Responding to Children’s Emergencies in Disas-
ters (Ball & Allen, 2000). The full consensus document,
including recommendations and action steps, is avail-
able through www.ems-c.org.

In 2002, President Bush signed the Public Health
Security and Bioterrorism Preparedness and Response
Act to initiate a response to bioterrorism preparedness.
Unfortunately, the Act’s attention to children was mini-
mal, even with the creation of a National Advisory Com-
mittee on Children and Terrorism (NACCT). As defined
within the Act, the purpose of the NACCT is to assess
and provide recommendations to the Secretary of the
Department of Health and Human Services on the pre-
paredness of the health care system to respond to chil-
dren’s needs; changes needed within health care and
EMS, including protocols, to meet children’s needs; and
changes, if needed, to the SNS to meet children’s needs
(Markenson & Redlener, 2004). This committee was not
appointed until March 2003 with its charge of issuing a

To that end, an interdisciplinary consensus conference
of pediatric emergency and terrorism professionals was
convened to develop evidence-based recommendations
on the care of children in disasters and public health
emergencies. (This chapter’s author served as an expert
consultant at the consensus conference.) Markenson
and Redliner (2006) summarize this conference’s rec-
ommendations, which were submitted to the Secretary
of Health and Human Services. The complete confer-
ence proceedings are available at www.ncdp.mailman.
columbia.edu/program_pediatric.htm.

At this time, there are two programs that provide
funding support to state health departments for coor-
dinating the health care system for terrorism prepared-
ness: the Bioterrorism Hospital Preparedness program of
the Health Resources and Services Administration and
the Public Health Preparedness and Response for Bioter-
rorism program of the CDC (Markenson & Reynolds,
2006). While both programs mention pediatric pre-
paredness, overall pediatric preparedness activities have
been minimal, and there may be plans without pedi-
atrics included (Markenson & Reynolds, 2006). Another
program, the voluntary Medical Reserve Corps, does not
include pediatric preparedness, nor does the Metropoli-
tan Medical Response System (MMRS). Much work and
coordination, at the local, state and federal levels, needs
to be done to assure the proper treatment of children
in a time of disaster or terrorism. This book describes
the disaster planning and emergency preparedness for
people exposed to natural or man-made disasters, acts
of terrorism, and public health emergencies. Additional
qualifications that should be in place for the pediatric
population are highlighted next.

Pediatric Considerations in Community
Emergency Preparedness

The highest concentration of children and youth is
found in schools during the daylight and early evening
hours. In a survey of 573 school nurses, only 74% (418)
reported having an emergency plan specifically for po-
tential mass disasters (Olympia, Wan, & Avner, 2005).
Among 2,137 surveys from public school superinten-
dents, 57.2% reported having a written plan for the
prevention of a terrorist or mass casualty incident (Gra-
ham, Shirn, Liggio, Aitken, & Dick, 2006). It appears
that much work needs to be done to improve schools’ responses to potential disaster situations.

Schools should be fully prepared to enact emergency procedures to shelter in place or evacuate to a safe area, particularly for schools located within 10 miles of a nuclear power plant. Supplies needed for sheltering in place are discussed in chapter 25. In the event of an evacuation during school hours, a specific community-wide plan should be in place and should be communicated to families and children and coordinated through public safety. Parents should be notified, and children could remain at school if the designated shelter is the school or be evacuated to a prearranged, predesignated pickup point, if possible (American Academy of Pediatrics, 2000, 2003; Floyd, 2002). Should parents not be able to pick up the child at the designated time and location, an alternative, responsible adult should be designated. Approximately 83.7% of public school superintendents surveyed reported having a parent reunification form or student release form in the event of a disaster, but only half (53.5%) informed parents where students would be evacuated to in case of an emergency (Graham et al., 2006). The availability of community services, such as the American Red Cross, Salvation Army, and counselors, should be available to help children and families cope with the stress of evacuation (Floyd, 2002). These recommendations allow families to remain together and help children to cope with the anticipated losses following a disaster.

An often overlooked area for emergency preparedness is child care facilities. Child care centers are vulnerable to the same threats of terrorism and disasters, similar to schools, buildings and other locations where groups of people congregate. Child care centers are in workplaces, private homes, separate buildings, malls and other locales (Gaines & Leary, 2004); thus there is no “one-size-fits-all” approach for creating emergency preparedness plans. Children’s ages vary from infancy through preschool age, and children with special health care needs may be in separate or integrated child care centers. Child care centers are not likely to have security personnel, visitor restriction or other safety monitoring (Gaines & Leary, 2004). Child health care consultants are highly prepared to assist centers and their communities in disaster and emergency preparedness. Child care centers would be well served to be integrated into community disaster plans, having policies for in-house emergency stockpiles, alternative methods of transporting children in evacuation, communication with families, and communication strategies with the children and staff to avoid panic and fear (Gaines & Leary, 2004).

Communities located within 10 miles of a nuclear power plant should have ready access to KI, particularly during school hours. Families residing within this radius should keep KI in their homes (American Academy of Pediatrics, Committee on Environmental Health, 2003), and state health departments have coordinated efforts to distribute KI to such communities.

There is a need to help families with children understand the importance of preparing for natural disasters and public health emergencies. This education is especially important for communities that are at risk for natural disasters, such as earthquakes, hurricanes, tornadoes, and floods. Rincon and colleagues (2001) reported that there were no differences in home disaster preparedness among families who did and did not live through Hurricane Andrew. Specifically, the majority of respondents in both groups of families did not have hurricane metal shutters or a generator. Rincon and associates (2001) further point out the difficulties of getting to and living in shelters following Hurricane Andrew, which may keep families with children from leaving their homes. Legislation in Florida is being initiated to create more public shelters, upgrade existing shelters, and enhance evacuation routes.

At some point in the future, children and families will need to be taught about using personal protective equipment, such as gas masks and atropine autoinjectors. Such education is needed to prevent the misuse of this equipment. In Israel, during the Persian Gulf Crisis (Spring 1991), personal defense kits containing automatic atropine injectors were distributed to the entire population in the event of chemical warfare (Amitai et al., 1992). Over a 4-month period, pediatric emergency departments were asked to document prospectively the assessment, treatment, and outcomes of children who unintentionally injected themselves with the atropine. There were 240 children who self-injected, and 74% (180) were boys. The most common site was the finger or palm. Only 8% had severe atropinization. No seizures or life-threatening dysrhythmias were reported; only five children were hospitalized and there were no fatalities (Amitai et al., 1992). Large doses of atropine administered in nonexposed children, no long-lasting effects were noted.

During the Persian Gulf crisis, over 4 million individuals in Israel received kits containing full face-fitting rubbers masks with detachable canisters containing activated, impregnated charcoal filter cartridges for protection against chemical warfare (Barach, Rivkind, Israeli, Berdugo, & Richter, 1998). Barach and colleagues (1998) report that collapsible cribs with polyethylene sheeting and a filter were given to families with infants. Adults received training through written and television media; school age children were given hands-on training. Over a 45-day crisis period during the war, there were 13 people who died from suffocation/asphyxiation due to improper mask use. Two of the victims were young children—one was an infant left in a portable plastic carrier for several hours and the other a 4-year-old who aspirated and went into cardiac arrest as her parents attempted to place the mask on her face. The only age
group that did not sustain fatalities was school-age children, and this was the only group who received hands-on training in the proper use of gas masks, as they were most likely to be away from home and family when an air strike would occur (Barach et al., 1998).

School-age children and adolescents need to express their feelings and emotions related to disasters in a healthy and positive way. After the bombing of the Murrah Building in Oklahoma City, children from around the United States sent cards, greetings, money, and other items to the children hospitalized for bombing-related injuries (Seideman et al., 1998). School classes, organizations (e.g., Girl and Boy Scouts) and other groups can collaborate with public safety and other social agencies to send age-appropriate greetings and other symbols of hope and encouragement to children and families affected by disasters.

School is the children’s workplace, and it is important that children return to school, their friends, and teachers as soon as possible following a disaster. Schools are important to children because they provide a support system (sometimes the only support system) outside of their families; they provide a setting for targeted psychoeducational teaching and other activities; teachers and counselors are trained in recognizing symptoms of stress and trauma; and teachers can adapt their instructional methods to meet students’ needs (Jagodic & Kontac, 2002). Despite this need, 75% of surveyed public school superintendents have a plan for in-school counseling or referral for students to seek mental health counseling following a mass casualty or terrorist incident (Graham et al., 2006).

Local emergency medical services are familiar with the children in their communities who have special health care needs, such as ventilators, continuous feeding devices, and the like. In the event of a disaster, where electricity is lost and water supplies are in jeopardy, emergency medical services may be able to assist families whose children need oxygen or other supplies. Parents of children with special health care needs should prepare and maintain an updated list of their child’s medications, procedures, and other needs and keep it nearby in case of an evacuation. Parents should store at least a few days’ worth of their child’s special feedings, suction catheters, diapers and other supplies, equipment, and medication in a “to-go” bag in the event of an evacuation or if the parents become separated from their child. Notification of utility companies to provide emergency support during a disaster, along with contingency plans for alternative power sources, should be in place (Markenson & Reynolds, 2006). Parents should know how to obtain medications and equipment through alternative sources, and additional family members should be taught how to care for children requiring technology, should in-home health care providers not be available (Markenson & Reynolds, 2006).

Hospitals should be prepared to triage, stabilize, and possibly treat children exposed to radiologic, biologic, chemical, or explosive agents. Because most hospitals no longer operate pediatric in-patient units, the number of emergency departments, hospitals and staff prepared to care for large numbers of children will not be adequate. The Emergency Pediatric Services and Equipment Supplement questionnaire was added to the 2002–2003 National Hospital Ambulatory Medical Care Survey to estimate the availability of pediatric services, expertise and supplies for caring for pediatric patients in United States hospitals (Middleton & Burt, 2006). The results showed approximately 4,800 hospitals with 24-hour emergency departments, with about 50% of the emergency departments receiving < 4,000 pediatric visits annually (Middleton & Burt, 2006). About 52.9% of the hospitals admitted pediatric patients, but did not have a designated pediatric ward or unit. Only 10% to 17% of the reporting emergency departments had pediatric trauma services, pediatric observation units or pediatric intensive care unit services. Overall, 62.2% of the emergency departments had board-certified pediatric attending physicians available on-site or on-call 24 hours a day, 7 days a week (Middleton & Burt, 2006). A mere 5.5% of the reporting emergency departments had all of the pediatric supplies recommended by the American Academy of Pediatrics and the American College of Emergency Physicians; the most likely supply was resuscitation medication/resuscitation tape/dose estimation system (95.8%), and the least likely supply was vascular access (12.4%) (Middleton & Burt, 2006). Overall, most emergency departments had at least 80% of the recommended supplies. While these results are an improvement from 1998, strides still must be made to ensure adequate pediatric emergency expertise and supplies in the event of a disaster or public health emergency.

Pediatric Considerations in Health Care Preparations

Nurses and other health care professionals will be pressed into action once a disaster or public health emergency has occurred. They should be knowledgeable about and familiar with the disaster relief agencies and groups within their communities and regions (Coffman, 1994). The assumption is made that health care will be delivered through its current means of existing hospitals, clinics, and health care professionals. Following the 2004 tsunami, as well as Hurricane Katrina, health care facilities, staff, and infrastructure were decimated. In the areas affected by the tsunami, the loss of nurses, midwives, physicians, and other health care professionals was particularly devastating because these resources were in short supply and high demand before the event (Carballo, Dalta, & Hernandez, 2005).
While the infrastructure can be replaced, the recruitment and retention of nurses, physicians, and other health care professionals into this area may take years. After a disaster has struck, nurses may be called on to assist with preventive mental health services; additional education in this area is of great importance. Early postdisaster interventions that nurses can include in their practice include helping children express their fears and concerns through age-appropriate means such as story telling, drawing, coloring books, dolls, puppets, and toys (Coffman, 1994; Zubenko, 2002). Such media also allow nurses to help correct misconceptions about what occurred and provide accurate and helpful information (Coffman, 1994). Broll (1996) details interventions that help children to heal emotionally following a disaster or traumatic event. Kestelny and Wessells (2006) report on the establishment of 240 child-centered spaces in tsunami-affected regions of Sri Lanka, India, and Indonesia that include 38,000 children from birth through 18. These safe places nurture young children’s sense of trust and safety and help older children to develop life skills and leadership abilities (Kestelny & Wessells, 2006). The community serves as an active partner in planning and coordinating these centers.

Equipment. For prehospital and in-hospital pediatric emergency care, there are standards and guidelines in place for essential equipment and supplies; for example, the Emergency Nurses Association, as well as the American Academy of Pediatrics and the American College of Emergency Physicians, has published minimum equipment lists that can be obtained online or in reprinted form from published journal articles. One piece of equipment that is especially helpful in mass casualty situations is the Broselow-Luten resuscitation tape (the “color-coded” tape; Hohenhaus, 2001). The Broselow-Luten resuscitation tape is used to estimate rapidly a pediatric patient’s equipment size and medication dosage based on the patient’s length. With the patient supine, the health care professional measures the patient’s length with the tape; the patient’s height corresponds to a color on the tape, which lists the size of emergency equipment and dosage of medications the patient may need. This system can reduce errors in judgment and save time in situations involving multiply injured or ill children. In one clinical trial of simulated pediatric resuscitations, the Broselow-Luten system was associated with a significant reduction in medication errors and incorrect equipment sizes (Shah, Frush, Luo, & Wears, 2003). Such a system may be beneficial to emergency care professionals who do not routinely care for critically ill or injured children and who may be required to do so during a disaster or public health emergency.

Bioterrorist acts resulting in large numbers of infected children will place a strain on the health care system. Physicians, nurses, and others will have to administer medications with which they are unfamiliar and untrained (Cieslak & Henretig, 2003), leading to stress. Such medications may not be readily available in pediatric dosages or preparations, and health care professionals will have to extrapolate to achieve the recommended pediatric dosage. In some instances, pediatric dosages will not have been established by the FDA, and the CDC and state health departments will need to provide close guidance and monitoring.

The release of a nerve agent near a school would put a strain on local prehospital and in-hospital resources, with airway equipment, supplies of 2-PAM and atropine, and pediatric intensive care beds being quickly used and depleted (Aghababian, 2002). Therefore, health care professionals should know how their community accesses the Strategic National Stockpile (SNS) and other resources to obtain medications and supplies in a timely manner. Additionally, hospitals should keep a 48-hour supply of pediatric equipment and pharmaceuticals on hand for their average daily census of pediatric patients, plus an additional 100 patients (Markenson & Redlener, 2004). Stockpiled pharmaceuticals and equipment should be specifically for pediatric use or appropriately substituted for such use (Markenson & Redlener, 2004). Hospital operations and preparedness policies should include pediatric care and treatment guidelines (Markenson & Redlener, 2004).

Education. Nurses and other health care professionals will be involved in caring for children following a disaster or public health emergency. Receiving timely and relevant information about the care of children during these times is essential. One course available for health care professionals is the 2-day Pediatric Disaster Life Support (PDLS) course. This course focuses on the physiologic and psychologic needs of children following natural disasters and acts of terrorism (Aghababian, 2002). Pediatric life support and advanced pediatric life support courses are available for prehospital and emergency health care professionals. At this time, most of these health care professionals have received this training. In the prehospital setting, the Pediatric Emergency Preparedness Program course as well as pediatric prehospital care courses are available. Recommendations for the education of emergency medical services personnel in pediatric care have been established (Pediatric Education Task Force, 1998). School nurses can enroll in the Managing School Emergencies courses offered through the National Association of School Nurses.

Nurses and other health care professionals may be called away from their communities to care for children following disasters or public health emergencies. They may find themselves in a new culture, with beliefs and practices different than their own. Health care professionals must be sensitive to and respectful of the culture.
and region in which they are called on to provide relief (Capozzoli, 2002).

Recommendations for nurses caring for children in disaster-relief areas are suggested. An adequate number of pediatric nurses should be involved at any type of disaster (Margarit et al., 2003) to provide and direct care for children. While translators are provided, nurses should remain mindful of cultural and language barriers (Margarit et al., 2003). Breastfeeding should be encouraged whenever possible, because clean water and alternative food sources may not be available (Margarit et al., 2003). Social support for children and families, as well as hygiene and weather-related concerns, should not be overlooked (Margarit et al., 2003).

Volunteers from the community can be trained through the hospital to provide basic services to children who are receiving treatment in a hospital or shelter or who are displaced from their families. Such training could be incorporated into the hospital’s disaster plan. As part of disaster planning, emergency departments can purchase an instant camera to prepare a “picture room” (Rosenbaum, 1993). In the event of a mass casualty incident, children will be taken to various hospitals, which will not have the staff available to answer telephones. Children do not carry personal identification, making it difficult to reunite them with their families. Emergency staff can take a photo of each child who arrives, and this photo can be posted in the “picture room.” Families who arrive in the emergency department can scan the pediatric photos and determine whether their child is in this emergency department. Social workers will remain with the families during the time they are scanning the photos to provide emotional support when an identification is made (Rosenbaum, 1993). Another consideration is the use of a secure Web site by the EMS and hospital personnel to locate children and families, photographs taken with a digital camera could be posted, along with the name of the treatment facility.

After a disaster strikes, families will experience stressors such as loss of their homes, jobs, social networks, and other support systems. Consequently, these losses are risk factors for child abuse and maltreatment. Curtis, Miller, and Berry (2000) reviewed countywide child abuse reports for 1 year before and after Hurricane Hugo, the Loma Prieta earthquake, and Hurricane Andrew. They found that child abuse reports were disproportionately higher in the quarter and half year following Hurricane Hugo and the Loma Prieta earthquake (Curtis et al., 2000). Therefore, parents need to recognize that they will experience stress and that they need to develop appropriate coping strategies to alleviate that stress. Nurses and health care and school professionals need to be vigilant for signs of child maltreatment following disasters and to report and follow up accordingly.

Nurses and health care professionals must consider the length of time needed for community recovery following a disaster and prepare to live and practice accordingly. Within 7 weeks following Hurricane Katrina, 20.2% of housing units lacked water, 24.5% had no electricity, 43.2% had no telephone service, and 55.7% of households contained one or more members with a chronic health condition (Norris et al., 2006). Among those older than 18 years of age who were surveyed, almost 49.8% reported emotional distress, indicating a potential need for mental health services (Norris et al., 2006). Consequently, the Louisiana Office of Mental Health has established a crisis-counseling program to provide interventions and support to hurricane survivors (Norris et al., 2006). The degree to which pediatric needs are being met has not been reported in the literature.

In the months following the Beslan, Russia, school siege, children and families continue to receive mental health counseling. Many children are afraid of loud noises. Some children try to hide or can only sleep holding their parents’ hands (Parfitt, 2004). Adults report feelings of guilt for not being able to save children held hostage, even if their own children survived (Parfitt, 2004). Counseling is expected to remain in place on an ongoing basis.

**SUMMARY**

Children are likely to be victims in natural disasters and public health emergencies. Health care professionals must be prepared to care for children in the prehospital, inpatient, and follow-up phases of disaster care. Children may experience long-term physical and psychosocial sequelae following a disaster; appropriate follow-up will be indicated. Nurses and health care professionals must place a high priority on the needs of children in disasters or public health emergencies and incorporate these needs into their hospital and community disaster plans.

**STUDY QUESTIONS**

1. Describe pediatric injuries that result from the following disasters: earthquakes, floods, hurricanes.
2. What are the conditions that predispose children living in refugee camps to infectious and communicable diseases?
3. Why are young children at greater risk for injury from inhalation of chemical agents as compared with adults?
INTERNET ACTIVITIES


2. Go to the Emergency Medical Services for Children Web site at http://www.emsc-c.org. Type in key word “disasters” or “Bioterrorism.” Locate EMS-C-related resources and materials through the hyperlinks.


5. Go to the American Academy of Child and Adolescent Psychiatry Web site at http://www.aacap.org. Click the icons for “Talking to Children about War and Terrorism” and “Disaster Responses.”


REFERENCES


American Academy of Pediatrics, Committee on Disaster and Emergency Medical Care. (1972). Disaster and emergency medical services for infants and children. Evanston, IL: Author.


Part II Disaster Management

Chapter 15: Unique Needs of Children During Disasters

303


P1: JZP
304 Part II
Rosenfield, R., & Bernardo, L. (2001). Pediatric implications in
Nakajima, T., Ohta, S., Morita, H., Midorikawa, Y., Mimura, S., &
304 Part II
Rosenfield, R., & Bernardo, L. (2001). Pediatric implications in
Norris, F., Speier, A., Henderson, A., Davis, S., Purcell, D. W.,
Pfefferbaum, B., Gurwitch, R., McDonald, N., Leftwich, M.,
Quintana, D., Parker, J., Jordan, F., Tuggle, D., Mantor, P., &
Raynor, C. (2002). The role of play in the recovery process. In
Topics in Emergency
Pfefferbaum, B., Gurwitch, R., McDonald, N., Leftwich, M.,
stress among young children after the death of a friend or
acquaintance in a terrorist bombing. Psychiatric Services, 52,
386–388.
Quintana, D., Parker, J., Jordan, F., Tuggle, D., Mantor, P., &
Rajagopalan, S. (2002). Deadly viruses. Topics in Emergency
Medicine, 24(3), 44–55.
Raynor, C. (2002). The role of play in the recovery process. In
W Zuberko & J. Cappozoli (Eds.), Children and disasters: A
practical guide to healing and recovery (pp. 124–134). New
York: Oxford University Press.
Rincon, E., Linares, M., & Greenberg, B. (2003). Effect of pre-
vious experience of a hurricane on preparedness for future
hurricanes. American Journal of Emergency Medicine, 21(4),
276–279.
an Israeli hospital. Social Work in Health Care, 11(3-4),
137–145.
Rosenfield, R., & Bernstein, L. (2001). Pediatric implications in
bioterrorism. Part II: Postexposure diagnosis and treatment.
International Journal of Trauma Nursing, 7, 133–136.
Chapter 15  Unique Needs of Children During Disasters  305


Planning to meet the needs of children who might be affected by a major disaster, whether natural, industrial or man-made, has been a difficult case to sell at most agencies and at all levels of government for a number of reasons. But, in terms of broad considerations, the reality is that the knowledge base for the management of children exposed to toxins, biological agents, radiation, and the like is relatively limited. In addition, the very notion of large numbers of children being victims of large-scale disasters may be so abhorrent that planners, themselves, have trouble simply incorporating the concept into the process. However, other than the American Academy of Pediatrics, there is little constituency for children’s concerns in disaster planning, and even this level of advocacy needs persistent attention.

In general, many planners and first responder organizations have little actual or organizational experience with or understanding the particular needs of children who might be involved in mass casualty incidents or otherwise affected by unusual conditions. Even within the health care professions, providers who are knowledgeable about, for instance, the diagnosis and treatment of exposure to sarin or botulism toxin in adults may have no experience with such situations involving children. Responders may be aware of protocol differences but have little explicit training in pediatrics. Others may feel that simply “reducing dosages” of antibiotics or antidotes might be sufficient. Sometimes, lack of experience leads to a general discomfort in managing problems in children for providers who are otherwise very comfortable in their professional roles regarding the care of adults.

All of this is also true of governmental and non-governmental planning and response agencies where little attempt has been made to date in codifying pediatric protocols. In general, the overall level of focus on high-consequence disaster planning has been greatly accelerated since 9/11 and priorities other than the needs of children have prevailed. The logic put forth is that it is most important to get the general planning developed and formalized first and then move on to consider the special needs of specific populations. Under this approach, however, the needs of children, the elderly frail, people with disabilities, and institutionalized populations may never actually be addressed.

Still, the reality of actually dealing with a major disaster conflicts with this phased approach to planning. Responders cannot choose to deal with some hypothetical mainstream population first, getting to the difficult challenges of special populations later. More than 20% of the persons needing evacuation and rescue in New Orleans after Hurricane Katrina in 2005 were people with disabilities. As might be expected, the more fragile or vulnerable the population, the more resources and attention will be required in all stages of the response. Furthermore, failures in dealing with special needs populations have particularly high media visibility and generate intense levels of public empathy. Problems in evacuating fragile newborns from flooded hospitals or abandoning seniors in nursing homes have substantial consequences, over and above the sheer number of individuals involved.

Most attention on the needs of children with respect to disaster planning has been seen in two federal agencies, both within the U.S. Department of Health and Human Services (HHS). The Health Resources and Services Administration has been actively promoting the incorporation of pediatric considerations in state-based disaster plans. This is an ongoing process, consistent with the language of federal bioterrorism preparedness legislation, which has required the inclusion of children’s needs in state disaster plans.

The Agency for Healthcare Research and Quality, also an HHS agency, has taken a particularly important leadership role in looking at the needs of children in disaster planning, having funded a number of pediatric disaster response initiatives, including two national consensus conferences specifically addressing the current state of knowledge of pediatric management in disasters. The first of these was in 2003; the second in 2005. In both conferences, leaders and experts in all aspects of pediatric response were gathered to consider management protocols and recommend areas of research where important informational gaps persist regarding the pediatric applications of specific medications, vaccines and the like.

Following the experiences of 9/11 and Hurricanes Katrina and Rita, it was clear that children can be at substantial risk during—and following—major disasters. Several large schools were in the immediate vicinity of the World Trade Centers in New York City. A near
miss of the primary targets could have caused extraordinary pediatric casualties if a school had been directly, or indirectly, struck. As it was, long-term and extensive psychological consequences for children from the terror attacks were substantial and well documented.

During the storms and flooding of New Orleans in the fall of 2005, thousands of children were in harm’s way, particularly those who had been hospitalized and required medical evacuation under significantly dangerous conditions. In the aftermath of the storms, many children and families displaced by the disaster remained in severely inadequate shelter conditions for extended periods of time, during which access to essential medical care, growing psychological stress, and reduced availability of a stable academic environment became unrelenting secondary consequences of the disaster.

There is no reason to believe that the risks to children will diminish anytime soon. Scientists predict a long cycle of severe climatic perturbations and major storms. Many areas of the United States are relatively “overdue” for calamities, such as a high Richter scale earthquake on the West Coast.

The prospects of future terrorism remain highly probable as well. In fact, there may well be reason to believe that specific targeting of American children by al-Qaeda is a gruesome possibility. One recalls the attack on a school in Beslan, Russia, in 2004 by Chechen rebels, suspected to have been backed by al-Qaeda. That horrific event killed more than 150 children, seriously injuring scores more, along with many adult casualties. Highly organized Russian pediatric mass trauma response teams were able to save many children at the site of the assault. Without this well-planned pediatric response capacity, many more children may have perished.

In fact, there have been past attempts to target U.S. children. One chilling example was a planned assault on an American school in Singapore after 9/11 that was thwarted by good counterterrorism work—and some measure of good luck. A number of published al-Qaeda doctrines, particularly by former bin Laden lieutenant, Suleiman abu Gheith, explicitly call for the killing of American children in retaliation for alleged U.S. policies that Islamic extremists claim have been responsible for millions of civilian deaths in international Muslim communities.

All of this underscores how important it is for the needs of children to be a central component of the disaster planning process at all levels of government and in all communities. This will only happen, however, with persistent advocacy by organizations—and individuals—focused on the health and mental health needs of children. The good news is that assuring a place for children in the planning process and providing the tools to ensure an appropriate level of pediatric response are attainable goals—well worth a concerted effort by those who choose to speak for the nation’s youngest citizens.
Key Messages

■ During a widespread disaster, medical professionals are frequently called upon to perform a range of support tasks (e.g., shelter support operations, triage determinations) in addition to their regular duties. These new roles and the demands of ensuring effective care during a disaster require a more holistic consideration of the individual’s circumstances and needs.

■ Employing a functional needs-based perspective addresses all aspects of an individual’s life (social conditions, mental health wellness, family separation/unification, independence, activities of daily living, . . . ) and mitigates the possibility of compounding the victim’s problems in the wake of the original disaster.

■ This chapter is about redefining the health care paradigm as it refers to high-risk and high-vulnerability populations. Disaster reality is that anyone acting in a response capacity will become involved with the human condition in ways that represent a substantial expansion of their usual scope of practice.

Learning Objectives

When this chapter is completed, readers will be able to

1. Appreciate a functional needs-based analysis versus a purely medical model when planning for or working with the full spectrum of individuals with unique disaster-related special needs.

2. Appreciate how, with the appropriate considerations in the planning stages for the defined population, a wider-reaching application for many more persons than originally considered can actually become an outcome.

3. Appreciate that when taking this population into account, the most appropriate, effective, and efficient way to work, even under disaster conditions, is with not for.
Before disaster strikes, emergency managers attempt to saturate the target area with information. All forms of media continuously highlight evacuation routes, shelter lists, and advice on preparing survival kits. Yet, when the storm passes, the flood subsides, or the quake ceases to rumble, the responders discover pockets of people who never got the message. Or they may have received a message, but not the one intended.

More disturbing are situations in which residents take appropriate action as emergency officials directed, only to find that critical needs cannot be accommodated. A deaf couple drives to a shelter, learning when they arrive that it lacks a sign-language interpreter to assist with communication. Staff at another shelter refuse to allow a man with cerebral palsy to enter because they confuse his slurred speech and disjointed movement for drunkenness. In the wake of a terrorist attack from an unidentified source, a woman wearing traditional Muslim cover and her husband are turned away from an aid station when they seek medical help. These, and other situations, unfortunately continue to occur with each disaster and crisis.

The United States is a large and diverse nation and becomes more diverse with each day. Certain groups are at greater risk or are more vulnerable in an emergency for many different reasons. Poor or economically disadvantaged persons may not be able to evacuate either because they do not own a car or because they live among others similarly situated. Medicaid or Medicare recipients may face additional hurdles to obtain access to vital drugs in the weeks after a disaster. People who speak English poorly or not at all face communication barriers at every stage in the emergency. People with disabilities or who are aged will require specific forms of assistance that emergency managers may not have accounted for in their plans.

This chapter will acquaint the reader with the meaning of diversity for the emergency planner. It will introduce the many ways in which a community may be divided. Finally, this chapter synthesizes knowledge obtained from previous disasters to offer advice on accommodating the needs of these diverse groups.
DEFINING THE POPULATION

The terms special populations and persons with special needs are widely used throughout the nation to describe individuals or groups that are difficult to reach, or whose key demographic characteristics make them more vulnerable than others when disaster strikes. Emergency managers and health care providers recognize that no one term satisfactorily describes this diverse and broad social spectrum. Many health departments partially define these groups by the recognition that their needs are not fully addressed by traditional service providers or through understanding that fears about comfort or safety limit access to and use by these groups of the standard resources offered in disaster preparedness, relief, and recovery.

Such special populations include, but are not limited to, those who are physically or mentally disabled. Health and disaster professionals may add persons with limited or no proficiency in English, and such individuals, often on the economic margins of a community, who are geographically or culturally isolated, medically or chemically dependent, homeless, or people who are frail and elderly. In addition, it is important to remember that children have their own unique needs, may come from troubled homes, and are affected differently than adults during emergencies and crisis both physically and emotionally.

It is appropriate here to note that a person may be a member of more than one demographic group. They may, in fact, belong to many. A 75-year old woman who is blind, speaks only Spanish, receives Medicaid, and lives in a small rural town is an artificial creation for this chapter, but is well-known to a demographer. In time of disaster, it is not important to carry over her group designation; it is vital to recognize that this person would bring with her a multiplicity of needs.

There is wide variation within most of the groups that compose the high-risk, high-vulnerability population. The term limited English proficiency does not connotate a uniform standard but a range of comprehension. Persons deemed legally blind actually see, but what they do see may be a full image at a great distance, or a few specks of movement in the middle of a tunnel. Similarly, people who are hearing-impaired may only require that others speak up a little, or may need the full panoply of auxiliary aids. The comparisons are equally wide among those who are poor or economically disadvantaged. One family of four has an income of $18,700, whereas another family of the same size lives on $9,000. Both families are below the 2006 national poverty line of $19,000, but one family’s income obviously goes much further. As with many complex situations, one size does not fit all in terms of planning for the needs of these variegated groups in disaster.

Conversations with public health and emergency management officials suggest that there is no unproblematic or universally accepted term embracing all these groups. Descriptors are acceptable in one locality, state, or region that are unacceptable elsewhere. For example, until 1998 the state of Michigan employed the term “handicappers” to describe what every other state and the federal government for years had been calling “persons with disabilities.” A population with no claim to specialness can be made so by disaster, when many people suddenly find themselves destitute, homeless, or disabled. Circumstances leave them outside mainstream communications in ways they were not before the disaster.

For these reasons, high-risk, high vulnerability is the terminology chosen for this discussion, because it is both inclusive and accommodates those individuals and populations whose needs may not be clearly defined during the preparedness phase of the disaster continuum. It should be clear, however, that this choice does not settle the argument, which will continue indefinitely.

THE MEDICAL NEEDS OF THE POOR

Periodically, the American people rediscover that some of them are at a severe economic disadvantage to others. The settlement workers and nurses toiling in urban centers during the late 19th century made the first discovery of American poverty. The prose of James Agee and photographs of Walker Evans introduced a Depression-wrecked United States to the plight of the rural poor in the 1930s. Poverty then seemed to vanish in the wartime and postwar boom years. It reappeared under the searing lens of such books as The Other America, published by Michael Harrington in 1962. President Lyndon Johnson declared an “unconditional war on poverty,” and the Congress appropriated billions for programs to better the lives of poor people throughout the nation.

As the new century dawned, so-called faith-based solutions to the poverty conundrum were introduced, and it seemed a good time to relieve the federal government, creator of so many failed schemes, of its responsibility to help the poor. After all, homelessness had become a chronic but apparently manageable problem,
STATISTICAL PROFILE OF THE POOR

More than 37 million Americans, or 12.7% of the total population in 2005, lived below the officially established poverty line, an income of $19,000 for a family of four (U.S. Census Bureau, 2005). The African American poverty rate stood at 24.7%, and percentages for other minority groups were equally dismaying. A small but critical number of this population was homeless. According to the National Law Center on Homelessness & Poverty, 750,000 persons faced each evening without a home to return to (National Law Center on Homelessness & Poverty, 2005). Up to 39% of these people are mentally ill, but they have a shrinking set of resources on which to rely. Others actually held jobs, but could not afford housing in the affluent areas around them.

Poverty is perhaps the greatest obstacle any individual can face in attempting to receive adequate health care. Although Social Security and Medicare now make a decent and dignified retirement possible for a majority of elderly persons, in 2003 the census still counted 37.9% of all persons 65 years of age or older as “poor” or “near poor” (U.S. Census Bureau, 2003). Not surprisingly, these nearly 14 million individuals were sharply limited in their ability to pay for medical costs beyond what Medicare allowed. It is old news that large numbers of American households are composed of single mothers and adolescents or infant children; the impact on health care may not yet be fully understood. Although some single moms have college degrees, many are high school dropouts, uncertain of elementary health measures. Those who are unemployed may not be able to afford care for their children; if employed, they may hold down two jobs, with inadequate time left for their own medical care, much less that of their kids. When they seek such care, more often than not, they will do so at the door of a hospital emergency room.

Disaster, of course, multiplies the number of homeless people in any community. It also increases poverty. Occasionally, poor people escape destruction of their homes and neighborhoods; a 1977 flood in Johnstown, Pennsylvania, devastated the homes of White residents in the well-off valley district, without touching the higher hillside residences of poorer African Americans. The plight of poor and Black New Orleanians is more typical, however. Thousands of elderly, disabled, and careless residents had no way to heed the belated evacuation order. Many in the lower Ninth Ward and other poverty-stricken neighborhoods were trapped in their homes for days, suffering both mental and physical injuries. More than 1,000 died.

Dr. Ruth Berggren, a teaching physician on the infectious disease unit of Charity Hospital, the medical training facility for Louisiana State University in New Orleans, wrote later that, “I discovered that medical care in such situations becomes a matter of first aid and survival. We had no laboratory tests, no radiology services, no ability to confer with specialists, and poor communication.” Dr. Berggren found the steady work of nurses to be an especially stabilizing element amid the chaos. “They maintained their ability to communicate coherently and to dispense kindness and caring to those who were suffering. In contrast, the doctors were terrible about sleep. The nursing co-director suggested that the ward make a banner from torn sheets, which read, ‘9 West has a big heart, Katrina can’t tear us apart’” (Berggren, 2005, p. 1551).

Nursing professionals must never forget the un forgiving reality of poverty’s impact on health care. They must become advocates for these often-voiceless patients. Berggren found the greatest asset at Charity Hospital to be a united team—and she had one. “All 18 members of our team (Black, White, rich, poor, gay, or straight) had chosen to care for the disenfranchised, the tuberculous, and the HIV-infected. We might not have been able to control what was happening to us, but we could control how we treated one another” (Berggren, 2005, p. 1550).

A NATION OF IMMIGRANTS

North America has witnessed several waves of immigration in recent history, beginning with the arrival of several small English ships off its eastern shore in the early 17th century. Almost 4 centuries later, the United States is experiencing the greatest flow of immigrants to this country ever seen. The fact that millions of those new arrivals are here illegally complicates a complex and vexing situation. In March 2005, 35.2 million foreign-born persons resided in the U.S.—a new record (U.S. Census, 2005). The years from 2000–2005 were the highest 5-year period for immigration in national history. More than a quarter of the new arrivals, some 9 to 10 million persons, were in the United States illegally. Largely because of a lack of education and appropriate skills, new immigrants were much poorer and resorted to the social welfare system more frequently than their native-born counterparts (Camarota, 2005).

Centers of immigration are arising in previously unimaginable places. Disaster relief staff sent to North Carolina in 1999 after Hurricane Floyd were astonished
at the large numbers of Hispanics living in small towns. However, a mere five states—California, Florida, New Jersey, New York, and Texas—account for 63% of all recent immigrants. The March 2005 survey revealed that 10.8 million persons, 31% of all immigrants, regardless of status, came from Mexico. Adding the remainder of Central America, the Caribbean region, and South America brings the total of immigrants from the four areas to just over half the total. East Asia accounts for 18% of immigration, about as much as Europe, the Middle East, and sub-Saharan Africa combined (Camarota, 2005).

THE LANGUAGE BARRIER

An inability to speak English is a serious impediment to some immigrants, especially in times of disaster and crisis. The language barrier limits their access to services and jobs. In a 2001 survey by the Census Bureau, 33% of Spanish speakers and 22.4% of all Asian and Pacific Island language speakers ages 18 to 64 years reported that they spoke English either “not well” or “not at all.” The bureaucratic term for this condition is limited English proficiency (LEP). Besides foreign-language speakers, the LEP rules cover persons who are deaf and the users of American Sign Language (ASL).

LEP and Health Care

LEP plays differing roles in limiting access to health care for these individuals. A 2000 survey found that Black and Hispanic children are at a substantial disadvantage compared with White children regarding access, even when accounting for health insurance and socioeconomic status (Weinick & Krauss, 2000). However, when their parents’ ability to speak English is comparable, the differences between Hispanic and White children become negligible. The results suggest that the disadvantage in Hispanic children’s access to care may be related to language ability and characteristics associated with having parents with limited English skills, including differing knowledge about the health care system. If those children can speak English, however, they may be forced of necessity to serve as interpreters for a parent seeking access to the health system. The problem with this arrangement are fairly evident: can the child truly understand the parent’s need? Does the child have the vocabulary to inform medical professionals of that need? Will a parent even seek medical assistance if to do so requires the revelation of sensitive information the parent does not want the child to know? These issues are magnified if the immigrant is undocumented.

Cultural Competence

To deal with the health care dimensions of LEP, hospitals, clinics, and physician’s offices must plan for and undertake a culturally competent response. The Rural Action Center, an initiative of the Department of Health and Human Services, defines cultural competence as:

- the ability of service delivery systems to provide quality assistance to clients with diverse values, beliefs, or traditions, including tailoring delivery to meet their social, cultural, and linguistic needs. It is a set of behaviors, attitudes, and policies that come together in an agency or among professionals enabling them to work effectively in cross-cultural situations. (DHHS, 2003)

The federal government as a standard for grantees has adopted the general requirements of cultural competence. In August 2000 the president issued Executive Order 13166, “Assisting Persons with Limited English Proficiency in Federally Financed Programs,” which, among other things, made federal agencies responsible for issuing guidance to state and local governments and private nonprofits on what they should do to help their LEP beneficiaries to access services. During the past several years, medical facilities have responded by issuing literature in different languages, employing interpreters and bilingual staff, and providing training for their monolingual personnel. To bridge the communication barrier, many institutions use a simple folding board with the names of body parts and systems in several languages, together with pictures, where appropriate. This item is particularly useful during the stressful hours of disaster, when language skills may desert even a competent English speaker.

WHO IS DISABLED?

People who are disabled or elderly live everywhere in America. To be sure, they can be found in such institutions as nursing homes, assisted communal living facilities, schools for people with mental retardation, and so forth. But these and similar services care for only a small proportion of the population. According to the Centers for Disease Control and Prevention’s National Center for Health Statistics, there are only 1.6 million residents living in nursing homes (CDC, 2006) and an aging population of 35.6 million Americans over the age of 65 (U.S. Administration on Aging, 2006). This is an indication that more and more elder Americans are living independent lives with perhaps some assistance. Some Florida counties have become such clear destinations for older persons that their presence can be determined merely by walking down the street. By
and large, however, golden age ghettos are not easy to find. There is not a blind barrio nor a quarter of the community reserved for wheelchair users.

The Americans With Disabilities Act (ADA) defines disability as a “physical or mental impairment that substantially limits one or more of the major life activities of such [disabled] individual; a record of such an impairment; or being regarded as having such an impairment” (U.S. Department of Justice, 1991). For the purposes of this discussion, only the first usage is of interest. The regulations implementing the ADA offer a lengthy list of conditions covering every part of the human body.

The U.S. Census Bureau takes a sample count of persons with a disability, requesting the information for one of every six American homes. According to the census, individuals were classified as having a disability if any of the following three conditions was true: they were 5 years old or older and reported a long-lasting sensory, physical, mental, or self-care disability; they were 16 years old or older and reported difficulty going outside the home because of a physical, mental, or emotional condition lasting 6 months or more; or they were 16 to 64 years old and reported difficulty working at a job or business because of a physical, mental, or emotional condition lasting 6 months or more. The census does not include persons under the age of 5, those in the armed forces, or institutionalized persons.

The major groups of disabling impairments are sensory (e.g., blindness or deafness), mobility (e.g., amputation or stroke), and developmental (e.g., retardation and other syndromes affecting cognition). To these must be added persons with mental illness or having a sexually transmitted disease such as HIV/AIDS, or another contagious malady. There are also limited circumstances under which people who are drug- or alcohol-dependent may be considered disabled. Of course, any one individual may fall into one or more of these categories. Each will be briefly discussed in the following.

Disability and Age

It is commonly heard today that 60 is the new 40, and, undeniably, many older persons would bristle to be considered disabled. Indeed, as the oldest baby boomers (those born in the mid-1940s) embrace healthy lifestyles and benefit from improved medical advances, the number of senior citizens with disabling conditions will increase. One factor contributing to this reality is the expected “graying of America,” already underway, and expected to continue for the next several decades. In the next 40 years, it is expected that the number of Americans 65 years and older will double from 35.6 million to more than 70 million and those over the age of 85 will triple (U.S. Administration on Aging, 2006). The National Organization on Disability estimates that there are about 54 million Americans with some sort of disabling condition. Not all are serious enough to designate particular individuals as high risk in time of disaster. But the number of persons with disabilities will increase. One factor contributing to this reality is the expected “graying of America,” already underway, and expected to continue for the next several decades. In the next 40 years, it is expected that the number of Americans 65 years and older will double from 35.6 million to more than 70 million and those over the age of 85 will triple (U.S. Administration on Aging, 2006). Barring a medical miracle that abolishes arthritis, dementia, blindness, and deafness, to name just a few, the number of senior citizens with disabling conditions will continue to increase. Ironically, medicine’s successes as well as its failures will add to the number of disabled persons. Military medicine has advanced to meet the horror of the modern battlefield; during the war in Iraq, more wounded soldiers survived their injuries than in the Vietnam conflict. However, lives have been won with an increase in amputations, loss of sight or hearing, and in cases of posttraumatic stress disorder (PTSD). Surgeons in American trauma units have learned from their colleagues at war, using some of the

is, therefore, an overlap between age and disability that cannot be ignored.

Age and Disaster

Older people are made vulnerable by disaster in ways not readily apparent. Many older individuals and couples function more than adequately within the well-established services and schedules of an adult congregate living facility (ACLF) or retirement community. Thrust into the austere environment of a shelter, characterized by chaotic conditions and screaming children, many become helpless, suddenly needing assistance they never required before. Workers in Florida shelters noted such behavior after Hurricane Andrew in 1992.

Older persons often create miniature social networks: one neighbor with limited vision cooks, while the person next door uses her wheelchair van to shop. After the multiple hurricane strikes on Florida in 2004, many of these networks were torn apart, their members separated to widely scattered Federal Emergency Management Agency (FEMA) trailer parks. Such calamities could befall any group, of course, but there is no doubt that disaster deals a crueler blow to the elderly than to other segments of society.

Continued Growth of the Disability Population

The National Organization on Disability estimates that there are about 54 million Americans with some sort of disabling condition. Not all are serious enough to designate particular individuals as high risk in time of disaster. But the number of persons with disabilities will increase. One factor contributing to this reality is the expected “graying of America,” already underway, and expected to continue for the next several decades. In the next 40 years, it is expected that the number of Americans 65 years and older will double from 35.6 million to more than 70 million and those over the age of 85 will triple (U.S. Administration on Aging, 2006). Barring a medical miracle that abolishes arthritis, dementia, blindness, and deafness, to name just a few, the number of senior citizens with disabling conditions will continue to increase. Ironically, medicine’s successes as well as its failures will add to the number of disabled persons. Military medicine has advanced to meet the horror of the modern battlefield; during the war in Iraq, more wounded soldiers survived their injuries than in the Vietnam conflict. However, lives have been won with an increase in amputations, loss of sight or hearing, and in cases of posttraumatic stress disorder (PTSD). Surgeons in American trauma units have learned from their colleagues at war, using some of the
same techniques to save more victims of auto accidents, but leaving more survivors with disabilities.

Ethical and Legal Issues

For a variety of reasons, a civil rights movement for people with disabilities came late in the stirring saga of groups seeking redress for injustices sometimes centuries old. So many distinct and differing conditions exist that many persons remain outside the movement or within membership organizations serving only those with their particular disability. Its signal achievement has been passage of the ADA, a law that has wrought many significant changes in daily life and, for that reason, has come under increasing challenge in the past few years. The movement seeks nothing less than full inclusion in all aspects of modern society. Government and many private organizations have adopted the term individual with a disability to recognize that emphasis is now to be placed on the person first. He or she no longer will be seen simply as a medical condition, but as a human being with personality, emotions, and desires. Indeed, years of struggle have been fought against the medical model, in which all-knowing medical experts expect people with disabilities to adjust to the reality created by their symptoms, rather than viewing their circumstances as the result of artificial social barriers that can be cast aside. People with disabilities ask neither for pity nor for charity, but for a voice—the voice—in determining how their lives shall unfold. Or, as a popular saying within the movement declares, “Nothing about us without us.”

ACCOMMODATING THE NEEDS OF PEOPLE WITH DISABILITIES AND THE ELDERLY

Requirements of the ADA

The ADA, together with an earlier and far less sweeping statute, Section 504 of the Rehabilitation Act of 1973, created a series of standards to be met by a wide swath of services and organizations, from restaurants to train stations to hospitals and clinics. Medical facilities are covered whether or not they receive assistance from the federal government. The law prohibits discrimination on the grounds of disability to the “programs, services, or activities” of a covered entity. It is difficult to imagine what would lie outside the purview of those three words. The solution to a problem sometimes may lie in the provision of physical access, but also may involve installing a specific electronic device, employing an individual with certain skills, or publishing information in a particular type font.

Limitations of the ADA

Any person, disabled or not, is eligible for disaster medical services if he or she requires them. The ADA comes into play once the person with a disability is inside the facility’s door. As will be seen, emphasis is placed on whether the person can be served with or without a reasonable accommodation. A reasonable accommodation, now a term of art within the field of disability law, refers to any alteration or change in the way programs, services, and activities are delivered or accomplished, without, to invoke another legal term, undue hardship. Undue hardship is an expense or degree of effort that has a significant impact on the total resources of the facility. A person who is deaf can be accommodated easily if he or she can understand written messages from the hospital staff regarding his or her treatment and can write notes in return; the provision of a team of sign-language interpreters around the clock might raise an issue of reasonableness.

ACCOMMODATING PERSONS WITH SENSORY DISABILITIES

Providing General Information

As might be inferred from the earlier example, access to information is the primary problem faced by people who are deaf or blind, the groups constituting the majority of those with sensory disabilities. Furthermore, information can be broken down to general information about the facility previously prepared (if appropriate), and minute-to-minute discussions with the individual on topics ranging from availability of parking to the outcome of proposed treatment.

The nature of information and the method of providing it will vary according to both the size of the facility and the disaster. Large hospitals, especially those at a distance from the event receiving patient overflow, should have on hand material in alternate formats that provides the same basic information available to sighted patients. One example, for those whose injuries would indicate a stay of more than a day, would be the food service menu.

There are several types of alternate formats, most of which would not be applicable in a disaster scenario. The ADA regulations suggest large print, Braille, audiotape, computer diskettes, and use of Web sites. Only the first two choices would have any practicality in a disaster scenario. Few, if any, evacuees will bring tape recorders or laptops with them. For many years the
general population thought about blind persons as those persons with fingers flying over sheets of Braille paragraphs. Unfortunately, Braille literacy among blind children has declined, and few persons with adventitious blindness attempt to master the dots and dashes of the Braille code. The National Library Service for the Blind and Physically Handicapped (NLS), which maintains a system of libraries to distribute books and magazines on cassettes and as Braille documents, reports that its total 2005 readership comprised 790,000 tape readers and a mere 42,000 Braille users, a ratio of 24 to 1 in favor of tape (NLS, 2005).

This does not mean that no hospital will ever receive a request for material in Braille. The NLS can point hospital staff to Braille transcribers and producers in their area. Like other ventures suggested in this chapter, a hospital or clinic planning in advance for this need probably should attempt to raise money from corporations to defray costs.

Most legally blind persons over the age of 65 have some vision, and for them, the most useful information format is large print. Using the font adjustment available with modern software, large facilities should easily be able to produce material accessible to this population segment. It is incumbent on the intake process to include questions about disability, including the important question dealing with the patient’s ability to read. Many seniors consider any disability as a stigma, or a condition that, once revealed, will result in the loss of independence. In a crisis condition of a disaster, nursing staff still have a responsibility to build trust with patients, trust that elicits cooperation and may allow seniors to accept services without damaging their pride.

Providing Information on the Run

In a hospital or clinic, short-staffing and long hours force nurses to work on the run. They enter the patient’s room, perform the given task humanely but quickly, and then they are on their way to the next person. Of course, this situation is only compounded when nurses work under the higher pressure of a disaster. The central point of this discussion is that nurses, no matter their workload, must keep a few critical points in mind when dealing with the patient who is either blind or deaf. To begin, a sign should be placed in the patient’s room or cubicle indicating that he or she is either blind or deaf. There are several specific purposes for this signage, some of which may not be readily apparent. First and foremost, it suggests that the patient may not hear the nurse enter and approach, particularly if the noise level around the room is high. Nurses and other staff must announce themselves upon entering and should not leave until they are sure the patient understands that they are departing. By doing so, they also give the patient a priceless opportunity—a few seconds in which to collect their thoughts and ask questions. Nurses are busy, but they must take a few critical seconds to listen to blind or deaf patients.

Accommodations for Persons Who Are Deaf

Statistics on the American deaf and hard of hearing population are available, but provide a range of estimates that make it difficult to suggest how common this disability is. The most recent figures are from the National Center for Health Statistics, based on its 2001 National Health Interview Survey. These figures are not based on actual counting, but on statistical extrapolation from a sample survey. These are derived from what is supposed to be a “representative sample of households across the country” for the “civilian non-institutionalized population of the United States.” Using the 1990 census, this survey estimated that some 31.2 million persons over the age of 18, or 15.63% of the total, had a “little” or a “lot” of trouble hearing (Gallaudet University Library, 2004). If we could spread this estimate across the nation, medical facilities should expect that roughly one out of seven patients would have some difficulty in hearing. These figures increase, as might be expected, as the population ages.

Methods of Communication

To use the telephone, persons who are deaf attach a telecommunications device known by its abbreviation, TTY/TDD to the instrument. The phone’s receiver sits in a cradle or coupler on the TTY connecting the two devices. Direct communication can work only if there is a TTY at both ends. The deaf person dials the number; when the hearing person picks up, she hears electronic chatter alerting her that a TTY call is underway; she plugs her receiver into the coupler on her TTY, and words begin to appear on an LCD screen above a typewriter keyboard.

By the time this textbook is published, any medical facility receiving federal funding long ago should have installed a TTY and publicized a specific TTY number for communication with people who are deaf. So long as electricity or battery power is available at either end, conversations should be possible. The TTY is a vital instrument in the effort to provide emergency information. The cost of a TTY has fallen along with those of electronic gear generally; it should be possible to include such a device in any shelter kit. Of course, such a device would not normally be found at a roadside clinic or other types of temporary medical facilities.

It is important to realize that during times of emergency or disaster, communication can take place via established formal modality or via other technologies not
originally intended to convey critical emergency messages to the deaf or hard of hearing community. Examples can include, but are not limited to, pagers and PDAs. As a result of 9/11 and Hurricane Katrina, the companies producing and distributing these alternative technological devices, as well as regulatory and planning agencies, are now considering such devices to be redundancies of traditional, standard communication methods for the deaf and hard of hearing population. This section does not list all technologies or applications, but readers are encouraged to research further reverse 911 systems, relay services, and other technologies, taking into account their impact on or by the deaf and hard of hearing community.

Face-to-Face Communication
A person may identify his hearing limitation by writing a note or showing a preprinted card. Depending on the patient’s condition, it may be possible to carry on a discussion among the person who is deaf or hearing impaired and a doctor, nurses, or other medical staff. However, there may well be a limitation both to the deaf person’s ability to write and the medical staff’s ability to convey information in an understandable manner. This is the time for sign language interpreters to step forward. As discussed previously in the section on language proficiency, American Sign Language (ASL) is considered a tongue just as is Spanish or Chinese. In nondisaster times, a large institution should have a contract with a service that can provide ASL interpreters within a reasonable period. Hearing children, whose comprehension of medicine and medical terminology may be limited in the extreme, should not be required to interpret for parents or other relatives who are deaf.

Of course, emergency circumstances may require that these rigid standards be relaxed. When the patient’s life is at stake, the hospital or clinic cannot wait hours for a member of the Registry of Certified Interpreters for the Deaf to arrive. Medical facilities can stock an inexpensive board that lists major body parts to which staff and the deaf person can point as a means of clarifying where the problem originates. Before bad weather or man-made terror spreads havoc, contact local advocacy organizations for the deaf or hard of hearing or regional offices of the state commission on the deaf or disabilities in general. As always, planners need to work with the community they serve, and an exchange on this serious issue should yield particularly fruitful results.

A Note on Service Dogs
Shortly after World War I, blind veterans began to use dog guides as a means of mobility. Indeed, like the use of Braille, the dog guide has become another stereotype associated with the group as a whole. Sadly, the elderly majority of blind persons do not appear to have much mobility at all. In 1990, the last year for which data is available, only 109,000 blind persons used canes, their number overwhelmingly below the age of 65. A little more than 7,000 blind people used dog guides, very few of these individuals being elderly (Guide Dog Foundation for the Blind, 1990).

During the last 3 decades a movement has arisen to use animals, primarily dogs, as service providers to persons with a variety of disabilities besides blindness. The largest group to use dogs has been persons who are deaf. There are no reliable statistics on so-called hearing ear dogs, but they provide such services as warning their owners of phone calls, visitors at the front door, and a baby’s cry from the nursery. All service dogs are allowed in medical facilities. The owner takes responsibility for the care and feeding of the animal and, in particular, for its toileting needs. These rights and duties apply especially to shelters. Nursing staff should be familiar with service dogs and should be able to distinguish between a pet, which cannot remain in the shelter, and a service animal, which has a right to be there.

Accommodating Persons With Mobility Impairments
By its very nature, a hospital should be an accessible building. Most patients cannot be discharged except from a sitting position in a wheelchair. The building’s design, however, does not necessarily assist persons with mobility impairments in all circumstances. If the generators fail in a multistory hospital, wheelchair users, together with those who rely on canes, walkers, and similar devices, cannot be evacuated by elevator. They can leave only via the stairs, and then only in specialized evacuation devices.

Evacuation Devices
Several companies make products to assist evacuation by wheelchair users or others with severe mobility impairments. Note, the needs for the use of any such device might be as a result of a disability (mobility, respiratory, or cardio), a pregnancy, or an injury as a result of the event triggering the evacuation at hand, to point out but a few examples. The most widely known are lightweight chairs used to carry a person down a stairway. A man with quadriplegia safely evacuated the World Trade Center on 9/11 using a comparable piece of equipment. In his case, he and his coworkers trained on this equipment procured for him after the 1993 bombing.

But this area of equipment technology is changing fast and improving every day. It is a very complex process to evaluate and decide the appropriate type and
model of equipment to purchase. Readers are encouraged to be familiar with existing equipment at their workplaces or seek further guidance as they research this particular topic.

Cautions and Concerns. No federal or state agency provides protection to consumers regarding evacuation devices, so all claims must be carefully evaluated. Using these chairs cannot be left for the last minute, but must be practiced by the support team. Finally, an evacuation chair is a substitute wheelchair, so staff must plan how people are to get along without their equipment if it must be abandoned.

Accommodations for Persons With Developmental, Intellectual, or Mental Disabilities

This section title represents current thinking about how to categorize millions of Americans. In the late 1970s, the designation might have simply referred to “Mentally Ill and Retarded Persons.” Scientific understanding and social sensitivity has come a long way since then. The term developmental disabilities is defined by Congressional enactment to include persons with severe and chronic disabilities having an onset before age 22, which includes persons with physical disabilities as well as those with a variety of mental disabilities. It is not exclusively related to mental retardation or to intellectual disabilities. In turn, the federal agency that funds state services to the formerly retarded decided to change the definition to the term intellectual disabilities, as a synonym or the nearest term that can be used as a synonym for mental retardation. The government sought to eliminate the two words that create difficulties for people with mental retardation. The word “mental” has often caused confusion with the term “mental illness” and the word “retardation” has often led to the use of offensive name calling, such as retard or retarded.

Developmental disabilities, which again through continued research are often referred to currently as cognitive disabilities, include Tourette’s syndrome, dyslexia, and attention deficit hyperactivity disorder. Mental illness includes depression, schizophrenia, bipolar disorder, and borderline personality, to name only a few of the conditions that can destroy the lives of individuals and wreak havoc on family and friends.

Reliable demographic data are difficult to obtain on these groups. The National Alliance on Mental Illness estimates that the most serious and disabling conditions affect 5 to 10 million adults and 3 to 5 million children ages 5 to 17 in the United States (National Alliance on Mental Illness, 2005). The government estimates the population of persons with intellectual disabilities at 1% of all Americans, or about 3 million people (U.S. Census Bureau, 2005). There is no firm data on people with developmental disabilities. Nor, with the exception of the characteristic Mongoloid facial features of some intellectually disabled persons, is there any way these populations can be identified. Those who use adaptive equipment may not have it with them under emergency circumstances. By and large, they speak normally and are indistinguishable from any other individual in a disaster-stricken community.

Accommodating people with these illnesses is one of the most difficult jobs in disaster response. Almost every person who enters a shelter or medical facility will have experienced great stress, which may disguise whatever other issues and concerns they may have. It will be up to the intake staff, under the severe pressure of time, to attempt judgment as to which among those in the emergency room or shelter lobby might require more attention. Sooner or later, hopefully sooner, some casual remark by the person will strike the intake person as not quite appropriate to the situation. Short of an open admission by the person, this offhand clue may be all that is provided. People with intellectual disabilities may arrive with a caretaker, easing the task of providing for their needs.

Once it is determined that a person has one of the many types of mental or developmental disabilities, the most important point is to assure the person that he or she is now in a safe environment—to the extent such a declaration actually can be made. Any hospital or shelter will be full of sound and loud conversation, but if any more quiet areas exist, these people should be directed to them. Make sure the person has clearly understood instructions and don’t hesitate to repeat. If you must perform a procedure on the individual, explain what you need to do and seek the person’s permission. He or she may have established a safe distance around him or herself that cannot be penetrated without his or her consent.

One of the most frightening disaster experiences happened to a group of about 100 persons with cerebral palsy and other developmental disabilities. The Miami chapter of United Cerebral Palsy (UCP) decided to move the residents of its housing program away from harm in suburban Miami in August 1992 to the heart of the city, which was forecast to be out of the path of fast-moving Hurricane Andrew. The forecast was correct, as far as it went; it did not account for a power failure that shut down air conditioning in UCP’s headquarters, where the apartment-dwellers had been brought. The heat rose, refrigerated food and medication began to spoil, and staff found themselves with virtually no supplies. With evacuation to hospital considered unsafe, the evacuees grew increasingly ill in the dreadful heat.

UCP staff finally contacted the media, making an appeal for generators. What they got turned out to be the
wrong size, requiring constant use of bicycle hookups to keep steady what little power flowed. After 3 days, the evacuees left their unwelcome shelter and moved to an abandoned hospital, which had more room. However, by that time, the regular program of instruction for the clients had become so disorganized that many students began to lose hard-won practical skills.

**Accommodating Persons With HIV/AIDS or Other Contagious Diseases**

The Centers for Disease Control and Prevention (CDC) still uses figures from the end of 2003 to estimate the AIDS population in America. At that time, between 1,039,000 and 1,185,000 persons were estimated to be living with HIV/AIDS. It remains a young person’s disease, with more than half of all victims in the cohort from 25 to 39 years of age. Although AIDS is classified as a sexually transmitted disease, medical personnel are well aware of the danger of acquiring the infection through contact with blood. Tuberculosis has begun to return with immigrant populations, and sheer forgetfulness on the part of residents has made measles once again a threat. Of course, a new dimension has been opened in disaster nursing with the possibility of biotoxins as a terrorist weapon.

Fortunately, persons living with HIV/AIDS normally will identify themselves because of the issue of medication. This is particularly true for low-income persons receiving help through the Ryan White Care Act program. Hundreds of such individuals evacuated to Houston following Hurricane Katrina in 2005. Staff of the Harris County (Houston) Public Health Department took the lead to identify and provide services for eligible evacuees setting up a booth in the Astrodome to centralize work. Eligible persons were sent to the Thomas Street Clinic, a subcontractor under the Ryan White Care Act of the Harris County Hospital. A first wave of AIDS patients brought records and a week’s supply of medications; a second, larger number of evacuees from the Superdome brought neither. As a result, physicians made sure this group did not suffer by screening all evacuees at the Astrodome.

Public health staff learned essential lessons that would apply in many instances to other diseases: that evacuees put their HIV/AIDS status at the low end of their priorities; that a lack of consolidated one-stop shopping for resources caused evacuees additional and unnecessary stress; that planning increased in difficulty with the number of unknown factors; and that preestablished network relationships with federal agencies led to a rapid delivery of funds and services (“County Officials Learn Lessons,” 2006).

**THE NEED FOR INCLUSION**

No matter the designation of these populations and no matter the type or nature of the impending disaster, the intent for nurses during disaster planning, especially for widespread emergencies, is inclusiveness. The goal is to assure that every person in a community can obtain and understand the information needed to prepare, cope, and recover when health emergencies strike. However, given the large number of population groups to be dealt with and the many specific issues created by the need to care for each, this chapter can serve only as a first exposure and introduction to this topic. It is neither comprehensive nor definitive. The medical professional who wishes to remain current on this subject matter must conduct research and follow professional trends to fully comprehend applications to nursing practice.

**REFERENCES**


Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services. (2003). Developing cultural competence in disaster mental health programs: Guiding principles and recommendations.


Recommended Reading and Further Resources

This is an annotated list of the best sources of information to research emergency planning for persons with special needs. For a more complete listing or other specific resource information, visit www.eadassociates.com or contact EAD & Associates, LLC—Emergency Management & Special Needs Consultants at 718-330-0034 or mail@eadassociates.com.

Institutional Planning Level


Visit www.nod.org/emergency to obtain a copy of this Guide as well as links to other specific preparedness information and continuously updated information about disabilities and disaster planning.

Easter Seals. s.a.f.e.t.y. first: Working Together for Safer Communities

www.easter-seals.org will provide the project materials for this workplace evacuation and safety measures planning.

Job Accommodation Network. A service of the Office of Disability Employment Policy of the U.S. Department of Labor

www.jan.wvu.edu will provide a document for employer emergency evacuation and also provide free guidance about workplace evacuation plans customized for a specific employee’s special needs.


http://www.disabilitypreparedness.gov/ offers information for emergency planners and first responders to help them better prepare for serving persons with disabilities.

FEMA/USFA. The following publications are provided from www.usfa.fema.gov/usfapubs/index.cfm

Emergency Planning & Special Needs Populations G197 (offered via SEMO Training Office)

Emergency Procedures for Employees With Disabilities in Office Occupancies (publication FA-154)

Orientation Manual for First Responders on the Evacuation of People With Disabilities (publication FA-235)

U.S. Access Board. The agency’s own planning methodology and plan criteria are posted as an example as well as guidance on the structural requirements under the Americans With Disabilities Act (ADA) pertaining to evacuation. Visit www.access-board.gov


U.S. Department of Justice. Guidance about basic areas of emergency preparedness and response that for people with disabilities as developed and implemented by local authorities. Contact http://www.usdoj.gov/crt/ada/emer.pdf

National Center for Accessible Media. The Access to Emergency Alerts project unites emergency alert providers, local information resources, telecommunications industry and public broadcasting representatives, and consumers in a collaborative effort to research and disseminate replicable approaches to make emergency warnings accessible. The Web site provides information on developments and resources. Visit http://ncam.wgbh.org/alerts

Nobody Left Behind Program at the University of Kansas. Information on the ongoing research project to investigate 30 randomly selected counties, cities, or boroughs in the United States that have recently experienced a natural or man-made disaster in order to study impacts on persons with mobility impairments. The Web site has an extensive resource list at http://rtcil.org/NLB

West Virginia University’s Project Safe EV-AC. A 3-year development project to improve evacuation from buildings, vehicles, and other settings during emergencies by providing training materials on the evacuation and accommodation of people with disabilities. The Web site provides information about the program and how to get involved. Visit http://evac.idci.wvu.edu

Individual Planning Level

National Organization on Disability’s Emergency Preparedness Initiative. A repository of continuously
updated information for both the disability community and emergency professionals and links to specific disaster preparedness information, checklists, and guidelines for people with disabilities. Visit www.nod.org/emergency.

The Federal Emergency Management Agency (FEMA) in conjunction with the American Red Cross (ARC) has published many documents for individual disaster preparedness. Those most helpful for people with special needs are listed and may be obtained from your local Red Cross chapter or the FEMA Distribution Center 1-800-480-2520 or www.fema.gov/library; alternate formats are also available.

- Disaster Preparedness for People with Disabilities (ARC—5091)
- Preparing for Disaster for People With Disabilities and other Special Needs (FEMA 476 A 4497) Note: replaces ARC—A4497
- Disaster Preparedness for Seniors by Seniors (ARC—A5059)
- Your Family Disaster Plan (FEMA/ARC—A4466)
- Your Family Disaster Supply Kit (FEMA/ARC—4463)


Prepare Now. A California site with links to information about disaster preparedness for specific special needs populations. Visit www.preparenow.org.

www.ready.gov is a comprehensive general emergency planning site maintained by the federal government and the Department of Homeland Security.

www.EmergencyEmail.org is one of several free sign-up services that will forward customized geographic emergency information to subscribers via e-mail or alpha pager systems as the information breaks.
A weather system has stalled over the region, bringing record-setting rain and widespread flooding. People living in low-lying areas have been evacuated, including residents of a large nursing home and assisted living center. Twenty-four shelters are currently operating, housing several thousand people, many with special medical needs. The rain is forecasted to continue for the next several days, with additional evacuations anticipated, and the shelter population is expected to increase.

The area is home to many retirees who are living independently but are often medically fragile. In the past, citizens with special medical needs have been encouraged to voluntarily register with the Emergency Management Agency (EMA), including those who may need assistance to evacuate. Based on their assessment of the demographics of the community, EMA officials believe the number of registrants is low. In addition, the region has a large Latino migrant population who have been severely impacted as a result of the flooding, including unemployment because of agricultural losses.

The local public health department has the lead responsibility for planning and caring for persons with special medical needs. The planning assumption used by public health authorities is that one in six evacuees will need some type of assistance or accommodation. Although public health authorities have anticipated the need to open special needs shelters, the plan has never been tested.

Community-based organizations have been active in the region and have formed a local Voluntary Organizations Active in Disaster (VOAD). Member agencies have begun meeting to coordinate mass care service delivery and other relief efforts, and [to] identify unmet needs in the community.

The Emergency Operations Center (EOC) has been activated for the past several days now. You are serving in the Special Needs Liaison Unit in the EOC and are assigned to support various county departments (e.g., Emergency Medical Services, Public Health Department, Department of Social Services) and [to] coordinate efforts with community-based organizations serving vulnerable populations (e.g., American Red Cross, Salvation Army), disability organizations, and local hospitals. The EOC director is encouraging you to be proactive in identifying vulnerable populations and anticipating needs and service demands.

Discussion Questions
1. How will you define vulnerable or special needs populations?
2. Based on your knowledge of special needs planning, what questions would you ask about the region’s readiness to deal with special needs populations, for example, availability of interpreters, accessible formats for information dissemination, and so forth?
3. Define your “concept of operations” for the Special Needs Liaison Unit.
4. What community agencies will you want to reach out to?
5. What referral procedures will you establish?
6. What outreach strategies to special needs populations and their caregivers might you employ?
7. How will you handle volunteers and offers of donations?
8. What “just in time” training may be needed?
Advances in health care allow the disabled of all genders, cultures, ages, and ethnic groups to survive their physical disabilities and live longer lives. Yet disaster planning for this group is less than adequate. This problem is not new in disaster management. But it continues to haunt the nearly 54 million men, women, and children with disabilities living in the United States, even after the events of 9/11 and the more recent hurricanes in the Gulf Region and the subsequent rethinking of disaster management planning after those events. No one will ever forget the image of a deceased woman left unattended in a wheelchair in the New Orleans Superdome during the aftermath of Hurricane Katrina.

How can we better plan to meet the needs of the millions of individuals with physical disabilities who will have unique physiological needs during and after disasters or public health emergencies? In each community, a substantial percentage of the population has neurological disorders, such as stroke, brain injury, or spinal cord injury; respiratory and cardiovascular diseases; musculoskeletal and orthopedic disorders; and sensory impairments. The majority of these individuals live independently or with caregiver assistance in residential settings. Depending on the type of disaster, people with disabilities may need to evacuate their homes and seek shelter and assistance. The majority of planning strategists assume that individuals are mobile, have adequate cognitive capabilities, and don’t need adaptive equipment or specialized supplies. This assumption doesn’t apply to a community’s physically disabled population. In every area of the United States, nurses and other health care professionals must rethink how they will help this special population maintain their level of health and avoid potential additional illness and further disability during and after a major disaster.

As with nondisabled individuals, the most important strategy for those with disabilities is personal disaster planning. In addition to disaster supplies—including necessary medications that should be maintained by everyone—people with physical disabilities should have an individual disability emergency plan. Nurses should encourage clients to think about a typical day at home. What supplies, equipment, and personal assistance might the disabled need to survive each day? What could they do without?

Developing a list based on a typical nondisaster day will help individuals focus on the essentials. The individual should decide where to keep vital equipment and supplies in an immediately accessible place should a disaster such as an earthquake or terrorist attack occur without warning.

People with disabilities should also make prior arrangements with their caregivers or community support persons or agencies. Will caregivers be able to accompany them to an evacuation site? What will happen if the caregiver can’t reach the client? Table 16.2 lists examples of body systems often affected by disability and potential needs for equipment, supplies, and personal assistance.

Nurses can help people with disabilities forecast their individual survival needs. Posing questions such as “What transportation arrangements have you made if you need to leave your home?” and “What equipment and supplies do you need to have with you ready to take in an emergency?” can help individuals start to formulate a plan.
After the dialogue begins, ask more specific questions. For example, if the person has a spinal cord injury and needs regular, intermittent catheterization to prevent potentially life-threatening complications (e.g., autonomic dysreflexia), the person should be encouraged to think about what equipment he or she should take if evacuation is necessary and who will provide assistance if needed.

Effective rehabilitation prepares individuals to provide their own disability-related care and/or to supervise others in doing so and to advocate for themselves. During or after a major disaster, people with disabilities need to use their self-advocacy skills to get the assistance they need. For example, individuals should be certain that their caregivers are not separated from them. They should also be assertive in finding out whether specific congregate situations can meet their individual needs and, if not, what other resources are available.

Professionals who advocate for the disabled should be enlisted in disaster planning and in the provision of care of the disabled. The Association of Rehabilitation Nurses (ARN) is one such resource. ARN’s membership includes more than 5,700 rehabilitation professionals, with more than 60 local chapters across the country. As an organization, ARN offers a wide range of resources that include the following:

- Nursing education
- Certification as a Certified Rehabilitation Registered Nurse (CRRN)
- Research grants
- Leadership development
- Publications
- Participation with other nursing and non-nursing organizations
- Involvement in health care policy
- Volunteer identification

The mission of ARN is to promote and advance professional rehabilitation nursing practice through education, advocacy, collaboration, and research to enhance the quality of life for those affected by disability and chronic illness. For more information and resources, contact Association of Rehabilitation Nurses, 4700 W. Lake Avenue Glenview, IL 60025-1485; 800/229-7530; or online at www.rehabnurse.org; e-mail: info@rehabnurse.org.
THINK BEFORE YOU SPEAK OR WRITE: POLITE COMMUNICATION


The words one chooses to use when referring to people with disabilities in oral and written communication often carry either a positive or a negative connotation. Therefore, adopting the following suggestions will help others know that you respect people with disabilities and may also encourage people to think and act more appropriately toward others.

Put People First
The person should always come first. An individual has abilities as well as disabilities. Focusing on the person emphasizes the status we share, rather than conditions we presently do not. Thus, say “the person who has a disability”, rather than “the disabled person”. Similarly, it is better to refer to “people with disabilities” than to “the disabled” or “the handicapped”.

Emphasize Action
People with disabilities, even severe ones, can be quite active. Thus it is better to say “President Franklin Roosevelt used a wheelchair and occasionally walked using braces and crutches” rather than “he was confined to a wheelchair”, or “the wheelchair bound President”, or “the President was in a wheelchair”.

Do Not Sensationalize, Pity or Characterize
Avoid words like “afflicted”, “crippled”, and “victim” when referring to a person with a disability. Also, remember that people are more than their disabilities. Instead of saying that “President Roosevelt suffered from asthma”, “Helen Keller was handicapped by blindness”, “Peter Stuyvesant was an amputee” or “Moses was afflicted with a speech impairment”, do say “Einstein has a learning disability”, “Napoleon had epilepsy”, or “Alexander Graham Bell was hard of hearing” or “Marlee Matlin is an actress who is deaf”.

Avoid Inappropriate Words
“Handicapped” has gone the way of “invalid” and “crippled” and is no longer viewed as an appropriate term to refer to a person with a disability. “Differently abled” and “physically challenged” are fad phrases which have not gained general acceptance among people with disabilities and, in fact, offend many. “Special” when used to refer to people with disabilities, is a rather backhanded compliment—everyone is special in some way—and use of that term as an alternative to “different” is as inappropriate as using the latter term. Words like “wheelchair person” simply should not be used. People without current disabilities, when referred to in contrast to people with disabilities should be referred to as “people without disabilities” rather than as “able bodied” or “normal” since a person with a disability may be more “abled” than others with respect to pertinent activities. Of course, in some contexts, when quoting from an old statute or referring to a particular entity by name, use of some words which otherwise should be avoided may be necessary. For example, The Federal Rehabilitation Act uses the term “handicapped” and schools have “Committees on Special Education” (an improvement over the former “Committees on the Handicapped”). At the time when some organizations were formed and laws were written, few people had yet considered the role of language in encouraging inclusion.

Points to Keep in Mind

- Physical disability does not imply a mental disability or childishness.
- Different means of communication does not mean low intellectual ability.
- Disabilities can occur to anyone at anytime in life.
- Some disabilities can be temporary or episodic.
- Don’t be afraid to encounter someone with a disability.

Note on language referring to the “elderly”
There are several terms used to refer to the “elderly” that are used interchangeably, depending on the agency or organization. Common terms include: “seniors”, “elderly”, “the aging”, “older persons”, etc. Often the title used in the name of the agency or organization will indicate the appropriate term to use while working with that entity (e.g. the Administration on Aging uses the “aging” primarily in speech and written materials). Follow the same general guidance listed here for people with disabilities and defer to individual preferences.

"By choosing words which convey a positive image of our colleagues, clients, and friends, we begin to break down often unconscious attitudinal barriers to their integration and meaningful participation in society."
PART III

Natural and Environmental Disasters
Key Messages

- Nurses should be familiar with the types and consequences of commonly occurring natural disasters in order to contribute to public health efforts to prevent, mitigate, and recover from these events.
- Nurses need to be familiar with commonly used definitions for severe weather watches and storm warnings.
- Rapid assessment of health needs in populations affected by disasters is critical. This scientifically valid information enables health care providers and emergency management officials to prioritize resources and make decisions about responding to natural disasters.

Learning Objectives

When this chapter is completed, readers will be able to

1. Identify the major types of natural/environmental disasters and their physical, social, and economic impact.
2. Describe the morbidity and mortality commonly associated with each type of disaster.
3. Propose prevention and mitigation activities for each type of disaster.
4. Understand the implications of advance warning systems.
5. Define terms regarding severe weather watches and storm warnings.
Natural Disasters
Linda Young Landesman and Tener Goodwin Veenema

CHAPTER OVERVIEW

Disasters that are due to natural causes often result in significant losses, physical destruction of dwellings, social and economic disruption, human pain and suffering, injury, and loss of life. This chapter presents the reader with a broad overview of the most frequently occurring natural/environmental disasters, their impact on communities, and their associated morbidity and mortality. Disaster preparedness, prevention, and mitigation activities specific to each type of disaster are discussed. Case studies of naturally occurring disasters are presented as evidence of the scope of their impact and can be used to evaluate previous disaster response efforts and to predict future needs.

TYPES AND CONSEQUENCES OF NATURAL AND ENVIRONMENTAL DISASTERS

Since earliest prehistory, much of human life, technology, and culture have been defined by our constant struggle against the forces of nature. Because weather-related events are ubiquitous and can occur without warning, humans have had little recourse but to prepare to respond to the wrath of the environment in which they live. Environmental devastation caused by natural hazards of terrestrial origin (earthquakes, volcanic eruptions, landslides, tsunamis, hurricanes and other severe storms, tornadoes and high winds, floods, wildfires, and drought) and solar-terrestrial hazards (solar flares and geomagnetic storms) is inevitable.

In contrast, the impact of natural disasters on communities—lingering disruption, persisting long after the causative event itself and exceeding the communities’ ability to recover unaided—is determined as much or more by societal behavior and practice as by nature per se. The negative impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely. Natural disasters kill and inflict human suffering. In addition, they destroy property, economic productivity, and natural resources, and they harm the environment. Disaster response also diverts assets...
from much-needed investments in our future—research, education, and economic development. Disaster science, accompanied by major advances in technology and meteorology, has provided a better understanding of the hallmark characteristics of natural/environmental disasters. This information enables nurses, health care planners, and public health officials to prepare for these types of events and to develop advance-warning systems to minimize injuries and the loss of life. As with other types of disasters, advance preparation for a major natural disaster can result in significant reductions in mortality later on (Bissell, Pinet, Nelson, & Levy, 2004; Cuny, 1998).

Natural disasters can be categorized as acute or slow in their onset (Noji, 1996). They are predictable because they cluster in geographic areas. Natural hazards are unpreventable and, for the most part, uncontrollable. Even if quick recovery occurs, natural disasters can have long-term effects. Natural disasters with acute onsets include events such as avalanche, blizzard or extreme cold, earthquake, fire, flood, heat wave, hurricane, cyclone, or typhoon; tornado; tsunami or storm surge; volcanic eruption; and wildfire. Natural hazards with a slow or gradual onset include deforestation, desertification, drought, and pest infestation. The most important natural disasters and examples of their environmental effects are listed in Table 17.1.

### Severity of Damage

The severity of damage caused by natural/environmental disasters is affected by population density in disaster-prone areas, local building codes, community preparedness, sophistication of communication systems, and the use of public safety announcements and education on how to respond correctly to the first signs of danger. Recovery following a disaster varies according to the public’s access to pertinent information (e.g., sources of government and private aid), preexisting conditions that increase or reduce vulnerability (e.g., economic or biological factors), prior experience with stressful situations, and availability of sufficient savings and insurance (resources).

A large proportion of the American population is at risk from only three types of natural/environmental disasters: earthquakes, floods, and hurricanes. Approximately 50 million people live in flood plains that have been highly developed as working and residential communities. Another 110 million people live in coastal areas of the United States, including the Great Lakes region. By the year 2010, 60% of the U.S. population may be living within 50 miles of the East or West coasts. Trends such as increasing population densities, the progressive movement of populations to disaster-prone flood plains, the risk of hurricanes in coastal regions, and the construction of communities in areas vulnerable to wildfires, means that our potential for catastrophic disasters is increasing (Auf der Heide, 1996). Economic losses associated with these types of disasters are substantial (see Table 17.2) and are rising for reasons that are likely to continue in the near term:

- A simple rise in the value of vulnerable assets, as a result of population increase and economic growth in high-risk areas.
- Increasing use of hazardous lands (coastal zones, fault zones, flood plains, unstable slopes, fire-prone areas, etc.) in response to both population pressure and demographic preferences.
- A continuing failure to use best seismic, wind, fire, and flood mitigation and engineering practice. Nations and private enterprise are beginning to take steps to reduce vulnerability, especially in new construction. However, existing construction may not
temperatures remain unusually high several days in a row and nighttime temperatures do not drop significantly. Because populations acclimate to summer temperatures, heat waves in June and July have more of an impact than those in August and September. There is often a delay between the onset of a heat wave and adverse health effects. Deaths occur more commonly during heat waves where there is little cooling at night, and there is often confusion, and unconsciousness; it is often fatal despite meet codes providing the most protection, may not be situated safely or tested by a major hazard.

A growing shift in the economic losses from property damage to associated business disruption. This shift occurs as both developed and developing societies become increasingly dependent on critical infrastructure that is introducing new vulnerabilities to hazards. Today, the direct costs of repairing road damage, restoring power to regional electrical grids, and reinstating disrupted water supplies are often small compared with the losses that are due to business stoppages while these repairs are being made (U.S. Government Subcommittee on Natural Disaster Reduction, 2006).

**HEAT WAVE**

Over time, populations can acclimate to hot weather. However, mortality and morbidity rise when daytime temperatures remain unusually high several days in a row and nighttime temperatures do not drop significantly. Because populations acclimate to summer temperatures, heat waves in June and July have more of an impact than those in August and September. There is often a delay between the onset of a heat wave and adverse health effects. Deaths occur more commonly during heat waves where there is little cooling at night, and there is often confusion, and unconsciousness; it is often fatal despite

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
<th>FEMA Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hurricane Katrina (AL, LA, MS)</td>
<td>2005</td>
<td>$7.2 billion*</td>
</tr>
<tr>
<td>Northridge Earthquake (CA)</td>
<td>1994</td>
<td>$6.961 billion</td>
</tr>
<tr>
<td>Hurricane Georges (AL, FL, LA, MS, PR, VI)</td>
<td>1998</td>
<td>$2.251 billion</td>
</tr>
<tr>
<td>Hurricane Ivan (AL, FL, GA, LA, MS, NC, NJ, NY, PA, TN, WI)</td>
<td>2004</td>
<td>$1.947 billion**</td>
</tr>
<tr>
<td>Hurricane Andrew (FL, LA)</td>
<td>1992</td>
<td>$1.813 billion</td>
</tr>
<tr>
<td>Hurricane Charley (FL, SC)</td>
<td>2004</td>
<td>$1.559 billion**</td>
</tr>
<tr>
<td>Hurricane Frances (FL, GA, NC, NY, OH, PA, SC)</td>
<td>2004</td>
<td>$1.425 billion**</td>
</tr>
<tr>
<td>Hurricane Jeanne (DE, FL, PR, VI)</td>
<td>2004</td>
<td>$1.407 billion**</td>
</tr>
<tr>
<td>Tropical Storm Allison (FL, LA, MS, PA, TX)</td>
<td>2001</td>
<td>$1.387 billion</td>
</tr>
<tr>
<td>Hurricane Hugo (NC, SC, PR, VI)</td>
<td>1989</td>
<td>$1.307 billion</td>
</tr>
</tbody>
</table>

*Amount obligated from the President’s Disaster Relief Fund for FEMA’s assistance programs, hazard mitigation grants, federal mission assignments, contractual services and administrative costs as of March 31, 2006. Figures do not include funding provided by other participating federal agencies, such as the disaster loan programs of the Small Business Administration and the Agriculture Department’s Farm Service Agency.

**Amount obligated from the President’s Disaster Relief Fund for FEMA’s assistance programs, hazard mitigation grants, federal mission assignments, contractual services and administrative costs as of May 31, 2005. Figures do not include funding provided by other participating federal agencies, such as the disaster loan programs of the Small Business Administration and the Agriculture Department’s Farm Service Agency.

Note: Funding amounts are stated in nominal dollars, unadjusted for inflation.

**Risk of Morbidity and Mortality**

Heat kills by pushing the human body beyond its limits. On average, about 175 Americans succumb to the taxing demands of heat every year. Our bodies dissipate heat by varying the rate and depth of blood circulation, by losing water through the skin and sweat glands, and as a last resort, by panting, when blood is heated above 98.6 °F. Sweating cools the body through evaporation. However, high relative humidity retards evaporation, robbing the body of its ability to cool itself (National Weather Service, 2006). When heat gain exceeds the level the body can remove, body temperature begins to rise, and heat-related illnesses and disorders may develop.

The heat index (HI) is the temperature the body feels when heat and humidity are combined. Figure 17.1 shows the HI that corresponds to the actual air temperature and relative humidity. (This chart is based on shady, light wind conditions. Exposure to direct sunlight can increase the HI by up to 15 °F.) Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Other conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality (FEMA, 2006b).

Heat waves result in adverse health effects in cities more than in rural areas. During periods of sustained environmental heat—particularly during the summer—the numbers of deaths classified as heat related (e.g., heatstroke) and attributed to other causes (e.g., cardiovascular, cerebrovascular, and respiratory disease) increase substantially. Those at an increased risk for heat-related mortality are elderly persons, infants, persons with chronic conditions (including obesity), patients taking medications that predispose them to heatstroke (e.g., neuroleptics or anticholinergics), and persons confined to bed or who otherwise are unable to care for themselves.

Adverse health outcomes associated with high environmental temperatures include heatstroke, heat exhaustion, heat syncope, and heat cramps. Heatstroke (i.e., core body temperature greater than or equal to 105 °F/40.4 °C) is the most serious of these conditions and is characterized by rapid progression of lethargy, confusion, and unconsciousness; it is often fatal despite
medical care directed at lowering body temperature. Heat exhaustion is a milder syndrome that occurs following sustained exposure to hot temperatures and results from dehydration and electrolyte imbalance; manifestations include dizziness, weakness, or fatigue, and treatment is supportive. Heat syncope and heat cramps are usually related to physical exertion during hot weather.

**Prevention**

Basic behavioral and environmental measures are essential for preventing heat-related illness and death. Personal prevention strategies should include increasing time spent in air-conditioned environments, intake of nonalcoholic beverages, and incorporation of cool baths into a daily routine. When possible, activity requiring physical exertion should be conducted during cooler parts of the day. Sun exposure should be minimized, and light, loose, cotton clothing should be worn. The risk for heat-induced illness is greatest before persons become acclimated to warm environments. Athletes and workers in occupations requiring exposure to either indoor or outdoor high temperatures should take special precautions, including allowing 10 to 14 days to acclimate to an environment of predictably high ambient temperature (FEMA, 2006b).

Nurses and other health care providers can assist in preventing heat-related illnesses and deaths by disseminating community prevention messages to persons at high risk (e.g., the elderly and persons with preexisting medical conditions) using a variety of communication techniques. They may also establish emergency plans that include provision of access to artificially cooled environments. Case Study 17.4 describes a case of mortality and the lessons learned in a heat wave in Milwaukee in 1995.

**CYCLONES, HURRICANES, AND TYPHOONS**

Cyclones are large-scale storms characterized by low pressure in the center surrounded by circular wind motion. The United States National Weather Service technical definition of a tropical cyclone (National
Weather Service, 1993), is, “A nonfrontal, warm-core, low pressure system of synoptic scale, developing over tropical or subtropical waters and having a definite organized circulation.” In practice, that circulation is a closed airflow at the earth’s surface, going counterclockwise in the northern hemisphere and clockwise in the southern hemisphere. Severe storms arising in the Atlantic waters are known as hurricanes, whereas those developing in the Pacific Ocean and the China seas are called typhoons (see Figure 17.2). The precise classification (e.g., tropical depression, tropical storm, hurricane) depends on the wind force (measured on the Beaufort scale, introduced in 1805), wind speed, and manner of creation.

A hurricane is a tropical storm with winds that have reached a constant speed of 74 miles per hour or more. Hurricane winds blow in a large spiral around a relatively calm center known as the eye. The eye is generally 20 to 30 miles wide, and the storm may extend outward 400 miles. As a hurricane approaches, the skies will begin to darken, and winds will grow in strength. As a hurricane nears land, it can bring torrential rains, high winds, and storm surges. A single hurricane can last for more than 2 weeks over open waters and can run a path along the entire length of the eastern seaboard. August and September are peak months during the hurricane season, which lasts from June 1 through November 30. Satellites track hurricanes from the moment they begin to form, so warnings can be issued 3 to 4 days before a storm strikes. The greatest damage to life and property is not from the wind, however, but from tidal surges and flash flooding. Owing to its violent nature, its potentially prolonged duration, and the extensive area that could be affected, the hurricane or cyclone is potentially the most devastating of all storms. Scientists have developed a relatively good understanding of the nature of hurricanes through observation, radar, weather satellites, and computer models.

A distinctive characteristic of hurricanes is the increase in sea level, often referred to as storm surge. This increase in sea level is the result of the low-pressure central area of the storm creating suction, the storm winds piling up water, and the tremendous speed of the storm. Rare storm surges have risen as much as 14 meters above normal sea level. This phenomenon can be experienced as a large mass of seawater pushed along by the storm with great force. When it reaches land, the impact of the storm surge can be exacerbated by high tide, a low-lying coastal area with a gently sloping seabed, or a semi-enclosed bay facing the ocean (FEMA, 2006e).

The severity of a storm’s impact on humans is exacerbated by deforestation, which often occurs as a result of population pressure. When trees disappear along coastlines, winds and storm surges can enter land with greater force. Deforestation on the slopes of hills and mountains increases the risk of violent flash floods and landslides caused by the heavy rain associated with tropical cyclones. At the same time, the beneficial effects of the rainfall—replenishment of the water resources—may be negated because of the inability of a deforested ecosystem to absorb and retain water.

Risk of Morbidity and Mortality

Deaths and injuries from hurricanes occur because victims fail to evacuate the affected area or take shelter, do not take precautions in securing their property, and do not follow guidelines on food and water safety or injury prevention during recovery (FEMA, 2006f). Nurses need to be familiar with the commonly used definitions for severe weather watches and storm warnings in order to assist with timely evacuation or finding shelter for affected populations (see Table 17.3 and Case Study 17.1).

Morbidity during and after the storm itself results from drowning, electrocution, lacerations, or punctures from flying debris, and blunt trauma or bone fractures from falling trees or other objects. Heart attacks and stress-related disorders can arise during the storm or its aftermath. Gastrointestinal, respiratory, vector-borne disease, and skin disease as well as accidental pediatric poisoning can all occur during the period immediately following a storm (see Case Study 17.2). Injuries from improper use of chain saws or other power equipment, disrupted wildlife (e.g., bites from animals, snakes, or insects), and fires are common. Fortunately, the ability to detect, track, and warn communities about cyclones, hurricanes, and tropical storms has helped reduce morbidity and mortality in many countries.
Drought affects more people than any other environmental hazard, yet it is perhaps the most complex and least understood of this type of event. Drought is often seen as the result of too little rain and is often synonymous with famine. Fluctuation in rainfall alone does not cause a famine. Drought often triggers a crisis in arid and semiarid areas, because rain is sparse and irregular. However, drought alone does not cause desertification. The ecosystem changes leading to desertification are all attributed to human activities, such as overcultivation, deforestation, overgrazing, and unskilled irrigation. Each of these activities is exacerbated by increasing human population size. The first three activities strip the soil of vegetation and deplete its organic and nutrient content. This leaves the soil exposed to the eroding forces of the sun and wind. The subsoil that is left can become so hard that it no longer absorbs rain. Water flows over its surface, carrying away the little topsoil that might have remained. Drought conditions can also trigger secondary natural disasters, such as wildfires.

Risk of Morbidity and Mortality

Displaced populations suffer high rates of disease because of stress of migration, crowding, and unsanitary conditions of relocation sites. Morbidity and mortality can result from diarrheal disease, respiratory disease, and malnutrition. Mortality exceeding a baseline rate of one death per 10,000 people per day is the index of concern. Low weight-to-height is identified through the percentage of children two or more standard deviations (z-score) from the reference median compared with mean z-scores, children with edema are severely malnourished.

EARTHQUAKE

An earthquake, generally considered to be the most destructive and frightening of all forces of nature, is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth’s surface. This shaking can cause buildings and bridges to collapse; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Aftershocks of similar or lesser intensity can follow the main quake. Buildings with foundations resting on unconsolidated landfill, old waterways, or other unstable soil are most at risk. Buildings or trailers and manufactured homes not tied to a reinforced foundation anchored to the ground are also at risk because they can be shaken off their mountings during an earthquake. Earthquakes can occur at any time of the year. Earthquake losses, like those of other disasters, tend to cause more financial losses in industrialized countries and more injuries and deaths in undeveloped countries (FEMA, 2006a).

The Richter scale, used as an indication of the force of an earthquake, measures the magnitude and intensity or energy released by the quake. This value is calculated based on data recordings from a single observation point for events anywhere on Earth, but it does not address the possible damaging effects of the earthquake. According to global observations, an average of two earthquakes of a Richter magnitude 8 or slightly more occur every

17.3 Severe Weather Watches and Warnings Defined

Flood Watch: High flow or overflow of water from a river is possible in the given time period. It can also apply to heavy runoff or drainage of water into low-lying areas. These watches are generally issued for flooding that is expected to occur at least 6 hours after heavy rains have ended.

Flood Warning: Flooding conditions are actually occurring or imminent in the warning area.

Flash Flood Watch: Flash flooding is possible in or close to the watch area. Flash Flood Watches are generally issued for flooding that is expected to occur within 6 hours after heavy rains have ended.

Flash Flood Warning: Flash flooding is actually occurring or imminent in the warning area. It can be issued as a result of torrential rains, a dam failure, or an ice jam.

Tornado Watch: Conditions are conducive to the development of tornadoes in and close to the watch area.

Tornado Warning: A tornado has actually been sighted by spotters or indicated on radar and is occurring or imminent in the warning area.

Severe Thunderstorm Watch: Conditions are conducive to the development of severe thunderstorms in and close to the watch area.

Severe Thunderstorm Warning: A severe thunderstorm has actually been observed by spotters or indicated on radar and is occurring or imminent in the warning area.

Tropical Storm Watch: Tropical storm conditions with sustained winds from 39 to 73 mph are possible in the watch area within the next 36 hours.

Tropical Storm Warning: Tropical storm conditions are expected in the warning area within the next 24 hours.

Hurricane Watch: Hurricane conditions (sustained winds greater than 73 mph) are possible in the watch area within the next 72 hours.

Hurricane Warning: Hurricane conditions are occurring or imminent in the warning area.


DROUGHT

Drought affects more people than any other environmental hazard, yet it is perhaps the most complex and least understood of this type of event. Drought is often seen as the result of too little rain and is often synonymous with famine. Fluctuation in rainfall alone does not cause a famine. Drought often triggers a crisis in arid and semiarid areas, because rain is sparse and irregular. However, drought alone does not cause desertification. The ecosystem changes leading to desertification are all attributed to human activities, such as overcultivation, deforestation, overgrazing, and unskilled irrigation. Each of these activities is exacerbated by increasing human population size. The first three activities strip the soil of vegetation and deplete its organic and nutrient content. This leaves the soil exposed to the eroding forces of the sun and wind. The subsoil that is left can become so hard that it no longer absorbs rain. Water flows over its surface, carrying away the little topsoil that might have remained. Drought conditions can also trigger secondary natural disasters, such as wildfires.

Risk of Morbidity and Mortality

Displaced populations suffer high rates of disease because of stress of migration, crowding, and unsanitary conditions of relocation sites. Morbidity and mortality can result from diarrheal disease, respiratory disease, and malnutrition. Mortality exceeding a baseline rate of one death per 10,000 people per day is the index of concern. Low weight-to-height is identified through the percentage of children two or more standard deviations (z-score) from the reference median compared with mean z-scores, children with edema are severely malnourished.

EARTHQUAKE

An earthquake, generally considered to be the most destructive and frightening of all forces of nature, is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth’s surface. This shaking can cause buildings and bridges to collapse; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Aftershocks of similar or lesser intensity can follow the main quake. Buildings with foundations resting on unconsolidated landfill, old waterways, or other unstable soil are most at risk. Buildings or trailers and manufactured homes not tied to a reinforced foundation anchored to the ground are also at risk because they can be shaken off their mountings during an earthquake. Earthquakes can occur at any time of the year. Earthquake losses, like those of other disasters, tend to cause more financial losses in industrialized countries and more injuries and deaths in undeveloped countries (FEMA, 2006a).

The Richter scale, used as an indication of the force of an earthquake, measures the magnitude and intensity or energy released by the quake. This value is calculated based on data recordings from a single observation point for events anywhere on Earth, but it does not address the possible damaging effects of the earthquake. According to global observations, an average of two earthquakes of a Richter magnitude 8 or slightly more occur every
cases exceed the prevalence of a disease. Prevalence is usual or expected level. An epidemic exists when new infection, community, or geographic area, in excess of the specific disease from a single source in a group, population. An epidemic is an outbreak or occurrence of one species, and greater property losses are more likely in many areas prone to earthquakes. At least 70 million Americans face significant risk of death or injury from earthquakes because they live in the 39 states that are seismically active. In addition to the significant risks in California, the Pacific Northwest, Utah, and Idaho, six major cities with populations greater than 100,000 are located within the seismic area of the New Madrid fault (Missouri) (FEMA, 2006a). Major Third World cities in which large numbers of people live on earthquake-prone land in structures unable to withstand damage include Lima, Peru; Santiago, Chile; Quito, Ecuador, and Caracas, Venezuela.

Risk of Morbidity and Mortality

Deaths and injuries from earthquakes vary according to the type of housing available, time of day of occurrence, and population density. Common injuries include cuts, broken bones, crush injuries, and dehydration from being trapped in rubble. Stress reactions are also common. Morbidity and mortality can occur during the actual quake, the delayed collapse of unsound structures, or cleanup activity. Disruption of the earth may release pathogens that when inhaled can lead to increased reports of infectious disease (see Case Study 17.3).

Prevention/Mitigation

Mitigation involves developing and implementing strategies for reducing losses from earthquakes by incorporating principles of seismic safety into public and private decisions regarding the setting, design, and construction of structures (i.e., updating building and zoning codes and ordinances to enhance seismic safety), and regarding buildings’ nonstructural elements, contents, and furnishings.

Epidemics

An epidemic is an outbreak or occurrence of one specific disease from a single source in a group, population, community, or geographic area, in excess of the usual or expected level. An epidemic exists when new cases exceed the prevalence of a disease. Prevalence is the number of people within a population who have a certain disease or disorder at a given point in time. An acute outbreak—a sharp increase of new cases that affect a significant group—is generally considered an epidemic (Merrill & Timmreck, 2006). The spread of infectious disease depends on preexisting levels of the disease, ecological changes resulting from disaster, population displacement, changes in density of population, disruption of public utilities, interruption of basic public health services, and compromises to sanitation and hygiene. The risk that epidemics of infectious diseases will occur is proportional to population density and displacement. A true epidemic requires a susceptible population, the presence of a disease agent, and a mechanism that facilitates large-scale transmission (e.g., contaminated water supply or vector population).

Quick response is essential because epidemics, resulting in human and economic losses and political difficulties, develop rapidly. An epidemic or threatened epidemic can become an emergency when the following characteristics are present. Not every characteristic need be present and each must be assessed with regard to its relative importance locally:

- Risk of introduction to and spread of the disease in the population.
- Large number of cases may reasonably be expected to occur.
- Disease involved is of such severity as to lead to serious disability or death.
- Risk of social or economic disruption resulting from the presence of the disease.
- Inability of authorities to cope adequately with the situation because of insufficient technical or professional personnel, organizational experience, and necessary supplies or equipment (e.g., drugs, vaccines, laboratory diagnostic materials, vector control materials).
- Risk of international transmission.

The categorization of emergency differs from country to country, depending on two local factors: whether the disease is endemic and whether a means of transmitting the agent exists. Frequently, the introduction of a pathogen and the start of an epidemic may be through an animal vector; thus, veterinarians may be the first to identify a disease new to a community.

Flood

Prolonged rainfall over several days can cause a river or stream to overflow and flood surrounding areas. A flash flood from a broken dam or levee or after intense rainfall of 1 inch (or more) per hour often catches people unprepared.
Global statistics show that floods are the most frequently recorded destructive events, accounting for about 30% of the world’s disasters each year. The frequency of floods is increasing faster than any type of disaster. Much of this rise in incidence can be attributed to uncontrolled urbanization, deforestation, and the effects of El Niño. Floods may also accompany other natural disasters, such as sea surges during hurricanes and tsunamis following earthquakes (FEMA, 2006d).

Except for flash floods, flooding directly causes few deaths. Instead, widespread and long-lasting detrimental effects include damage to homes and mass homelessness, disruption of communications and health care systems, and heavy loss of business, livestock, crops, and grain, particularly in densely populated, low-lying areas (see Figure 17.3). The frequent cyclic nature of flooding can mean a constant and ever-increasing drain on the economy of rural populations.

**Risk of Morbidity and Mortality**

Flood-related morbidity and mortality vary from country to country. Flash flooding, such as from excessive rainfall or sudden release of water from a dam, is the cause of most flood-related deaths. Many victims become trapped in their cars and drown when attempting to drive through rising or swiftly moving water. Other deaths have been caused by wading, bicycling, or other recreational activities in flooded areas. The health impacts of flooding include infectious disease morbidity exacerbated by crowded living conditions and compromised personal hygiene, contamination of water sources, disruption of sewage service and solid waste collection, and increased vector populations. Waterborne diseases (e.g., enterotoxigenic *Escherichia coli*, *Shigella*, hepatitis A, leptospirosis, *giardiasis*) become a significant hazard, as do other vector-borne disease and skin disorders. Injured and frightened animals, hazardous waste contamination, molds and mildew, and dislodging of graves pose additional risks in the period following a flood (FEMA, 2006d). Food shortages that are due to water-damaged stocks may occur because of flooding and sea surges.

The stress and exertion required for cleanup following a flood also cause significant morbidity (mental and physical) and mortality (e.g., myocardial infarction). Fires, explosions from gas leaks, downed live wires, and debris can all cause significant injury.

TORNADO

Tornadoes are rapidly whirling, funnel-shaped air spirals that emerge from a violent thunderstorm and reach the ground. Tornadoes can have a wind velocity of up to 200 miles per hour and generate sufficient force to destroy even massive buildings. The average circumference of a tornado is a few hundred meters, and it is usually exhausted before it has traveled as far as 20 kilometers. Severity is rated on the Fujita scale according to wind speed. The Fujita scale uses a scoring system of F0 (no damage) to F5 (total destruction). The extent of damage depends on updrafts within the tornado funnel, the tornado’s atmospheric pressure (which is often lower than the surrounding barometric pressure), and the effects of flying debris. An enhanced Fujita scale was released in February 2007 and reflects updated metrics for existing wind based on damage occurring as a result of a tornado.

Risk of Morbidity and Mortality

Approximately 1,000 tornadoes occur annually in the United States, and none of the lower 48 states are immune. Certain geographic areas are at greater risk because of recurrent weather patterns; tornadoes most frequently occur in the midwestern and southeastern states. Although tornadoes often develop in the late afternoon and more often from March through May, they can arise at any hour of the day and during any month of the year. Injuries from tornadoes occur from flying debris or people being thrown by the high winds (e.g., head injuries, soft tissue injury, secondary wound infection). Stress-related disorders are more common, as is disease related to loss of utilities, potable water, or shelter.

Prevention/Mitigation

Because tornadoes can occur so quickly, communities should develop redundant warning systems (e.g., media
### Enhanced F Scale for Tornado Damage

<table>
<thead>
<tr>
<th>FUJITA SCALE</th>
<th>DERIVED EF SCALE</th>
<th>OPERATIONAL EF SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF Number</td>
<td>EF Number</td>
<td>EF Number</td>
</tr>
<tr>
<td>Second Gust</td>
<td>Second Gust</td>
<td>Second Gust</td>
</tr>
<tr>
<td>(mph)</td>
<td>(mph)</td>
<td>(mph)</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>45-78</td>
<td>65-85</td>
</tr>
<tr>
<td>2</td>
<td>118-161</td>
<td>111-138</td>
</tr>
<tr>
<td>3</td>
<td>182-209</td>
<td>136-165</td>
</tr>
<tr>
<td>4</td>
<td>210-280</td>
<td>166-200</td>
</tr>
<tr>
<td>5</td>
<td>263-317</td>
<td>Over 200</td>
</tr>
</tbody>
</table>

### Enhanced F Scale Damage Indicators

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>DAMAGE INDICATOR</th>
<th>ABBREVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small barns, farm outbuildings</td>
<td>SBO</td>
</tr>
<tr>
<td>2</td>
<td>One- or two-family residences</td>
<td>FR12</td>
</tr>
<tr>
<td>3</td>
<td>Single-wide mobile home (MHSW)</td>
<td>MHSW</td>
</tr>
<tr>
<td>4</td>
<td>Double-wide mobile home</td>
<td>MHDW</td>
</tr>
<tr>
<td>5</td>
<td>Apt., condo, townhouse (1 story or less)</td>
<td>ACT</td>
</tr>
<tr>
<td>6</td>
<td>Motel</td>
<td>M</td>
</tr>
<tr>
<td>7</td>
<td>Masonry apt. or motel</td>
<td>MAM</td>
</tr>
<tr>
<td>8</td>
<td>Small retail bldg. (fast food)</td>
<td>SRB</td>
</tr>
<tr>
<td>9</td>
<td>Small professional (doctor office, branch bank)</td>
<td>SPB</td>
</tr>
<tr>
<td>10</td>
<td>Strip mall</td>
<td>SM</td>
</tr>
<tr>
<td>11</td>
<td>Large shopping mall</td>
<td>LSM</td>
</tr>
<tr>
<td>12</td>
<td>Large, isolated (“big box”) retail bldg.</td>
<td>LRB</td>
</tr>
<tr>
<td>13</td>
<td>Automotive showroom</td>
<td>ASR</td>
</tr>
<tr>
<td>14</td>
<td>Automotive service building</td>
<td>ASB</td>
</tr>
<tr>
<td>15</td>
<td>School – 1-story elementary (interior or exterior halls)</td>
<td>ES</td>
</tr>
<tr>
<td>16</td>
<td>School – Jr. or Sr. high school</td>
<td>JSHH</td>
</tr>
<tr>
<td>17</td>
<td>Low-rise (1-4 story) bldg.</td>
<td>LR</td>
</tr>
<tr>
<td>18</td>
<td>Mid-rise (5-20 story) bldg.</td>
<td>MRB</td>
</tr>
<tr>
<td>19</td>
<td>High-rise (over 20 stories)</td>
<td>HRB</td>
</tr>
<tr>
<td>20</td>
<td>Institutional bldg. (hospital, govt. or university)</td>
<td>IB</td>
</tr>
<tr>
<td>21</td>
<td>Metal building system</td>
<td>MBS</td>
</tr>
<tr>
<td>22</td>
<td>Service station canopy</td>
<td>SSC</td>
</tr>
<tr>
<td>23</td>
<td>Warehouse (tall up walls or heavy timber)</td>
<td>WHB</td>
</tr>
<tr>
<td>24</td>
<td>Transmission line tower</td>
<td>TTL</td>
</tr>
<tr>
<td>25</td>
<td>Free standing tower</td>
<td>FST</td>
</tr>
<tr>
<td>26</td>
<td>Free standing pole (light, flag, laminary)</td>
<td>FSP</td>
</tr>
<tr>
<td>27</td>
<td>Tree – hardwood</td>
<td>TH</td>
</tr>
<tr>
<td>28</td>
<td>Trees – deflected</td>
<td>TS</td>
</tr>
</tbody>
</table>

Figure 17.4 An update to the original F-scale by a team of meteorologists and wind engineers, was implemented in the U.S. on 1 February 2007.

Source: Available at: http://www.spc.noaa.gov/tw/ef-scale.html
alerts and automated telephone warnings), establish protective shelters to reduce tornado-related injuries, and practice tornado shelter drills. In the event of a tornado, the residents should take shelter in a basement if possible, away from windows, while protecting their heads. Special outreach should be made to people with special needs, who should make a list of their limitations, capabilities, and medications and have ready an emergency box of needed supplies. People with special needs should have a "buddy" who has a copy of the list and who knows of the emergency box.

THUNDERSTORMS

A thunderstorm is formed from a combination of moisture, rapidly rising warm air, and a force capable of lifting air such as a warm and cold front, a sea breeze, or a mountain. All thunderstorms contain lightning. Thunderstorms may occur singly, in clusters, or in lines. Thus, it is possible for several thunderstorms to affect one location in the course of a few hours. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time. Thunderstorms can bring heavy rains (which can cause flash flooding), strong winds, hail, lightning, and tornadoes. Severe thunderstorms can cause extensive damage to homes and property (FEMA, 2006f).

Lightning is a major threat during a thunderstorm. Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a bolt. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning reaches a temperature approaching 50,000 °F in a split second. The rapid heating and cooling of air near the lightning causes thunder.

Risk of Morbidity and Mortality

In the United States, between 75 and 100 Americans are hit and killed each year by lightning. Morbidity is reduced if, when caught outdoors, individuals avoid natural lightning rods such as tall, isolated trees in an open area or on top of a hill and metal objects such as wire fences, golf clubs, and metal tools. It is a myth that lightning never strikes twice in the same place. In fact, lightning will strike several times in the same place in the course of one discharge (FEMA, 2006f). Although thunderstorms and lightning can be found throughout the United States, they are most likely to occur in the central and southern states. The state with the highest number of thunderstorm days is Florida.

TSUNAMI

Tsunamis are a series of waves usually generated by large earthquakes under or near the ocean occur when a body of water is rapidly displaced on a massive scale. Submarine landslides and volcanic eruptions beneath the sea or on small islands can also be responsible for tsunami, but their effects are usually limited to smaller areas. Tsunamis are often mistakenly referred to as tidal waves because they can resemble a violent tide rushing to shore. Powerful enough to move through any obstacle, damage from tsunamis results from both the destructive force of the initial wave and the rapid flooding that occurs as the water dissipates. Depending on the strength of the initiating event, underwater topography, and the distance from its epicenter to the shore, the effects of a tsunami can vary greatly, ranging from being barely noticeable to total destruction.

Tsunami waves can be described by their wavelength (measured in feet or miles), period (minutes or hours), speed (miles per hour), and height. Tsunamis may travel long distances, increasing in height abruptly when they reach shallow water, causing great devastation far away from the source. In deep water, a person on the surface may not realize that a tsunami is forming while the wave increases to great heights as it approaches the coastline. Tsunamis are not preventable, nor predictable, but there are warning signs. Any of the following events may signal an approaching tsunami:

- A recent submarine earthquake.
- The sea appears to be boiling, as large quantities of gas rise to the surface of the water.
- The water is hot, smells of rotten eggs, or stings the skin.
- There is an audible thunder or booming sound followed by a roaring or whistling sound.
- The water may recede a great distance from the coast.
- Red light might be visible near the horizon and, as the wave approaches, the top of the wave may glow red.

There are systems available and others being developed to provide alerts about impending tsunamis. Tsunami warning systems can detect tsunamis when the wave is still at sea. Some systems advise residents where to evacuate to avoid an incoming tsunami. One of the earliest warnings comes from animals, which run to higher ground before the water arrives. Other mitigating actions include building high walls in front of populated coastal areas or redirecting the incoming water via floodgates and channels. However, the effectiveness of these strategies can be limited, as tsunamis can be higher than these barriers.
Risk of Morbidity and Mortality

In the immediate aftermath of a tsunami, the first health interventions are to rescue survivors and provide medical care for any injuries. For people caught in the waves, the force of the water pushes people into debris, resulting in the broadest range of injuries, such as broken limbs and head injuries. Most deaths from tsunamis are related to drowning.

The floods that accompany a tsunami result in potential health risks from contaminated water and food supplies. Loss of shelter leaves people vulnerable to exposure to insects, heat, and other environmental hazards. Further, the lack of medical care may result in exacerbations of chronic disease. Tsunamis have long-lasting effects and recovery necessitates long-term surveillance of infectious and water- or insect-transmitted diseases, an infusion of medical supplies and medical personnel, and the provision of mental health and social support services.

Potential waterborne diseases that follow tsunamis include cholera; diarrheal or fecal-oral diseases, such as amebiasis, cryptosporidiosis, cyclosporiasis, giardiasis, hepatitis A and E, leptospirosis, parasitic infections, rotavirus, shigellosis, and typhoid fever; animal- or mosquito-borne illness, such as plague, rabies, malaria, Japanese encephalitis, and dengue fever (and the potentially fatal complication dengue hemorrhagic shock syndrome); and wound-associated infections and diseases, such as tetanus. Mental health concerns are another consequence of tsunami events.

WINTER/ICE STORMS

A major winter storm can be lethal. Winter storms bring ice, snow, cold temperatures, and often dangerous driving conditions. Even small amounts of snow and ice can cause severe problems for southern states where storms are infrequent (see Figure 17.5).

Nurses need to be familiar with winter storm warning messages, such as wind chill, winter storm watch, winter storm warning, and blizzard warning. Wind chill is a calculation of how cold it feels outside when the effects of temperature and wind speed are combined. On November 1, 2001, the National Weather Service implemented a replacement wind chill temperature index for the 2001/2002 winter season. The reason for the change was to improve on the existing index, which was based on the 1945 Siple and Passel Index. A new scale has been developed by the National Weather Service to classify snowstorms, similar to the Fujita and Saffir-Simpson scales that characterize tornados and hurricanes respectively. The Northeast Snowfall Impact Scale (NESIS) characterizes and ranks high-impact Northeast snowstorms whose accumulations of snowfall total 10 inches or more. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it is interested in providing an indication of a storm’s societal impacts, such as transportation, by assessing population data in addition to meteorological measurements. Snowstorms are tracked by the National Oceanic Atmospheric Administration’s National Weather Service.

Risk of Morbidity and Mortality

Transportation accidents are the leading cause of death during winter storms. Preparing vehicles for the winter season and knowing how to react if stranded or lost on the road are the keys to safe winter driving. Morbidity and mortality associated with winter storms include frostbite and hypothermia, carbon monoxide poisoning, blunt trauma from falling objects, penetrating trauma from the use of mechanical snow blowers, and cardiovascular events usually associated with snow removal. Frostbite is a severe reaction to cold exposure that can permanently damage its victims. A loss of feeling and a light or pale appearance in fingers, toes, nose, or earlobes are symptoms of frostbite. Hypothermia is a condition brought on when the body temperature drops.
to less than 90 °F. Symptoms of hypothermia include uncontrollable shivering, slow speech, memory lapses, frequent stumbling, drowsiness, and exhaustion.

Water has a unique property in that it expands as it freezes. This expansion puts tremendous pressure on whatever is containing it, including metal or plastic pipes. No matter the strength of a container, expanding water can cause pipes to break causing flooding. Flooding creates a risk for drowning and electrocution. Pipes that freeze most frequently are those that are exposed to severe cold, like outdoor hose bibs, swimming pool supply lines, water sprinkler lines, and water supply pipes in unheated interior areas like basements and crawl spaces, attics, garages, or kitchen cabinets. Also, pipes that run against exterior walls that have little or no insulation are subject to freezing. Pipe freezing is a particular problem in warmer climates where pipes often run through uninsulated or underinsulated attics or crawl spaces.

Prevention/Mitigation

Investing in preventive mitigation steps such as home winterization activities (insulating pipes, installing storm windows) will help reduce the impact of winter storms in the future. Winter storm preparation activities should include the following:

- Collecting winter clothing and supplies such as extra blankets, warm coats and clothes, water-resistant boots, hats, and mittens.
- Assembling a disaster supplies kit containing a first aid kit, battery powered weather radio, flashlight, and extra batteries.
- Stocking canned food, a nonelectric can opener, and bottled water.
- Winterizing vehicles, keeping gas tanks full, and assembling a disaster supply car kit.
- Ensuring an adequate supply of any medications needed during and immediately following the storm.

WILDFIRES

More and more people are making their homes in woodland settings in or near forests, rural areas, or remote mountain sites. As residential areas expand into relatively untouched wildlands, people living in these communities are increasingly threatened by forest fires. Protecting structures from fire in the wildland poses special problems, often stretching firefighting resources to the limit. Wildfires often begin unnoticed and spread quickly by igniting brush, trees, and homes (see Figure 17.6).

There are three different classes of wildfires. A surface fire, the most common type, burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire is usually started by lightning and burns on or below the forest floor in the humus layer down to the mineral soil. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. Depending on prevailing winds and the amount of water in the environment, wildfires can quickly spread out of control causing extensive damage to personal property and human life. If heavy rains follow a fire, other natural disasters can occur, including landslides, mudflows, and floods. Once ground cover has been burned away, little is left to hold soil in place on steep slopes and hillsides. A major wildfire can leave a large amount of scorched and barren land. These areas may not return to pre-fire conditions for decades. Danger zones include all wooded, brushy, and grassy areas—especially those in Kansas, Mississippi, Louisiana, Georgia, Florida, the Carolinas, Tennessee, California, Massachusetts, and...
Risk of Morbidity and Mortality

Morbidity and mortality associated with wildfires include burns, inhalation injuries, respiratory complications, and stress-related cardiovascular events (exhaustion and myocardial infarction while fighting or fleeing the fire).

Prevention/Mitigation

More than four out of every five wildfires are started by people. Negligent human behavior, such as smoking in forested areas or improperly extinguishing campfires, is the cause of many forest fires. Another cause of forest fires is lightning. Prevention efforts include encouraging people to do the following:

- Build fires away from nearby trees or bushes. Ash and cinders lighter than air float and may be blown into areas with heavy fuel load, starting wildfires.
- Be prepared to extinguish the fire quickly and completely. If the fire becomes threatening, someone will need to extinguish it immediately.
- Never leave a fire—even a cigarette—burning unattended. Fire can quickly spread out of control.
- Find out whether the area where people live is at risk for wildfire and develop a family wildfire evacuation plan (FEMA, 2006c).

SUMMARY

Natural and environmental disasters result in significant losses, physical destruction of dwellings, social and economic disruption, human pain and suffering, and significant injury and loss of life. Disaster preparedness activities including prevention efforts and advance warning systems specific to each type of disaster can reduce or mitigate these effects. Nurses should be familiar with the types and consequences of frequently occurring natural disasters, in order to contribute to public health efforts to prevent, mitigate, and recover from these events. Nurses need to be familiar with commonly used definitions for severe weather watches and storm warnings. Case studies of previous naturally occurring disasters can be used to predict future needs. Scientifically valid information enables health care providers and emergency management officials to prioritize resources and make decisions about responding to natural disasters.

ACKNOWLEDGMENTS

Incorporated into this chapter are selected paragraphs from chapter 1 from Public Health Management of Disasters: The Practice Guide, 2nd ed. (pp. 1–16), by L. Y. Landesman, 2005, Washington, DC: The American Public Health Association. The editor gratefully acknowledges Dr. Linda Landesman and the American Public Health Association for permission to reprint portions of her previous work.

STUDY QUESTIONS

1. Is the risk of a major natural disaster occurring in the United States increasing or decreasing? Defend your position.
2. Catastrophic natural disasters bear little resemblance to the multicasualty incidents that make up most disaster experience in the United States. Catastrophes may injure tens of thousands and spread across hundreds of miles. Describe the impact in terms of severity of damage of one type of major natural disaster. Describe the health implications for the affected population.
3. Compare and contrast a drought disaster versus a flood disaster in terms of the health consequences on the affected population and its impact on the health care system.
4. Explain the meteorological relationship between thunderstorms and tornadoes. Design a public health education campaign to reduce morbidity and mortality associated with severe thunderstorms and tornadoes.
5. Compare and contrast the adverse health outcomes resulting from extreme heat and winter/ice storms.
6. California has a large geographic area and concentrated population centers, and, despite its attractiveness, is subject to a variety of natural challenges. Describe the natural disaster events most likely to affect this state and identify any advance warning systems that might help reduce morbidity and mortality.

INTERNET ACTIVITIES

For additional Internet information, review Appendix A. (1) http://www.nhc.noaa.gov/

This is the Web site for the National Weather Service’s National Hurricane Center. What tropical
natural and environmental disasters

storms are currently active in the Atlantic and Caribbean? In the Eastern Pacific? Where would you locate the sea surface temperature analysis charts? What do scientists use these measurements to predict? Why is prediction of this storm important? Write an essay describing the health implications of hurricanes and describe strategies for mitigating these consequences.

(2) http://www.fema.gov/
This is the Web site for the Federal Emergency Management Agency. FEMA is charged with monitoring all types of natural/environmental disaster activity in the United States. You are the nurse assigned the task of compiling a notebook of factual information regarding “Protection Against Natural Disasters” to give to families in your community. Compile a list of fact sheets and information for all potential hazards for the community where you live:

a. Stamford, Connecticut
b. Southport, North Carolina
c. Watertown, New York
d. San Antonio, Texas
e. San Francisco, California
f. Santa Fe, New Mexico

(3) http://www.americanredcross.org
The American Red Cross Web site provides disaster preparedness and management advice for all types of naturally occurring disasters. What types of activities should nurses encourage people to do to prevent and mitigate the consequences of wildfires? What type of natural disasters are you and your family at risk for? Visit the American Red Cross Web site. Develop a personal family disaster preparedness plan based on what you find. Review it with each member of your family.

You are working as an emergency manager for your county health department. Prepare a report documenting any and all current national situations for today’s date. Compile a list of all state offices and emergency management agencies for the state that you live in. How would you locate current disease prevalence information for your community?

(5) http://www.nws.noaa.gov/
This is the Web site for the National Weather Service. Locate the 5-day forecast for your region.

REFERENCES
CASE STUDY

17.1 Deaths Associated With Hurricane George, Puerto Rico, September 1998

On the evening of September 21, 1998, Hurricane George struck Puerto Rico with estimated maximum winds of 115 mph (Category 3). It made multiple landfalls throughout the Caribbean, including Antigua, the U.S. Virgin Islands, Hispaniola, and Cuba. On September 25, Hurricane George struck the U.S. mainland near Key West, Florida, and made final landfall on September 27 in Biloxi, Mississippi, as a Category 2 hurricane. All 78 civil divisions in Puerto Rico reported damage to homes, and 416 government-run shelters were housing approximately 28,000 persons. Approximately 700,000 persons were without water, and 1 million had no electricity.

The medical examiner at the Institute of Forensic Sciences provided information about the number and causes of deaths associated with Hurricane George, as well as the following case reports:

Cases 1–2. On September 23, a 28-year-old woman from Ponce died inside her home from carbon monoxide (CO) poisoning. A gasoline-powered electric generator had been operating inside the home while she was sleeping. Two other family members were hospitalized because of CO poisoning. On September 24, a 46-year-old man from Bayamon was found dead from CO poisoning inside his family store. He had been cleaning the store the night after the hurricane, and a gasoline-powered electric generator was operating outside near an opening where fumes could enter the structure.

Cases 3–6. On September 25, a 27-year-old woman from Caguas and her three children (ages 4, 6, and 7 years) died in a fire in their home. They were using candles to light the home. The mother apparently was asleep when the house caught fire.

Case 7. On September 25, a 66-year-old man from Utuado died as a result of head trauma sustained on September 22. He was removing water that had entered his home during the hurricane when he fell and struck the back of his head.

Case 8. On September 28, a 49-year-old man in San Juan was electrocuted while repairing a cable damaged by the storm. He was an employee of the electrical company.

Lessons learned: Mortality surveillance and investigation of deaths indicate that all deaths occurred during the postimpact phase. Because improvements in hurricane warning systems have greatly decreased deaths during the impact phase of such storms in many areas, additional intervention efforts should focus on adverse health events in a storm’s aftermath, such as those associated with storm damage and cleanup. The two deaths caused by CO poisoning from generators illustrate the growing importance of this toxicant as a cause of morbidity and mortality in postdisaster situations. Public health authorities should emphasize worker safety during cleanup and power restoration activities and the hazards of open flames in homes. In addition, to reduce the risk for CO poisoning, persons should be warned to place generators outside and away from homes and discouraged from operating gasoline-powered items in enclosed areas.

CASE STUDY

17.2 Emergency Mosquito Control Associated With Hurricane Andrew, Florida and Louisiana, 1992

Hurricane Andrew crossed south Florida on August 24, 1992, entered the Gulf of Mexico, and struck the Louisiana coast on August 26. In Florida, an estimated 25,000 housing units were destroyed and 37,000 severely damaged in a 200,000-acre area in the southern portion of Dade County; in Louisiana, an estimated 25,000 housing units were destroyed or severely damaged by the storm, primarily in the coastal areas. Initial assessment of the disaster areas indicated a need for vector surveillance and control.

Persons residing in the affected areas or returning after the initial evacuation were exposed to high densities of mosquitoes (e.g., because of damage to door and window screens and lack of electricity to run air conditioners). In addition to being a nuisance that hampered recovery efforts (e.g., repair and reconstruction crews were unable to work during early morning and late afternoon/early evening hours), this exposure increased the potential for mosquito-transmitted diseases among recovery workers and displaced residents, and secondary bacterial infections of mosquito bites among children were reported.

The presence of competent mosquito vectors (Ae. aegypti and Anopheles quadrimaculatus) and of recent immigrants from the Caribbean Islands and Latin America raised the possibility of dengue and malaria transmission in Florida. Because mosquito-based surveillance for St. Louis encephalitis (SLE) is unable to detect these diseases, fliers with information on identification and reporting of dengue and malaria were distributed to health care workers in the area. No dengue or malaria cases were reported to the Florida Department of Health and Rehabilitative Services.

Lessons learned: Increased human exposure to mosquitoes in the Florida disaster area occurred primarily because of the extensive damage to housing, and mosquito densities that were tolerable before the storm were unacceptable when human exposure increased. In Louisiana, storm-associated rainfall substantially increased nuisance mosquito populations, and displaced persons were exposed to higher than usual mosquito densities.

Federal assistance for emergency vector surveillance and control is available when a disaster is declared and when one or more of the following conditions are met:

- Transmission of human or animal disease is in progress or is deemed imminent.
- Reconstruction efforts are substantially hampered by large populations of nuisance species.
- Normal functioning of communities in the disaster area is substantially disrupted.
- The large nuisance populations place additional stress on the human population.

Mosquito-transmitted pathogens were not detected in either disaster area, and emergency mosquito control was primarily intended to provide relief from high mosquito densities that hampered recovery efforts. Surveillance after control measures were implemented indicated that mosquito populations had decreased markedly.

Emerging Infectious Diseases: Coccidioidomycosis Following the Northridge Earthquake, California, 1994

From January 24 through March 15, 1994, 170 persons with laboratory evidence of acute coccidioidomycosis were identified in Ventura County, California. This number substantially exceeds the total number of coccidioidomycosis cases (52) reported through routine passive surveillance in 1993 in Ventura County—considered an area of low incidence for this disease. The increase in cases follows the January 17 earthquake centered in Northridge (in adjacent Los Angeles County), which may have exposed Ventura County residents to increased levels of airborne dust.

Coccidioides immitis is a dimorphic fungus that grows in soil in much of the southwestern United States; infection results from inhalation of airborne C. immitis arthroconidia. Coccidioidomycosis is not transmitted from person to person. Approximately 60% of infected persons are asymptomatic; the remainder can develop a spectrum of disease from mild influenza-like illness to pneumonia to disseminated disease, including meningitis. Because the incubation period for this infection ranges from 1 to 4 weeks, persons who may have become infected while visiting areas where coccidioidomycosis is endemic may not become ill until after they return home, and the diagnosis may not be readily considered by clinicians.

Lessons learned: Exposure to C. immitis may have occurred among residents of and travelers to Ventura County, Los Angeles County, or other counties in or near the San Joaquin Valley following the earthquake and its aftershocks and during cleanup activities. Following earthquakes where C. immitis occurs, health advisories should be developed and broadcast, using the Health Alert Network, to health departments across the United States. These advisories should advise health professionals to be aware of potential exposure in persons who recently traveled to the impacted area.


Heat Wave-Related Mortality, Milwaukee, Wisconsin, July 1995

During July 12–15, 1995, a heat wave occurred in major portions of the midwestern and eastern United States. Record high temperatures were recorded at approximately 70 locations, ranging from the central and northern Great Plains to the Atlantic coast and caused substantial numbers of heat-related illnesses and deaths in some locations. In Milwaukee, Wisconsin (1994 estimated population: 938,112), maximum daily temperatures ranged from 91°F (32.7°C) to 103°F (39.5°C), and average daily humidity was as high as 70%.

During July 13–23, the Milwaukee Medical Examiner’s Office (MCMEO) received reports of and investigated 197 deaths. Of these, 91 (46%) were determined to be related to the heat wave. Deaths were considered heat related if (a) the decedent’s measured body temperature at the time of death was greater than or equal to 105°F (40.4°C) or (b) there was evidence of high environmental temperature—usually greater than or equal to 100°F (37.7°C)—at the scene of death. Hyperthermia or excessive heat was cited as
the underlying or direct cause for 34 (37%) of these 91 deaths and as an important contributing cause for 57 (63%).

Case 1. On July 13, 1995, a 7-month-old girl was brought to an emergency department because of respiratory arrest but could not be resuscitated. The cause of death was listed by MCMEO as bronchopulmonary dysplasia associated with environmental hyperthermia. She had been receiving home nursing care for congenital respiratory impairment. A window air conditioner was being installed at the time of her death.

Case 2. On July 14, 1995, an 82-year-old woman was found dead in her two-story home. A neighbor reported that the decedent had had no health complaints the previous evening. Family members reported that the decedent had used a fan but kept all doors and windows closed because of safety concerns; the wall thermostat registered greater than 90°F (32.2°C) on the day before death. The immediate cause of death was listed by MCMEO as arteriosclerotic heart disease, with elevated environmental temperature as an important contributing factor.

Case 3. On July 15, 1995, a 24-year-old man with a history of schizophrenia, acute depression, and psychotropic drug use was found dead in the living room of his family residence. He had last been seen returning from a store on the previous day by a neighbor. The immediate cause of death was listed by MCMEO as environmenal hyperthermia, with use of psychotropic medications as an important contributing factor.

Case 4. On July 17, 1995, a 79-year-old woman was found dead in her home. She had last been seen returning from a store on the previous day by a neighbor. The immediate cause of death was listed by MCMEO as arteriosclerotic heart disease, with elevated environmental temperature as an important contributing factor.

Lessons learned: During heatwaves, mortality may be reduced by the broadcasting of health education messages about reducing the impacts of heat exposure and identifying those most at risk.


CASE STUDY

A Nor’easter, December 1992

During December 10–13, 1992, a severe weather system of snow, sleet, rain, and high winds struck Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, and West Virginia. The highest recorded winds from this winter storm, called a nor’easter, were 80 miles per hour (mph) gusts at Cape May, New Jersey, with sustained winds of 20 to 30 mph. The tidal surge was 1 to 4 feet above normal, and wave heights were 20 to 25 feet near the shore. The 24-hour snowfall was 27 inches in the hills west of Boston. Flooding was recorded at 4 to 5 feet in both Boston and New York City. In the Berkshire Mountains in western Massachusetts, 4 feet of snow fell, with drifts as high as 10 feet.

To assess mortality associated with this storm, CDC officials contacted offices of the Medical Examiner (ME) in Connecticut, Delaware, Maryland, Massachusetts, New Jersey, and Rhode Island; Suffolk, Westchester, and Nassau counties in New York; New York City; and Philadelphia County, Pennsylvania. MEs in this region attributed three deaths on December 11 and one on December 13 to the nor’easter. In Hudson County, New Jersey, a 38-year-old woman died from multiple blunt force injuries; she had been walking on a sidewalk when the roof of an apartment building blew off during high winds and crushed her. In Westchester County, New York, a 73-year-old man drowned on the premises of a country club in Mamaroneck (northeast of New York City on Long Island Sound) when, because of high winds, he lost his grip while holding on to a tree to escape rising flood waters. In Connecticut, a 40-year-old man drowned in the incoming tide. On December 13, a young female died in Rhode Island as a result of a snowstorm, additional details about this death are unavailable.

Lessons learned: Although the findings of mortality surveillance suggest that the public health impact of this storm was minimal, the media reported considerably
more deaths than did the MEs. The discrepancy may be due, in part, to the lack of a widely accepted definition of weather-related deaths. Some ME/Cs define weather-related deaths as those resulting from environmental forces such as wind and rising water. However, other ME/Cs include deaths from circumstances such as motor vehicle collisions and stress-induced cardiovascular events in their definition of weather-related deaths. A standard definition for weather-related morbidity and mortality would assist health officials in assessing the public health impact associated with severe weather systems and other natural disasters.


CASE STUDY

17.6 Community Needs Assessment Following an Ice Storm, Maine, January 1998

On January 7, 1998, an ice storm struck the northeastern United States and southeastern Canada. In Maine, 3 consecutive days of rain combined with ground temperatures consistently below freezing resulted in heavy accumulations of ice on trees and electric power lines. Falling trees and branches and breaking utility poles resulted in the loss of electrical power to an estimated 600,000 persons. Although the rain had stopped by January 11, temperatures declined to less than 10 °F (−12 °C) over most of the state, exacerbating the danger. On January 16, an estimated 50,000 households, primarily in the interior portion of the state, remained without power.

The Maine Bureau of Health (MBH) and the CDC developed a community needs survey to assess the continuing needs of and potential health hazards to residents of the state who remained without power. On January 17, residents from 111 households were interviewed. Electrical power had been restored to 75 (68%) of these households, 20 (18%) were using gasoline-powered generators to supply electricity, and 16 (14%) had no source of electricity. In all households, drinking water was available from municipal service, private wells, or water distribution points. All but one of the 111 households had water to flush toilets and access to transportation. Telephone service remained unrestored in 14 (13%) homes. Residents were listening to a radio or television in 103 (93%) households and, therefore, had access to public service broadcasts.

Potentially hazardous sources of CO were present in many homes. Among the 36 households without re-stored electrical power, 8 used a propane heater, and 5 used a kerosene heater. Where a gasoline generator was used for electricity, 4 households placed it in an open porch or garage and 3 households placed it in an enclosed porch or garage.

To determine the early health impact of the ice storm, Emergency Departments (EDs) that were in the region of the state most heavily affected by the storm were surveyed. Three EDs treated 1,758 patients during the reference period and 2,586 during the poststorm period, a 47% increase. Presumptive CO poisonings increased from zero to 101 cases. Most of the injury categories showed increases, including cold exposure (0%–0.3%) and burns (0.4%–0.7%). Visits for lower respiratory tract disease (6.3%–7.4%), and cardiac complaints (4.2%–4.6%) were also proportionally higher during the poststorm period.

Lessons learned: CO exposures and poisonings were the most dramatic health concerns in the early aftermath of the ice storm. CO toxicity has been documented as a health concern following winter storms, especially during power outages. Many of the same mechanisms observed in previous outbreaks of CO poisoning (e.g., improper use of gasoline generators and fuel-powered heaters) may have played a role in Maine.

CASE STUDY 17.7 Tornado Disaster, Kansas, 1991

On April 26, 1991, 54 tornadoes swept across six midwestern states, causing 24 deaths and more than 200 injuries, requiring disaster relief services for more than 8,000 persons and causing property damage of more than $250 million. In Kansas, one tornado, with wind speeds exceeding 260 mph, caused 17 deaths. The 46-mile path of the tornado led through Andover, Kansas (Butler County; population: 4,300), where the town’s only outdoor warning siren failed. A mobile-home park (MHP) in Andover with 244 homes and one community storm shelter was struck by the tornado, resulting in the destruction of 205 (84%) of these homes. Telephone interviews were conducted with one adult from each MHP household that was destroyed. Data were obtained from relatives or neighbors for households in which no one survived. Information collected included length of warning, evacuation and shelter behavior, types of injury, and causes of death.

In the 45 minutes before the tornado reached the MHP, 146 persons (44%) fled the MHP. Among the 187 (56%) persons remaining, 149 (80%) were in the community shelter and 38 (20%) were not home when the tornado struck. No deaths or serious injuries (i.e., injuries requiring hospitalization) occurred among persons who fled the MHP or among persons who reached the community storm shelter. Among the 38 unsheltered persons, 11 (29%) were killed, 17 (45%) were hospitalized, and 9 (24%) sustained minor injuries.

Remaining unsheltered in the MHP was the prominent risk factor for injury or death and was associated with both delayed warning and advanced age. Persons receiving less than 5 minutes of warning time were more likely to remain unsheltered than were those with greater than or equal to 5 minutes of warning. Persons 60 years old or more were more likely to remain unsheltered than were those less than 60 years old. Because the tornado struck the MHP during daylight, many residents were able to see the funnel for as long as 14 minutes before impact.

Lessons learned: Adequate warning and proper sheltering are critical factors in preventing tornado injuries and deaths. The postdisaster investigation demonstrates that the use of a community storm shelter by a MHP population can prevent injuries and deaths during a tornado. Recommendations include (a) providing community shelters that are accessible and of sufficient size and number to accommodate all residents; (b) making special provisions for the elderly who may have disabilities that impair their ability to access shelter and/or comprehend storm warnings; and (c) ensuring that tornado warning systems do not rely on a single mechanism to assure prompt and specific notification of potential danger.


CASE STUDY 17.8 West Nile Virus

West Nile (WN) virus has emerged in recent years in temperate regions of Europe and North America, presenting a threat to public, equine, and other animal health. The most serious manifestation of WN virus infection is fatal encephalitis (inflammation of the brain) in humans and horses, as well as mortality in certain domestic and wild birds.

West Nile virus was first isolated from a febrile adult woman in the West Nile District of Uganda in 1937. The virus became recognized as a cause of severe human
meningoencephalitis (inflammation of the spinal cord and brain) in elderly patients during an outbreak in Israel in 1957. Equine disease was first noted in Egypt and France in the early 1960s. The first appearance of WN virus in North America was in 1999, with encephalitis reported in humans and horses, and the subsequent spread in the United States may be an important milestone in the evolving history of this virus.

Geographic distribution of West Nile virus has been described in Africa, Europe, the Middle East, west and central Asia, and most recently, North America. Recent outbreaks of WN virus encephalitis in humans have occurred in Algeria in 1994, Romania in 1996–1997, the Czech Republic in 1997, the Democratic Republic of Congo in 1998, Russia in 1999, the United States in 1999–2001, and Israel in 2000. As of August 21, 2002, there have been 270 total human cases of WN virus illness reported and confirmed, including 13 fatalities.

Lessons learned: Health professionals across the United States need to develop strategies to reduce mosquito populations, to prevent mosquito exposures, and to utilize surveillance and reporting systems to recognize the disease in its early stages of manifestation in a community.


CASE STUDY

17.9 Ice Storm 2003 Lessons Learned

Angela J. Hodge and Mary Kate Dilts Skagg

It was just a normal winter storm on a Sunday morning, or so we all thought at the time. As staff began arriving telling stories of slipping and sliding, the night shift was anxiously waiting to give their report and begin their own trips home. The ED staff had thoughts of a light day, whereas the nursing units hoped enough staff would make it in to care for their patient load. Maintenance was calculating how much outside work would need to be done, whereas housekeeping was worrying how to keep the floors safe from falls. Just another snow day in Portsmouth, Ohio, or so we thought.

As the temperature continued to drop, the snow turned to icy rain and snow. The sheriff issued a Level 1 snow emergency restricting roads to emergency traffic only. The grocery stores were emptied out, the gas station lines were long, and the communities of Scioto County prepared for a winter storm.

The first inklings we had that things would not be as we thought came as the Emergency Medical Service (EMS) started telling the Emergency Department staff about worsening road conditions. Family members began calling to tell us how the ice was coating everything: trees, roofs, cars. Staff began asking for low census to go home early.

The Nursing Shift Manager began problem solving staffing issues. Each department and unit began to handle their individual problems as they arose. Sometimes they remembered to tell the Nursing Shift Manager, sometimes they did not.

Southern Ohio Medical Center (SOMC) had developed broad generalized emergency response plans by a small group of ED employees and nursing shift managers, but at the time of the ice storm, it still was mostly putting out fires as they occurred. The decisions were made by a small group of managers who spend many tiring hours managing this event.

Over the next several days, the community and the hospital had to endure worsening conditions. Freezing rain continued, the ice coating caused trees to fall, most of the community had disruptions in their electricity, water, and phone service. Many of SOMC staff were not able to report to work because of road conditions, fallen trees, or lack of utilities. The 200-foot tower that held the communication equipment for the county’s emergency responders (fire, sheriff, and EMS) fell because of the heaviness of the ice coating, leaving ambulance dispatching out of service.

SOMC had intermittent power interruptions and was on emergency power. At one point, a power line coated with ice snapped, landing on staff cars in the
hospital parking lot, resulting in a fire. The SOMC switchboard was overwhelmed with calls from the community looking for help. Extended care facilities were without power. Home oxygen-dependent and aerosol respiratory patients were without power. The ED was overwhelmed with special needs individuals who did not have electricity to supply their needs. The Emergency Management Agency (EMA), EMS, and fire services were overwhelmed with calls.

SOMC had a loss of water, thus a loss in medical gases, and surgeries were canceled. A Code White at SOMC was called, which meant that no employee could leave their shift unless relieved by another staff member. On Monday morning, the CEO of the hospital called together the executive staff and some of the department directors. Based on the utilities and staffing, decisions were made; for example, the Cancer Center and Urgent Care facilities were closed. This group met twice per day for the next 3 to 4 days.

In retrospect, this was Incident Command and a modified Hospital Emergency Incident Command System (HEICS), as we would learn in the future. With the Code White in effect, many staff stayed on duty. This left many of the hospital staff without money, clothing, or medications. Some of the hospital staff worked double shifts, tried to sleep a few hours in closed departments or education classrooms, showered, and returned to work. Some staff traveled between home and work daily depending on how far they lived from the hospital. Water and electricity were the daily topic of conversation.

EMA opened their office, but unfortunately only the Director and one other volunteer had been able to make it in. Radio communications were down and each township was trying to run independent emergency operations.

Thus ended the second day of the great ice storm, and more icy rain came down.

Southern Ohio Medical Center is a 222-bed community hospital that serves seven counties in Ohio and Kentucky. SOMC has 2,200 employees, 140 physicians, and 800 volunteers who lived in the community. There are no other medical facilities within a 1-hour radius.

The hospital became a safe haven for extended facility patients and home-bound patients that needed electricity for their care. Units that normally did not care for admitted patients became patient care areas such as the Cardiac Cath Lab and Same Day Surgery areas. SOMC opened their banquet facility as a respite area for staff and their families for sleeping and personal care. Electricity was restored at this location so staff could sleep or take a shower.

Fire and EMS services became the community life line making well care checks for families who had been stranded, providing aerosol treatments for respiratory patients, while attempting to meet their community's medical and safety needs. Township offices, schools, and other public buildings were opened for shelter. Unfortunately, it was difficult to get Ohio EMA and regional Red Cross to understand that the ice storm had done major damage to southern Ohio when the entire state had been affected.

The only communication to the community came through the local radio stations, which was not always accurate. There was no coordination of communication between emergency response agencies. This had been the largest and longest event since the advent of our EMA planning.

On the third day, water was restored to most hospital departments and surgery was reopened. Road conditions remained hazardous. Pharmacy made arrangements to get medications to staff who had remained on duty during the Code White. Arrangements were made for the dietary department to feed the staff. But the good news was it had stopped snowing, and the AEP electric repair trucks had begun to arrive.

Administration began having formal meetings and planning sessions. Recovery continued. The community began to dig itself out of the snow and ice. EMA developed a communication plan and more accurate information was released by the local media. Extended care facilities reopened, and special needs patients were able to go home safely.

It took 3 weeks for electricity to be restored to our entire community. Many lessons were learned, not only by our hospital, but by the community as well. As a community, we now have a redundant communication process, we have developed a Joint Communication Center, we have updated the Emergency Response Plan to emphasize coordination between agencies, and we have developed a Citizen Corp organization for better emergency planning.

Two weeks after the event, 30 managers and front line staff met to discuss events, provide documentation of activities, and develop action plans for the future. The event was handled like any other event that had happened in the past; problem solving as problems arose, a strong leader took control, and a small group of individuals managed the event until the end and were exhausted. The normal operating methods and crisis management had worked in the past and did work this time, but it was decided there had to be a more efficient method. For example, not all managers had a database of addresses and phone numbers to contact employees by phone or were aware of what part of the county the employee might reside in.

Over the next year SOMC began updating their response to all emergencies. SOMC has adopted an incident command system. Hospital Emergency Incident Command System (HEICS) was developed based on the fire services command system. HEICS divides the work of an emergency event into manageable parts. These
manageable parts are assigned to a chief, director, or leader, and it provides for real-time documentation of the event. The work is managed by objectives and goals developed in strategy meetings. Because HEICS is a position-driven system, the work can be started by one individual and completed by another, thus preventing the fatigue experienced in previous events. HEICS was woven into all emergency response plans.

Our emergency plans were revamped. SOMC realized that all departments had not been considered when the previous plans were developed, and parts of the plan were ineffective. A multidisciplinary team met monthly for 1 year to revise all the emergency plans. This team consisted of a variety of staff including nursing, maintenance, housekeeping, laundry, physician offices, management, and front-line staff. These updated plans have worked well both in drills and real events.

So what did we learn as a health care facility and a community? To summarize—prepare, practice, adapt, and never enough communication.

To prepare, look at your hazard vulnerabilities, look through worst case scenario eyes, and look at your emergency plans. Ask what liabilities do you have in the community you serve and what assets are available. Think about your staff and their need to care for their families. Do your plans address families? Think about an incident management system and what is necessary for prolonged events. Look at your plans—do they address your entire organization?

Practice your plans; drill plausible scenarios. Take the fear out of drills by developing a culture of a good drill is when things go wrong. When things go wrong in a drill, the problem can be fixed. If it happens during a real event, there could be disastrous results. Make sure everyone understands their Incident Command System and emergency plans.

During drills everyone needs to play, from medical records to CFOs. All staff should evaluate the drills and actions needed to be taken based on these evaluations. Organizations need to take part in planning and participate in community and regional drills.

Adaptability must be used in handling an emergency event. Organizations need to provide the flexibility for staff to use good judgment and critical thinking skills to make decisions in a constantly changing environment during an actual event. Organizations must support the decision makers even when things do not go as expected (hindsight is 20/20). An environment that allows for staff involvement is a must.

Communication is the key to success, but is one of the first problems encountered during an event. Make sure there is plenty of redundancy in your communication plans. Develop plans for interagency communications. One last word of wisdom: Get involved—no one is protected—it could happen to you!

Thanks to the Southern Ohio Medical Center staff and leadership, Scioto County EMA, EMS, and Fire Services. With your dedication, no loss of life was experienced, just a lot of cold and inconvenience.
Key Messages

■ An environmental emergency is a sudden threat to the public health or the well-being of the environment, arising from the release or potential release of oil, radioactive materials, or hazardous chemicals into the air, land, or water.

■ An environmental disaster is an environmental emergency whose scope and duration exceeds the local resources available to respond.

■ The health impact of an environmental disaster on a community may be immediate, ongoing, or delayed.

■ Collaboration with many types of government officials and community responders is critical to mitigating the damage that may occur from an environmental hazard.

■ Successful planning for potential environmental disasters/emergencies demands that nurses be knowledgeable of the environmental hazards endemic to the area, including the movement of hazardous substances through the area.

■ Working in conjunction with their public health colleagues and as members of an interdisciplinary disaster response team, nurses must be able to detect environmental changes that will create the potential for both immediate and long-term negative health outcomes.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the importance of a safe, stable environment as a foundation for good health.

2. Discuss examples of environmental hazards and their impact on communities.

3. Explain the purpose of environmental tracking systems in a community.

4. Identify the health outcomes associated with the most commonly occurring environmental emergencies/disasters.

5. Recognize the need for timely response and immediate removal of the environmental hazard.

6. Describe the role of the Occupational Safety and Health Administration (OSHA) and the Risk Management Program Rule with regard to chemical emergencies.

7. Identify strategies for the mitigation of environmental emergencies/disasters.
This chapter provides information on the health consequences associated with commonly occurring environmental disasters and emergencies. Nurses responding to the needs of populations and communities affected by environmental disasters and/or emergencies require an understanding of (a) the immediate health effects related to the event, (b) the potential for long-term health effects resulting from the event, and (c) the federal agencies designated to respond to the event. In situations involving environmental hazards, nurses will be called on to work as members of interdisciplinary response teams comprised of government officials, police, EMS, firemen, and the Coast Guard.

CHAPTER OVERVIEW

ENVIRONMENTAL EMERGENCIES

An environmental emergency is a sudden threat to the public health or to the well-being of the environment arising from the release or potential release of oil, radioactive materials, or hazardous chemicals into the air, land, or water. These emergencies may occur from transportation accidents, events at chemical facilities or other facilities using or manufacturing chemicals, or as a result of natural or man-made disaster events (Environmental Protection Agency [EPA], 2003b). Although there are many other serious environmental problems with which health officials are concerned, environmental emergencies and the activities that surround them are focused generally on sudden, immediate threats.

ENVIRONMENTAL DISASTERS

An environmental disaster is defined as an environmental emergency or ecologic disruption of a severity and magnitude resulting in deaths, injuries, illness, and/or property damage that cannot be effectively managed by the application of routine procedures or resources and that result in a need for additional assistance. The consequences of the damage to the environment will vary based on the type of hazard, the mechanism of its
release into the environment, the geographic location of
the event, the determinants of human exposure (such
as the weather conditions at the time of the event), and
the length of time until the response. Whether the event
is an acute one-time occurrence or a chronic, ongoing
mechanism of disruption will also be a major determi-
nant of the health consequences for the affected popu-
lation.

As with natural disasters, health promotion and dis-
ease prevention activities must focus on the following:

1. The immediate removal of the hazard from the en-
vironment (or if this is not possible, the movement
of the population away from the hazard).
2. Decontamination of exposed individuals.
3. The restoration of services to meet the immediate
physiological needs of the affected people.
4. The prevention of further illness or injury as a result
of exposure to the hazard.

Disasters of a chronic or long-term nature (such as in-
dustrial contamination of soil and water supply) are
more insidious and may be more difficult to address.
The health outcomes of these types of environmental
disasters may take years to manifest (e.g., certain can-
cers, endocrine disruption), and the scientific evidence
that they will occur is mounting (Colburn, Dumanoski,
& Myers, 1997).

ENVIRONMENTAL PUBLIC HEALTH
TRACKING: PROTECTING COMMUNITIES
THROUGH INTEGRATED ENVIRONMENTAL
PUBLIC HEALTH SURVEILLANCE

Environmental public health tracking is the ongoing col-
lection, integration, analysis, and interpretation of data
about the following factors:

- Environmental hazards.
- Exposure to environmental hazards.
- Health effects potentially related to exposure to envi-
ronmental hazards.

The goal of environmental public health tracking is to
protect communities by providing information to fed-
eral, state, and local agencies. These agencies, in turn,
will use this information to plan, apply, and evaluate
public health actions to prevent and control environ-
mentally related diseases (Centers for Disease Control
and Prevention [CDC], 2003b). Public health tracking
monitors known environmental hazards along with the
mechanism of action that may create the potential for
disaster. Some environmental hazards create the poten-
tial for a public health emergency because of regular
exposure—they are already present in the environment
the individual is living and working in (e.g., lead, radon,
asbestos). Other environmental hazards create the po-
tential for a disaster or emergency by being transferred
from one location to another. For example, it is the
movement or transportation of hazardous chemicals
and petroleum products that creates the potential for
exposure (e.g., oil spills).

ENVIRONMENTAL PROTECTION
AGENCY (EPA)

The U.S. Environmental Protection Agency is the lead
governmental agency responsible for monitoring the en-
vironment in the United States. The EPA’s mission is
to “protect human health and to safeguard the natu-
ral environment—air, water, and land—upon which life
depends” (EPA, 2003a). Protecting human health is an
integral part of the EPA’s mission. The EPA conducts
numerous research programs throughout the world that
study the effects of pollution on the human body. Re-
search efforts include studies on how pollution affects
children and people with asthma and other illnesses
and how water contaminants may affect swimmers
and beachgoers. Monitoring environmental quality also
plays an important role in protecting human health. The
EPA works with state and local agencies, as well as vol-
unteer and other citizens’ groups, to monitor air and
water quality and to reduce human exposure to con-
taminants in the air, land, and water.

The EPA provides leadership in the nation’s envi-
ronmental science, education, and assessment efforts
and works closely with other federal agencies, state and
local governments, and Indian tribes to develop and
enforce regulations under existing environmental laws.
The EPA is responsible for researching and setting na-
tional standards for a variety of environmental programs
and delegates to states and tribes responsibility for issu-
ing permits and monitoring and enforcing compliance.
Where national standards are not met, the EPA can is-
sue sanctions and take other steps to assist the states
and tribes in reaching the desired levels of environ-
mental quality. The EPA also works with industries and
all levels of government in a wide variety of voluntary
pollution prevention programs and energy conservation
efforts.

HURRICANE KATRINA: A NATURAL
DISASTER CREATES AN
ENVIRONMENTAL EMERGENCY

On August 29, 2005, Hurricane Katrina made landfall on
the Gulf Coast, leaving behind a trail of mass destruction
in Louisiana, Mississippi, and Alabama. In Louisiana and Mississippi, the storm created an estimated 86 million cubic yards of debris; caused the spill of more than 7 million gallons of oil, produced floodwaters that deposited fuel oils, gasoline, bacteria and metals in sediments; and passed over 18 Superfund National Priorities List (NPL) hazardous waste sites and more than 400 industrial facilities that store or manage hazardous materials. Because of flooding and hurricane storm surges, millions of hazardous products such as bleach, cleaners, oil, fuels, pesticides, herbicides, paint, and batteries were scattered into the environment. In Louisiana alone, the hurricane potentially affected approximately 850 underground storage tank facilities and more than 300,000 white goods (appliances such as refrigerators and air conditioners which may contain harmful substances such as Freon, EPA, 2006).

Under the National Response Plan, the EPA is the lead federal agency for ESF 10—Oil and Hazardous Materials. ESF 10 responsibilities include the following:

- Addressing threats from actual or potential releases including oil spills, sediment contamination, and hazardous materials.
- Managing hazardous household waste and other material releases that may pose a threat to public health or the environment, such as electronics or white goods.
- Managing, overseeing, and assisting in the segregation of hazardous debris and waste.

The EPA’s postimpact activities included collecting and responding to information on the nature, magnitude, and timing of the hazardous materials releases. EPA investigated and monitored sediment contamination following the recession of the floodwaters, contamination and release of Superfund sites and underground storage tank facilities, and multiple oil spills (Office of the Inspector General, 2006). Sediment samples (taken in September 2005 and February 2006) from the greater New Orleans area contained a variety of chemicals, including some metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and pesticides, some in levels unacceptable to the EPA.

**EXAMPLES OF ENVIRONMENTAL HAZARDS AND THEIR IMPACT**

**Chemical Spills**

The intentional release or accidental leakage or spill of certain chemical substances into the environment can have devastating consequences on human health. Nurses need to be aware of the environmental and safety hazards that exist in or near the communities in which they live and work. The Emergency Planning and Community Right-to-Know Act (EPCRA) was passed in response to concerns regarding the environmental and safety hazards posed by the storage and handling of toxic chemicals. These concerns were triggered by the disaster in Bhopal, India, in which more than 8,000 people suffered death or serious injury from the accidental release of methyl isocyanate. To reduce the likelihood of such a disaster in the United States, Congress imposed requirements on both states and regulated facilities.

EPCRA establishes requirements for federal, state, and local governments; Indian tribes; and industry regarding emergency planning and community right-to-know reporting on hazardous and toxic chemicals. The community right-to-know provisions help increase the public’s knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment. For information on the management of a chemical emergency and decontamination guidelines see chapters 8 and 26.

**Case Study: Bhopal**

The release of toxic gases at Union Carbide’s pesticide plant in Bhopal in 1984, the worst industrial disaster on record, killed 8,000 people and injured at least 150,000. Recent scientific investigations suggest that the victims of this environmental disaster are still suffering from its effects. A Greenpeace report published in 1999 found severe contamination of the factory site, surrounding land, and groundwater. Levels of mercury in some places were 6 million times higher than expected. Drinking water wells near the factory used by local people were heavily polluted with chemicals known to produce cancers and genetic defects (Greenpeace, 1999). The 2002 study by the Fact Finding Mission on Bhopal found lead, mercury, and organochlorines in the breast milk of nursing mothers (Agarwal & Nair, 2002).

The Bhopal disaster was a watershed in the area of environmental policy and legislation worldwide. Suddenly the horror of the industrial model of development became very stark and real. How and where industries were sited and how they dealt with the dangers that they posed to the communities around them became real questions. After the Love Canal saga (see the case study later in this chapter), Bhopal was the one incident that led to worldwide regulation on chemicals and toxicity. Intertwined with all the information was the fact that communities be given information and be included as participants in industry decision making.

Devastating chemical environmental disasters are not exclusive to developing countries. A 1990 EPA
analysis compared U.S. chemical incidents in the early to mid-1980s to the Bhopal incident. Of the 29 incidents considered, 17 U.S. incidents released sufficient volumes of chemicals with such toxicity that the potential consequences (depending on weather conditions and plant location) could have been more severe than in Bhopal. As a result of this, the Occupational Safety and Health Administration (OSHA) was asked to develop programs to prevent chemical incidents, and the U.S. Congress authorized the EPA to promulgate the Risk Management Program Rule (40 CFR 68) for protection of the public, and OSHA to promulgate the Process Safety Management Standard (29 CFR 1910.119) to protect workers. The amendments also established the independent U.S. Chemical Safety and Hazard Investigation Board.

Risk Management Program Rule (40 CFR 68)

When Congress passed the Clean Air Act Amendments of 1990, it required the EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program Rule that addresses these topics. The plans must be revised and resubmitted every 5 years (EPA, 2003e). The purpose of the RMP is to reduce chemical risk at the local level. This information helps local fire, police, and emergency response personnel (who must prepare for and respond to chemical accidents) and is useful to individuals in understanding the chemical hazards in communities. Ideally, making the RMPs available to the public stimulates communication between industry and the public to improve accident prevention and emergency response practices at the local level.

Oil Spills

Each year the United States uses over 250 billion gallons of petroleum oil products and millions more of nonpetroleum oils. With billions of gallons of oil being constantly transported and stored throughout the country and transported across the seas, the potential for oil spills is significant, and the effects of spilled oil can pose serious threats to the environment. The EPA works through its Spill Prevention, Control, and Countermeasures (SPCC) program, at several hundred thousand oil storage facilities to prevent the discharge of all kinds of oil into the waters of the United States. As the lead agency responsible for prevention planning and enforcement measures, the EPA leads local and industrial responses to oil spills through extensive contingency planning, emergency training, and experience in containment and cleanup. In an attempt to prevent oil spills from reaching our nation’s waters, the EPA requires that certain facilities develop and implement oil SPCC Plans. Unlike oil spill contingency plans that typically address spill cleanup measures after a spill has occurred, SPCC Plans are designed to ensure that facilities put in place containment and other countermeasures that would prevent oil spills that could reach navigable waters. A spill contingency plan is required as part of the SPCC Plan if a facility is unable to provide secondary containment, for example, berms surrounding the oil storage tank (EPA, 2003d).

Despite the nation’s best efforts to prevent spills, almost 14,000 oil spills are reported each year, mobilizing thousands of specially trained emergency response personnel and challenging the best-laid contingency plans. Although many spills are contained and cleaned up by the party responsible for the spill, some spills require assistance from local and state agencies and/or the federal government. Under the National Contingency Plan, the EPA is the lead federal response agency for oil spills occurring in inland waters, and the U.S. Coast Guard is the lead response agency for spills in coastal waters and deepwater ports. Despite a last response, the damage to communities, wildlife, and the physical and mental well-being of inhabitants can be extreme (Monson, Doak, Ballachey, Johnson, & Bodkin, 2002).

Case Study: Exxon Valdez

On March 24, 1989, shortly after midnight, an accident involving the supertanker vessel, the Exxon Valdez, resulted in a spill of 11 million gallons (260,000 barrels) of crude oil into the waters of Prince William Sound, Alaska. The spill was the largest in U.S. history and tested the abilities of local, national, and industrial organizations to respond to a disaster of such magnitude. Many factors complicated the cleanup efforts following...
Food and Agriculture Organization (FAO) estimates that pesticides have posed significant health risks to people in developing countries. The United Nations banned pesticides because they pose serious health risks to human health. More worrisome from a public health perspective are chronic health effects such as cancer, infertility, birth defects, miscarriage, and negative effects on the brain and nervous system.

Pesticides pose significant risks to human health and the environment, when people do not follow directions on product labels or use products irresponsibly. For example, people might use pesticides when they are not really needed, apply too much, or apply or dispose of them in a manner that could contaminate water or harm wildlife. Even alternative or organic pesticides can have these unintended consequences if not used correctly (EPA, 2003d). Humans were not untouched by this disaster. Visits to community clinics for primary care and mental health services in the affected area increased dramatically after the spill (Impact Assessments, 1990). Exposure to the incident was shown to have a profound impact on the prevalence of psychiatric disorders with increased rates of generalized anxiety disorder, posttraumatic stress disorder, and depressive symptoms present in the population (Palinkas, Petterson, Russell, & Downs, 1993).

In the aftermath of the Exxon Valdez incident, Congress passed the Oil Pollution Act of 1990, which required the Coast Guard to strengthen its regulations on oil tank vessels and oil tank owners and operators (EPA, 2003d).

Pollutants/Release of Toxins

Pesticides

Pesticides are frequently used to control insects, rodents, weeds, microbes, or fungi. In addition, they help farmers provide an affordable and plentiful food supply. Pesticides are also used in other settings, such as homes and schools, to control pests as common as cockroaches, termites, and mice. Pesticides pose significant risks to human health and the environment, when people do not follow directions on product labels or use products irresponsibly. For example, people might use pesticides when they are not really needed, apply too much, or apply or dispose of them in a manner that could contaminate water or harm wildlife. Even alternative or organic pesticides can have these unintended consequences if not used correctly (EPA, 2003d). There is abundant scientific evidence of the risks toxic pesticides pose to human health. For decades, stockpiles of obsolete, expired, and new pesticides pose significant health risks to people in developing countries. The United Nations Food and Agriculture Organization (FAO) estimates that 500,000 tons of obsolete pesticides no longer usable for their intended purposes are scattered throughout developing nations. Among the greatest concern are persistent organic pollutants, such as aldrin, chlordane, DDT, dieldrin, and endrin (United Nations Food and Agriculture Organization, 2001). These chemicals can cause nausea, convulsions, liver damage, and death.

End users in recipient countries may not be able to read contents, usage instructions, and precautions (where listed). Old pesticide containers may be used as containers for carrying drinking water or food. Governments may be aware of the threats these chemicals pose, but they may be constrained by a lack of funds or knowledge as to how to properly dispose of them.

Case Study: Aral Sea

The Aral Sea area in Central Asia has been encountering one of the world’s greatest environmental disasters for more than 17 years. The 5 million people living in this neglected and virtually unknown part of the world were suffering not only from an environmental catastrophe that had no easy solutions but also from a litany of health problems (Small, van der Meer, & Upshur, 2001). The Aral Sea is a landlocked sea in Central Asia; it lies between Kazakhstan in the north and Karakalpakstan, an autonomous region of Uzbekistan, in the south. Since the 1960s the Aral Sea had been shrinking, as the rivers that feed it (the Amu Darya and the Syr Darya) were diverted by the Soviet Union for irrigation. The Aral Sea is heavily polluted, largely as the result of weapons testing, industrial projects, and fertilizer runoff before and after the breakup of the Soviet Union. The region is often dismissed as a chronic problem where nothing positive can be achieved. Within this complicated context, Medecins Sans Frontieres, winner of the Nobel Peace Prize in 1999, actively assessed the impact of the environmental disaster on human health to help the people who live in the Aral Sea area cope with their environment. Medecins Sans Frontieres has combined a direct medical program to improve the health of the population while conducting operational research to gain a better understanding of the relationship between the environmental disaster and human health outcomes. In 2005, the North Aral Sea began renaissance, due to the construction of kol-Aral dam, an $85.8 million project funded by a loan from the World Bank. The dam prevents water from flowing and has resulted in a dramatic recovery of the North Aral Sea (NASA, 2007).

Outdoor Air Toxics

Air Pollutants

Toxic air pollutants, also known as hazardous air pollutants, are those pollutants that cause or may cause
The World Trade Center disaster. The aftereffects of exposure to dust in the air from the World Trade Center (WTC) on September 11, 2001, various public health concerns arose regarding the air quality. Researchers believe that the explosion may account for adverse health effects in the workers and residents in the environment around the WTC. As a result, researchers from Johns Hopkins University, New York University, and Columbia University have monitored truck drivers exposed to the dust, fires, and air pollutants in the WTC aftermath. Phase I focused on the exposure of truck drivers from the disaster site, and Phase II focused on the respiratory health of the workers at the disaster site. Interviews and lung function tests were conducted to evaluate changes in lung function or symptoms (Community Update, 2002). Current research is under way addressing the aftereffects of exposure to dust in the air from the World Trade Center disaster.

Case Study: World Trade Center

Following the explosion at the World Trade Center (WTC) on September 11, 2001, various public health concerns arose regarding the air quality. Researchers believe that the explosion may account for adverse health effects in the workers and residents in the environment around the WTC. As a result, researchers from Johns Hopkins University, New York University, and Columbia University have monitored truck drivers exposed to the dust, fires, and air pollutants in the WTC aftermath. Phase I focused on the exposure of truck drivers from the disaster site, and Phase II focused on the respiratory health of the workers at the disaster site. Interviews and lung function tests were conducted to evaluate changes in lung function or symptoms (Community Update, 2002). Current research is under way addressing the aftereffects of exposure to dust in the air from the World Trade Center disaster.

Case Study: Mold From Hurricanes Katrina and Rita

After Hurricanes Katrina and Rita made landfall on August 29 and September 24, 2005, respectively, large sections of New Orleans ( Orleans Parish) and the three surrounding parishes (Jefferson, Plaquemines, and St. Bernard) were flooded for weeks, leading to extensive mold growth in buildings (Health concerns, 2006). As residents reoccupied the city, local health care providers and public health authorities became increasingly concerned about the potential for respiratory health effects from exposure to water-damaged homes. The CDC was invited by the Louisiana Department of Health and Hospitals (LDHH) to assist in documenting the extent of potential exposures. A CDC-sponsored report summarized the results of an investigation into this environmental disaster, which determined that 46% of inspected homes had visible mold growth and that residents and remediation workers did not consistently use appropriate respiratory protection. Indoor and outdoor air samples were positive for Aspergillus spp. and Penicillium spp. The CDC report recommended that public health interventions addressing mold growth emphasize the importance of safe remediation practices and ensure the availability of recommended personal protective equipment (Health concerns, 2006).

Brownfields

Brownfields are environmental disasters characterized by abandoned or underutilized industrial and commercial sites that are, or are perceived to be, chemically, physically, or biologically contaminated. With certain legal exclusions and additions, the term Brownfield site means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant (EPA, 2003f). In recent years, many manufacturing plants and military bases have closed or relocated. New development on these Brownfield sites is the source of great debate among politicians, policy makers, and public health officials. The decisions regarding whether to build houses, schools, and new industry on these sites are often complicated by real or perceived environmental contamination. Grave concerns surround the reliability of Brownfield cleanup and subsequent protective measures (Greenberg, 2002). Normally, cleanup means that builders remove of the top layer of soil and replace it with clean soil, then place an impervious cap over it to prevent any contamination left in the ground from reaching the surface. The future use of the property is often restricted (e.g., no digging, no fence posts, no food gardens, etc.). In reality, protection measures may be inadequate or improperly constructed, monitoring is difficult, and enforcement of
deed restrictions is difficult. Given the inability to ensure that every cleaned up Brownfield site that becomes a house, school, or playground will be a safe and healthy environment, the potential for a public health emergency persists. Through the Economic Redevelopment Initiative, the EPA is the government agency responsible for the following:

- Assess existing sites.
- Prevent further contamination.
- Safely clean up sites.
- Design plans to reuse them.

**Case Study: Love Canal**

The Love Canal, a neighborhood in the southeast LaSalle district of the city of Niagara Falls, New York, takes its name from the failed plan of 19th-century entrepreneur, William T. Love. From 1942 through 1953, the Love Canal Landfill was used principally by Hooker Chemical, one of the many chemical plants located along the Niagara River, as a municipal and chemical disposal site. Nearly 21,000 tons (42 million pounds) of what would later be identified by independent scientists as toxic chemicals were dumped at the site.

In 1953, with the landfill at maximum capacity, Hooker filled the site with layers of dirt. As the post-war housing and baby boom spread to the southeast section of the city, the Niagara Falls Board of Education purchased the Love Canal land from Hooker Chemical for $1. Included in the deed transfer was a warning of the chemical wastes buried on the property and a disclaimer absolving Hooker of any further liability.

Single family housing surrounded the Love Canal site. As the population grew, the 99th Street School was built directly on the former landfill. At the time, homeowners were not warned or provided information of potential hazards associated with locating close to the former landfill site. According to residents who lived in the area, from the late 1950s through the early 1970s repeated complaints of odors and “substances” surfacing in their yards brought city officials to visit the neighborhood. The city assisted by covering the substances found on the play- 
ground at the 99th Street School. Faced with continuing complaints, the city, along with Niagara County, hired Calspan Corporation as a consultant to investigate. A report was filed indicating the presence of toxic chemical residue in the air and in the sump pumps of residents living at the southern end of the canal. Also discovered were 50-gallon drums just below the surface of the canal cap and high levels of PCBs (polychlorinated biphenyls) in the storm sewer system. Remedial recommendations included covering the canal with a clay cap, sealing home sump pumps, and constructing a tile drainage system to control migration of wastes. No action was taken.

By 1978, the Love Canal neighborhood included approximately 800 private, single-family homes, 240 low-income apartments, and the 99th Street Elementary School—located near the center of the landfill. In April 1978, Michael Brown, a reporter for the Niagara Gazette newspaper, wrote a series of articles on hazardous waste problems in the Niagara Falls area, including the Love Canal dumpsite. In response to the articles, Love Canal residents once more began calling on city and county officials to investigate their complaints. By this time, many residents were beginning to question health risks and noting already existing inexplicable health problems.

At the same time, the New York State Department of Health began collecting air and soil tests in base- 
ments and conducting health studies of the 239 families immediately surrounding the canal. On April 25, 1978, the New York State Commissioner of Health, Dr. Robert Whalen, issued a determination of public health hazard existing in the Love Canal community. He ordered the Niagara County Health Department to remove exposed chemicals from the site and install a protective fence around the area.

On August 2, 1978, Whalen declared a medical state of emergency at Love Canal and ordered the immediate closure of the 99th Street School. Immediate cleanup plans were initiated and recommendations to move were made for pregnant women and children less than 2 years old who lived in the immediate surrounding area of the Love Canal, and on August 7, 1978, United States President Jimmy Carter declared a federal emergency at Love Canal. The Love Canal became the first man-made disaster to receive such a designation based on a variety of environmental and health-related studies (Love Canal Collections, 1998).

**SUMMARY**

Environmental emergencies involving the release, or threatened release, of oil, radioactive materials, or hazardous chemicals potentially may affect communities and the surrounding environment. Releases may be accidental, as in the case of a spill at a chemical plant, or may be deliberate. Releases may also be caused by natural disasters. Environmental emergencies may progress to become disasters.

Nurses must work to create an environment that promotes and sustains health for all its citizens. Increases in scientific knowledge regarding the development of toxic chemicals and advances in technology must be balanced by the wisdom restricting their transport and use. The impact on the health of a community
resulting from an environmental emergency may be immediate, ongoing, or delayed for decades. Depending on the type of toxic agent and the duration of the exposure, populations may need to be closely monitored for years in order to evaluate the health impact of the event. Nurses must become educated regarding the environmental hazards in their communities and must become advocates for public policy limiting toxic agent use and proponents of research on the health effects of these environmental agents.

**STUDY QUESTIONS**

1. What differentiates an environmental emergency from an environmental disaster?
2. What are the health implications of a massive chemical spill in a community?
3. Describe the multiple responsibilities of the Environmental Protection Agency with regard to environmental health in the United States.
4. Identify and discuss the health impact of three environmental hazards that are readily found in the environment.
5. Why was Bhopal such a significant world event?
6. What are the legal, moral, and health implications of cleanup actions taken in response to an environmental disaster?
7. What are the health consequences of mold?

**INTERNET ACTIVITIES**

1. The individuals living in your neighborhood are growing increasingly concerned about the safety of the environment that surrounds their homes. You have been chosen by your neighbors as the person to investigate what is known about the area in which you live. Go to the U.S. Environmental Protection Agency Web site at [http://www.epa.gov/epahome/commsearch.htm](http://www.epa.gov/epahome/commsearch.htm) and search where you live using your zip code. Create a comprehensive report describing the following topics: air quality, water, land, and the potential of toxic elements in your environment.
2. You have been hired by the Environmental Protection Agency to review the response to the five largest oil spills in U.S. history. You are charged with conducting the analysis and developing recommendations for the future prevention of, and response to, a major oil spill in U.S. territory [land and water]. Start your research by identifying and reviewing the reports of each of these major oil spills at [http://www.epa.gov/oilspill/oilprof.htm](http://www.epa.gov/oilspill/oilprof.htm).

**REFERENCES**


Selected references for this chapter can be located at the Environmental Protection Agency (EPA) Web site at: http://www.epa.gov. The specific Web pages for each citation are not listed as these Web pages are frequently moved. The reader is strongly encouraged to go to the EPA Web site and search based on the following topic areas:

- About EPA
- Air Pollutants
- Environmental Emergencies
- Fact Sheet on Pesticides
- Oil Pollution Act
- Risk Management Program
Louisiana was struck by Hurricane Katrina on August 29, 2005, and by Hurricane Rita on September 24, 2005. The two hurricanes caused unprecedented damage from wind and storm surge to the Louisiana Gulf Coast region, and levee breaks resulted in flooding of large residential areas in and around New Orleans. With the flooding, an immediate public health concern was the potential for outbreaks of infectious diseases, including cholera. Cases of cholera rarely occur in the United States, and cholera epidemics, such as those reported in certain developing countries, are unlikely, even with the extreme flooding caused by the two hurricanes. This case study describes the investigation by the Louisiana Office of Public Health and the CDC into two cases of toxigenic *V. cholerae* O1 infection in a Louisiana couple; the cases were attributed to consumption of undercooked or contaminated seafood. Although noncholeraenic *Vibrio* illnesses were reported in 22 residents of Louisiana and Mississippi after Hurricane Katrina, no epidemic of cholera was identified, and no evidence existed of increased risk to Gulf Coast residents.

The two cases of toxigenic *V. cholerae* O1 infection were identified in a Louisiana couple approximately 3 weeks after Hurricane Rita. On October 15, 2005, in southeastern Louisiana, a 43-year-old man and his 46-year-old wife had onset of diarrhea. The husband had a history of high blood pressure, alcoholism, diabetes, brain tumor, and chronic renal failure that required dialysis three times a week. On October 16, 2005, he was hospitalized for fever, muscle pains, nausea, vomiting, abdominal cramps, and severe diarrhea and dehydration; subsequently he experienced complete loss of renal function and respiratory and cardiac failure. However, after treatment with ciprofloxacin and aggressive rehydration therapy, the man recovered to his previous state of health. His wife had mild diarrhea and was treated as an outpatient with ciprofloxacin and extra fluids.

Because the couple’s residence had been severely damaged and flooded by Hurricane Rita, both patients had waded in coastal floodwaters in late September, 2 to 3 weeks before their illness onset. Five days before onset of illness, both had eaten locally caught crabs. On October 14, the day preceding illness onset, both had eaten shrimp purchased from a local fisherman. The shrimp were boiled for 5 minutes; however, at least some of the boiled shrimp were returned to a cooler containing raw shrimp and were eaten later. Two other persons who ate the shrimp reported mild diarrhea and abdominal discomfort; they did not seek medical attention, and no stool or serum specimens were collected from them for testing. Toxigenic *V. cholerae* was isolated at the hospital from stool specimens of the two patients and was confirmed at the Louisiana State Public Health Laboratory.

Hurricane Katrina made landfall on August 29, 2005, with major impact on the U.S. Gulf Coast. The risk for illness related to infectious diseases became a major public health concern. The findings in this case study describe illnesses caused by *Vibrio* species, including wound infections resulting from posthurricane exposure of wounds to floodwaters. During August 29 to September 11, surveillance identified 22 new cases of *Vibrio* illness with five deaths in persons who had resided in two states. These illnesses were caused by *V. vulnificus*, *V.
parahaemolyticus, and nontoxicogenic V. cholerae. A case of posthurricane Vibrio infection was defined as clinical illness in a person who had resided in a state struck by Hurricane Katrina (i.e., Alabama, Louisiana, or Mississippi) with illness onset and reporting during August 29 to September 11, where Vibrio species was isolated from a wound, blood, or stool culture. These case findings underscore the need for prompt recognition and management of Vibrio wound infections by health care providers. When the number of illnesses from infectious diseases increases after a natural disaster, they usually are caused by infectious agents normally present in the community or local environment.

Non-Wound Associated Illnesses

Four persons were reported with non-wound associated Vibrio infections (2 in Mississippi, 1 in Louisiana, and 1 displaced from Louisiana to Arizona). Information on the Vibrio species and clinical illness was available for two of these patients; the species were nontoxicogenic V. cholerae isolated from patients with gastroenteritis. One of the infections occurred in a 2-month-old boy with diarrhea whose stool culture yielded both Salmonella group C2 and V. cholerae non-O1, non-O139.

Wound-Associated Illnesses

Eighteen wound-associated Vibrio cases were reported, in residents of Mississippi (7) and Louisiana (5), in persons displaced from Louisiana to Texas (2), Arkansas (2), and Arizona (1); and in a person displaced from Mississippi to Florida (1). Speciation was performed in clinical laboratories for 17 of the wound-associated cases; 14 (82%) were V. vulnificus, and 3 (18%) were V. parahaemolyticus. Five (28%) patients with wound-associated Vibrio infections died.

The most frequently reported posthurricane Vibrio illnesses were V. vulnificus and V. parahaemolyticus wound infections. These cases represent an increase over the normal reported incidence of Vibrio wound infections in Gulf Coast states and are consistent with exposure after hurricane landfall. Infections caused by V. vulnificus likely resulted from wounds exposed to floodwaters among persons with medical conditions that predisposed them to Vibrio infections.

Case Reports. To illustrate the rapid onset and severity of Vibrio wound infections, brief descriptions of three of the cases are provided.

Patient A. A 60-year-old man with a history of stroke, hypertension, and alcohol abuse arrived in Texas on August 31, after spending 3 days wading in the floodwaters of New Orleans, Louisiana. He was not housed at an evacuation center. On September 1, 2005, the man visited an emergency department with bilateral ankle wounds and diarrhea; he was treated and released. No details regarding treatment were available. Blood cultures subsequently yielded V. vulnificus. The patient was located and admitted to the hospital on September 2. He died the next day.

Patient B. A 61-year-old man from Mississippi with human immunodeficiency virus infection, coronary artery disease, and hyperlipidemia was examined on August 29 and determined to have hypothermia and multiple second- and third-degree abrasions on his trunk. V. parahaemolyticus was isolated from his blood. Despite receiving antimicrobial therapy with levofloxacin, he died the next day.

Patient C. A 49-year-old woman reported by her family to have hepatitis C was evacuated from New Orleans after a boat rescue. She visited an Arkansas hospital on September 4 with bullae, septic shock, and necrotizing fasciitis on her left leg, which was extensively debrided. V. vulnificus was isolated from her blood. As of September 12, she was being treated with cefazidime and doxycycline and remained in critical condition.

Persons working in hurricane-damaged areas, especially in areas with standing brackish water, should wear boots and other protective gear to prevent wounds and to prevent exposure of broken skin to contaminated water. To prevent Vibrio infections, persons with open wounds or broken skin should avoid contact with brackish water or seawater, especially if they have pre-existing liver disease or other immunocompromising conditions. Injury prevention is especially important for persons in these high-risk populations. Healthy persons are at much lower risk for Vibrio infection. In areas where floodwaters have receded and surfaces are dry, Vibrio should not be a concern because the organism is killed rapidly by drying.

To reduce the risk for Vibrio wound infection, persons should wash all wounds that have been exposed to sea or brackish waters with soap and clean water thoroughly as soon as possible and seek medical care for any wound that appears infected. Clinicians should be vigilant for Vibrio infection in hurricane evacuee populations, particularly in patients with infected wounds and especially if the patients are in a high-risk group. Wound infections also should be treated with aggressive attention to the wound site; amputation of the infected limb is sometimes necessary. Additional information regarding management of V. vulnificus wound infections is available at http://www.bt.cdc.gov/disasters/hurricanes/Katrina/vibriofaq.asp.

PART IV

Disasters Caused by Chemical, Biological, and Radiological Agents
Key Messages

- Occasionally, terrorists have used toxic compounds or pathogens in targeted attacks on civilians. The 2001 attacks characterized by the sending of envelopes laced with Bacillus anthracis, suggest increased interest on the part of terrorists to use chemical and biological agents. Because of the difficulties involved in using such unconventional weapons, however, it is more likely that terrorists will continue to use more conventional (explosive) devices. Improvised chemical or biological weapons, although menacing to the general public, are likely to be limited in their ability to cause casualties. The effects of a chemical or biological terrorist event on society at large, however, may be greatly multiplied because of the mystique and fearsome images these weapons possess.

- Chemical agents that could be used in terrorism are likely to cause casualties within an hour or more, whereas biological agents (as in bioterrorism) are not likely to be recognized at the very least until many hours or days after their release. Decontamination measures may be called for in some cases of chemical events, whereas this is not a primary issue for bioterrorism casualties, except in the case of certain hardy organisms like B. anthracis. However, some biological threats such as smallpox will obviously require very stringent containment measures, including quarantine.

- Nerve agents and cyanide may be utilized in some fashion against civilians in acts of terrorism. These are self-limiting events, however, and can be regarded as hazardous materials (HAZMAT) incidents (“lights and sirens”). In the event of bioterrorism, victims of exposure and subsequent infection are likely to be identified in health care settings, perhaps days or weeks following an event. Among possible biological weapon agents, Bacillus anthracis spores, the causative agent in inhalation anthrax, remains atop the list of bioterrorist threats.

- One of the greatest challenges in a large incident involving chemical or biological agents are the sheer numbers of sick, worried, and possibly panicked individuals showing up en masse at hospitals or clinics. Remaining calm and projecting confidence can do a lot to ease the anxiety of such patients. This is just as important in cases of psychogenic illness, where an etiological agent is not found but in which victims are truly suffering, agitated, and require medical care.

Learning Objectives

When this chapter is completed, readers will be able to

1. Understand the difference between what might be possible versus probable in the case of terrorists using chemical and biological agents as weapons of mass destruction (WMD).
2. Distinguish between the features of a possible chemical and biological (bioterrorism) terrorist event.
3. Learn the basic categories of chemical agents and biological agents one might encounter in an unconventional attack.
4. Anticipate what challenges any hospital or clinic would face in the rush of casualties and “worried well” in the event of a real or perceived chemical or biological terrorist event.
5. Define the basic features of mass psychogenic illness and apply this to the public’s reaction to real or perceived bioterrorist threats.
Biological and Chemical Terrorism: A Unique Threat
Eric Croddy and Gary Ackerman

CHAPTER OVERVIEW

The prospect of chemical or biological terrorism, especially an event that causes mass casualties (i.e., a weapon of mass destruction) poses a great challenge to the U.S. health care system. The use of infectious organisms or toxic compounds by terrorists can have immediate and long-term effects. But even if our understanding of terrorism is inchoate, it is also important to keep the real risks in perspective. The terrorist operates in a different world than a state-run military, and the contrast is especially important when it comes to developing chemical or biological weapons. Past experience and the nature of chemical or biological agents suggest that terrorists will continue to rely mostly on conventional explosives, at least for some time.

Some large casualty events could result, however, from the application of large quantities of toxic nerve agents or efficiently aerosolized pathogens. In such cases, hospitals and other emergency health care facilities may be forced to make stark choices in triaging patients. Given the heightened awareness of the real or perceived threat of chemical or biological terrorism in today’s society, it is also likely that mass psychogenic illness may present itself in a given population. Distinguishing such events involving mass anxiety from actual cases of biological and chemical terrorism may be quite difficult, at least early on.

During the Cold War (ca. 1945–1991), the United States and the former Soviet Union stockpiled massive chemical and biological weapons arsenals. Yet, in the years following the collapse of the Soviet “Evil Empire,” the threat of Warsaw Pact forces employing chemical and biological (CB) weapons against the Western NATO countries has all but vanished. The United States, and to a limited extent Russia, have begun destroying their chemical weapons stockpiles. As for biological weapons, no conclusive evidence is available to indicate that these are currently possessed by Russia. The United States long ago (1969) renounced offensive biological weapons.
weapons research and destroyed all remaining biological weapons in the early 1970s. Other nations, however, such as North Korea, are widely cited as having chemical or biological weapons capabilities (Bolton, 2002).

Now, much of the emphasis, in terms of national security, has shifted to the use of unconventional weapons unleashed on civilian targets by terrorists. Sometimes referred to as superterrorism, this includes the possible use of nuclear (that is, a fusion-reaction explosion), radiological (as in the so-called dirty bomb), biological, or chemical weapons. In the context of terrorism, this chapter concerns itself with the latter two types.

Compared with the many instances of attacks using conventional explosives, the use of weapons employing toxic or infectious agents by terrorists has been rare (Pilat, 1997). Yet, particularly since the 1990s, much has been made (rightly or wrongly) of the threat from terrorists using CB agents. Although often referred to as weapons of mass destruction (WMD), it is not clear that either chemical or biological weaponry can easily cause the thousands of casualties one might expect from nuclear or even some conventional explosives. Nonetheless, the impact of a large CB terrorist event could be catastrophic for any populated city, presenting a unique and seemingly overwhelming challenge to the U.S. public health care system (Winslow, 1999). Although the list of CB threats in the milieu of the war fighter are harrowing enough—nerve agents (e.g., sarin), anthrax, botulinum toxin, and so on—in the civilian context there are also other tools of unconventional warfare. These include the improvised use of toxic household products, the deliberate spread of foodborne pathogens, and the intentional release of industrial chemicals (Stern, 1999).

In the fecund mind of a terrorist, there are doubtless many more possibilities. Aside from the immediate care of those directly affected by the payload impact of this type of terrorism may prove just as challenging. To be sure, health care providers must be cognizant of the real dangers posed by chemical and biological terrorism. But we also need to recognize the signs of mass anxiety, psychogenic illness, and other pathologies that may accompany real or perceived cases of CB terrorist attacks (Hyams, Murphy, & Wessely, 2002). How can one distinguish the true casualty from the “worried well”? How does the American health care system handle mass psychogenic illness in an age of chemical and biological terrorism? Some have even suggested that, indeed, the psychological effect of bioterrorism is a more prominent threat than its actual use (Moscrop, 2001).

Regardless of how one views the threat of chemical or biological terrorism, it seems clear that the modern public health profession demands thorough knowledge and thoughtful approaches to the problem. Both past experience and current events suggest that, once thus committed, little can stop a determined terrorist from obtaining chemicals or biological pathogens/toxins and assembling these into some sort of delivery device. The immediate questions that should concern us are: how significant is the threat and what should we do about it?

### CHEMICAL TERRORISM AND BIOTERRORISM DEFINED

For the health care professional who is dealing with urgent casualties, it probably makes little difference as to what label one uses to describe a WMD event, whether it is the result of terrorism, criminal activity, or the work of a lone actor. However, in order to be reasonably consistent, a brief word is necessary to define terms. Although some may disagree on how one defines terrorism, we usually “know it when we see it.” Perhaps we can do better. In this chapter, we will refer to terrorism as defined by Bruce Hoffman, who argues that it describes “the deliberate creation and exploitation of fear through violence or the threat of violence in the pursuit of political change” (Hoffman, 1998). Thus, the use of chemical or biological agents as the main element of a terrorist attack or threat would be referred to as chemical or bioterrorism, respectively.

If CB agents fall within the rubric of WMD, then we are looking at acts of violence that involve large numbers of casualties. But what defines a “large number” of casualties (including dead and wounded)? Do we mean dozens, hundreds, or thousands?

To answer this question, let us look at a modern example of a terrorist event in which a conventional explosive was used. The massive bomb (4,000 or more pounds) that destroyed the Murrah Building in Oklahoma City on April 19, 1995, killed 168 and injured hundreds more. Although no toxic chemicals or pathogens were involved, the scope and scale of destruction qualified this terrorist weapon as a WMD. (Timothy McVeigh and his co-conspirator in the bombing, Terry Lynn Nichols, were later indicted on federal WMD-related charges.) At the risk of being arbitrary, we could use this example in terms of its numbers of casualties to define what we would consider to be a catastrophic event. The latter WMD would then involve (a) the use of chemical or biological agents by nonstate groups such as terrorists or criminal organizations and (b) those showing the potential of creating hundreds or more casualties (including both dead and wounded).

Cult members of the Aum Shinrikyo in Japan released sarin nerve agent on the subway in March 1995, killing a dozen people and causing more than a thousand injuries. In terms of its overall lethality, the use of nerve agent in this case was limited. But it certainly was a case of chemical terrorism. Similarly, looking at
the deliberate use of pathogens in the U.S., in 1984 the followers of Bhagwan Shree Rajneesh, in an attempt to influence local elections in Antelope, Oregon, sickened 751 people with Salmonella typhimurium, the causative agent in food poisoning (Miller, Engelberg, & Broad, 2001). While none died as a direct consequence of this latter attack it qualifies as a case of domestic bioterrorism (with an impressive number of casualties).

But even a small number of casualties caused by either chemical or biological agents can have reverberating effects throughout our society. As an example, the letters containing anthrax spores mailed on or after September 11, 2001, resulted in the death of 5 and infected 13 more (Shane, 2002). These are tragic events to be certain, but they resulted in no more casualties than some mass shootings that occasionally befall modern societies. Yet the anthrax-related events of fall 2001 spurred a great number of individuals to take unwarranted steps, such as self-medicating (with antibiotics) and purchasing protective masks. The anthrax attacks clearly demonstrated the potential to cause large numbers of casualties, and we can therefore regard them as acts of bioterrorism.

Now that we have given a name to the label of terrorism using chemical and biological agents, a brief word is necessary to further define these terms.

Chemical and Biological Warfare Agents: Quick Definitions

Chemical agents are those chemical compounds synthesized artificially and include the many toxic chemicals that may be available to terrorists. Everything from chlorine gas to the highly potent nerve agents (i.e., organophosphate compounds) are considered in this category. We can distill its essence in the following way: Chemical weapons utilize the toxic nature of selected substances to cause death or injury. These chemical warfare (CW) agents may cause injury via the respiratory route, through the skin, or by ingestion.

Biological agents are those pathogens used deliberately to infect persons, as well as toxins normally derived from plants or animals. (The inclusion of toxins in the biological category is somewhat arbitrary, but we do so for ease of convention.) In biological warfare (BW), infectious disease is the name of the game. As with naturally occurring infectious diseases, biological agents used in terrorism can infect through respiratory and ingestion routes. Vectors such as arthropods may also be involved, but are less likely to be utilized in bioterrorism. Finally, save for trichothecene mycotoxins, the documented use of which being somewhat controversial (Stahl, Green, & Farnum, 1985), none of the known biological warfare agents are dermally active (Wannemacher & Wiener, 1997).

**WHY WOULD TERRORISTS USE CHEMICAL OR BIOLOGICAL AGENTS?**

There are a number of reasons why terrorist groups or individuals might consider using chemical and biological agents. For someone intent on causing large-scale death and disruption, these agents, when used effectively, are indeed capable of inflicting enormous casualties and causing massive disruption to society. Other terrorists may develop an inherent fascination with these rather exotic agents that for some evoke biblical or apocalyptic connotations.

Yet terrorists are most likely to be motivated to use chemical or biological agents for the following reason: By virtue of their novel and fearsome qualities, the use of such unconventional agents greatly affect the targeted population (Falkenrath, Newman, & Thayer, 1998). Because the primary goal of most terrorists is to strike fear and uncertainty, some authors have also suggested that the now routine journalistic association between chemical and biological weapons and the word terror confirms that the purpose of these weapons is to wreak destruction via psychological means—by inducing fear, confusion, and uncertainty in everyday life. These effects will take two forms, acute and long term. (Wessely, Hyams, & Bartholomew, 2001, p. 878)

Implicit in this statement is fear of the unknown, which can be a powerful weapon for the terrorist. Especially for the general public, ignorance of the details concerning chemical or biological agents and their various means of delivery is likely to be the source of acute apprehension. After all, the topic of CB warfare is relatively obscure, relegated mostly to military or scientific texts that have little bearing on what most people face from day to day. Furthermore, the public may learn some details regarding CB agents from popular entertainment or superficial reading on the topic, but this only intensifies anxieties. When it comes to the topic of chemical or biological terrorism, people might ask themselves some very troubling questions: Will even low levels of toxic exposure mean painful death; long-term, debilitating illness; and birth defects? Will a bioterrorist release a pathogen that lays waste to much of mankind, leaving only survivors who envy the dead? Even without the actual use of CB weapons, its mere suggestion can inject a powerful psychological element that is sometimes exacerbated by popular media and overactive imaginations. Terrorists are no doubt eager to capitalize on such vulnerabilities.

Another important consideration is that, to the extent that some terrorist groups may wish to acquire a nuclear weapon, designing an effective chemical or...
biological device would be relatively easier to build and use. (Although probably not realistic, Iranian President Rafsanjani’s statement that chemical weapons were the “poor man’s atomic bomb” seems appropriate here.) However, a better way of approaching this question might be to ask: Why wouldn’t a terrorist choose a chemical or biological weapon? A number of researchers in terrorism have proposed a set of disincentives for a terrorist group to turn to such devices. One of the more often cited reasons is a traditional propensity among terrorists to use conventional weapons (bombs and bullets) that are a much more familiar technology and more predictable in their effects. Another argument is that because many terrorist groups usually rely on a political base for funding and other support, using chemical or biological agents might offend the moral sensibilities of their supporters (Gurr & Cole, 2000). (Usually left unexplained, however, is why such an audience would countenance the murder of civilians in the first place, including women and children.) Alternatively, some contend that terrorist organizations that do not rely on an outside constituency are more apt to employ CB weapons. This could include groups that are waning in influence and, feeling they have nothing else to lose, may employ such weapons in a last desperate act (Hurwitz, 1982).

Disinformation or Hoaxes

The mere threat of an attack using dangerous chemical or biological materials can cause great anxiety and disorder, if not outright panic, in any society. Following the attack on the Tokyo subway in 1995, for example, the numbers of psychosomatic victims and worried well far exceeded the actual number of victims. Subsequent to the attack, metropolitan Tokyo subways experienced a rash of false alarms, high-profile reports of unknown noxious odors in commuter subway trains, and other releases of undefined, irritating substances. Prior to the few real cases of anthrax in letters in the fall of 2001, the United States experienced a rash of anthrax hoaxes. Most often these hoaxes involved mailed letters or parcels, sometimes containing a powder or other suspicious-looking substance, with a note saying that the victim had been exposed to anthrax. Before October 2001, none of these hoaxes contained any hazardous material, yet prudence dictated full security and decontamination procedures—often causing massive disruption and incurring great financial costs in responding to the event. During and subsequent to the appearance of the real anthrax letters, there have been several hundred more hoaxes in both the United States and other countries, perpetuating fear among the public and necessitating even more resource expenditure. How Might the Choice of CB Weapons Differ Between Military and Terrorist Use?

It is not just that CB agents are toxic or infectious. What is also common among CB agents that have been developed for warfare is their relative ease of production and dissemination. To be effective as weapons, they should also be reasonably stable in storage and maintain their potency until delivered to the target. Another factor that has been considered most important to militaries—but not necessarily for terrorists—is the capacity of a given agent to cause large numbers of casualties (including dead and wounded); these need not be predominantly lethal. In the military context, for example, inflicting non-lethal injuries can create more logistical problems for the enemy. Although this is a cold calculation, the reality is that costly medical and other logistical expenditures are no longer needed if the casualty is dead. Chemical casualties that survive exposure, for example, generally require medical treatment, evacuation, and decontamination measures, resulting in serious logistical burdens. Forcing the enemy to care for the living—all the while having to conduct operations—makes chemical weaponry a significant “force multiplier.” Therefore, decades ago when the United States was still prepared to use offensive chemical weapons, reference tables were constructed to calculate the exact number of nerve agent shells required for a given target. U.S. Army manuals directed that only enough artillery shells were to be used in order to create incapacitating doses (not necessarily lethal ones) for the enemy. This was not done to be more humane, but rather for achieving the desired effect of causing casualties while conserving ammunition stores (United States, Department of the Army, Air Force, 1958). Likewise, the United States and the former Soviet Union could choose among BW agents that were lethal or those that were mostly nonfatal, depending on the mission. On the one hand, the inhaled route of anthrax infection is among the most lethal (more than 50% would die under the best of circumstances), a weapon delivering an aerosol of anthrax spores would have meant large percentages of dead. On the other hand, Venezuelan equine encephalitis (VEE) virus could be employed, in which case most of those infected with VEE would be incapacitated by the disease but few would ultimately die (Smith et al., 1997).

The terrorist, however, may have very different criteria for choosing a CB agent for an attack. Unlike state-level militaries, terrorist organizations have much less flexibility, funds, or luxury of time and space to develop full-fledged CB weapon programs. (Some resourceful groups may pursue the acquisition of CB warfare agents developed by state programs.) On the one hand, then,
terrorists may be more likely than militaries to use lethal agents, as they do not necessarily share with the military the strategic goal of creating large numbers of wounded. On the other hand, terrorists will attempt to gain as much impact as possible from limited resources and are more likely to engage in terrorist incidents, which are more commonly found chemicals or pathogens even if these are less toxic than traditional warfare agents. Terrorists therefore have a much wider scope in their choice of agent than do most militaries. After all, if creating havoc and fear among civilians is the primary goal, terrorists can choose from a wide range of lethal or irritating chemical compounds and pathogens. Foodborne pathogens and derived toxins could be utilized in some fashion, from the more deadly (e.g., botulinum toxin) to predominantly incapacitating (e.g., staphylococcal enterotoxins). Regardless of the agent employed, the toxic shock of such an event to a community, society, and polity may be more than sufficient for the purposes of CB terrorism.

Some Unique Aspects of a Chemical or Biological Terrorist Incident

Knowledge beforehand that patients are victims of a CB attack would, of course, be useful in order to anticipate and triage casualties, as well as to plan for long-term treatment modalities. But the fact that casualties were deliberately caused by a terrorist attack involving Category C or B agents may go unrecognized for some time. Two examples illustrate this latter point.

In Matsumoto City, Japan, at almost midnight, June 27, 1994, the local police station was informed that patients were being rushed to the hospital and alerted to the fact that the nature of their injuries seemed most unusual. Further investigation discovered five deceased at an apartment complex. Two seriously affected individuals later died at the hospital, while another 270 were treated. Around the residential area, dead animals—dogs, birds, and large insects—were also discovered underground. Most of the casualties were located within about 150 meters of a pond, in which there were also found dead fish and crustaceans. Initial reports of casualties indicated that they were suffering from darkened vision, eye pain, myosis, nausea, and markedly lowered serum cholinesterase activity (Sato, Tsunoda, Kataoka, Tsuge, & Nagano, 2000). It took a week following the event to determine that sarin nerve agent was responsible. After suspecting a hapless resident in Matsumoto (who nearly lost his wife to the sarin release), it then took at least several weeks before Japanese authorities seriously considered that the Japanese cult, Aum Shinrikyo, might have been responsible. As it turned out, the cult had, in fact, used sarin nerve agent in an attack, but had intended to assassinate local magistrates in Matsumoto City. None of these intended targets, however, were killed (Tu, 2002).

Likewise, the foodborne outbreak (salmonellosis) in The Dalles, Oregon, perpetrated by the Rajneeshees in September 1984, was not known to have been deliberately caused for almost a year. Were it not for a sudden and incriminating outburst by its leader that led to a full investigation by state and federal authorities, it is possible that the Oregon Salmonella typhimurium outbreak would have never been solved (Miller et al., 2001).

What Are the Real Risks of Chemical Terrorism/Bioterrorism?

In the community of academic researchers and security analysts, debate continues over the real risks posed by a terrorist attack involving chemical or biological agents. The wide-ranging number of variables and lack of hard data make a reliable risk assessment extremely difficult. Generally speaking, however, one can arrive at the following conclusions: Although terrorists have for the most part opted for conventional weapons, the use of chemical or biological agents by terrorists has already occurred, albeit in rather limited fashion. Some current terrorist organizations are clearly interested in using chemical or biological agents, but appear, thus far, to be unsuccessful in perpetrating large-scale attacks employing these agents.

Certain terrorist organizations have made statements that clearly speak to the menace of CB weapons. al-Qaeda (Arabic for “the base”) is a name for a loosely interconnected organization of terrorists having in common a radical Islamic vision, an organization that has looked to Osama bin Laden as its leader. Responsible for not only the World Trade Center and Pentagon attacks on September 11, 2001, al-Qaeda members have also been implicated in the devastating conventional bombings of U.S. consulates in 1998 in Africa and on a U.S. warship in Yemen in 2000. There is some evidence that al-Qaeda was attempting to prepare anthrax as a bioterrorist weapon at facilities in Afghanistan before the 2001 U.S. invasion (Gordon, 2002), and videotapes released in August 2002 revealed experiments on dogs with toxic agents. In June 2002, a purported spokesman for al-Qaeda, Suleiman Abu Gheith, wrote the following in an article that appeared in an Arabic newspaper in London:

We have the right to kill 4 million Americans—2 million of them children—and to exile twice as many and wound and cripple hundreds of thousands. Furthermore, it is our right to fight them with chemical and biological weapons, so as to afflict them with the fatal maladies that have afflicted the Muslims because of the [Americans’] chemical and biological weapons. (Abu Gheith, 2002)
Such fearsome pronouncements aside, it is an open question as to whether or not a terrorist organization, even one as sophisticated as al-Qaeda, could pull off a substantial chemical or biological attack, especially one that would kill or injure more than the 2,800 who died on 9/11 (Tucker, 2000).

One must be careful of extrapolating from the few known terrorist attacks using chemical or biological agents in the past to arrive at a probability for their future use. But we can still hazard a guess: In addition to the wider availability of information for producing them, the increased attention being paid to the effects of chemical and biological agents point toward an increasing likelihood of future attacks involving CB terrorism. Because of the technical hurdles usually involved, CB terrorist attacks will probably involve fewer casualties than is generally feared. As one noted scholar of modern terrorism wrote, “The true threat of superterrorism is not a Hiroshima-like disaster, but a widespread panic caused by a relatively small CBW incident involving a few dozen fatalities” (Sprinzak, 2000).

However, one could suggest as a counterfactual to this the 1988 massacre at Halabja, in northern Iraq. Perpetrated by the Iraqi military, this was certainly the largest chemical attack on a civilian population, resulting in the death of at least 4,000 men, women, and children. It is uncertain as to exactly which agents were most responsible, although nerve agents (such as the highly toxic organophosphates sarin and possibly VX) probably contributed most of the deaths. In this case, however, we note that a state military was involved, using significant quantities of chemical agents delivered by the Iraqi air force. Terrorists would necessarily have fewer options for delivering agents over a densely populated target. (Modifying a crop duster for chemical or biological delivery, however, could be an effective delivery platform.)

Although we cannot predict with any certainty future CB terrorist events, it is certainly worthwhile to understand and prepare for them (National Research Council, 1999). At the same time, keeping the risks of such attacks in perspective is also crucial. The current trend still suggests that “conventional” high explosives will remain the mainstay of terrorists bent on causing greater numbers of casualties—and not CB weaponry. Perhaps the greatest challenges presented by a large-scale CB terrorism attack are the logistical and psychological demands on the health care system. Not only is this a matter of staff resources, treatments, equipment, and decontamination measures, but also the very basic limitations of space. One can imagine the stress created by a mass casualty event when victims show up by the hundreds, maybe thousands, looking for beds. During the Tokyo sarin attack, for example, within hours 640 people were brought into the chapel and treated there (Okumura et al., 1996).

For the health care provider (and this is especially applicable in the military context), chemical or biological attacks may not only cause a significant number to die, but they will also create many more injured (or infected) requiring care. Hospital staff and other health care workers will be hard pressed to cope with so many injured people of all ages, undoubtedly bringing enormous difficulties for a health care facility that sometimes is barely able to keep up with its usual flow of patients.

At this point it is useful to address chemical and biological threats separately, as their threat and effects vary considerably. We start with chemical agents.

**CHEMICAL TERRORISM**

In nearly all respects, chemical terrorism is essentially a hazardous materials (HAZMAT) event. Unlike the effects of a contagious biological agent release (e.g., smallpox), chemical events are generally self-limiting. A chemical terrorist attack may include small or large numbers of casualties, and, depending on the agent used, victims may require special decontamination measures.

**Delivery of Chemical Agents**

In a military setting, the effectiveness of CW agents is optimized by producing contaminated areas with high concentrations of a toxic compound. Since World War I, the method of delivering chemicals has remained largely the same, usually filling artillery shells or bombs with a particular CW agent. Chemical compounds that are gaseous at room temperature (e.g., phosgene), or are extremely volatile (e.g., hydrogen cyanide), do not need much engineering to deliver. Because of their gaseous state, however, they also disperse rapidly, demanding a large quantity to be delivered to the target.

For liquid or solid CW agents that do not produce vapors readily, creating large areas of contamination is accomplished by spraying from an aerial bomb or dispersing them from artillery (explosive) munitions. Maximizing the amount of CW agent in a given area is achieved by producing an aerosol, loosely defined here as a cloud of suspended liquid or solid particles. Although aerosols can increase the effectiveness and lethality of CW agents, some chemical compounds are versatile enough to deliver in other forms. Mustard, a blister agent, can produce contact injuries by contaminating surfaces, while its vapors also present a severe hazard to the upper respiratory system.

For a terrorist who is intent on causing chemical casualties, acquiring “higher end” agents such as
military nerve compounds (e.g., sarin, VX, etc.) might be too difficult or unnecessary. Instead, the would-be chemical terrorist could utilize toxic chemicals procured from commercial suppliers, or even synthesize hazardous compounds for dissemination (Tour, 2000). By their very nature, improvised chemical weapons are also more likely to be crude and inefficient. Although one should not minimize the danger of such attacks, it is expected that the actual number of direct casualties will be low.

The list of potential chemical agents that could be used in terrorism is quite extensive. Full and detailed discussions on CW agents can be found in chapter 25 in the literature (Marrs, Maynard, & Sidell, 1996). Rather than simply running through such a listing, it makes more sense to look at the most important physiological effects of different classes of chemicals that could be used in terrorism. These are:

- **Nerve agents (e.g., sarin)**
- **Tissue (blood) agents (e.g., cyanide)**
- **Lung irritants (e.g., chlorine gas)**
- **Vesicants (i.e., blister agents such as mustard or lewisite)**
- **Psychomimetics (e.g., BZ, LSD)**
- **Pesticides**

### Nerve Agents

Nerve agents include the chemicals tabun, sarin, soman, and VX. These toxic organophosphate compounds all operate on the same basic principle—they inhibit acetylcholinesterase (AChE). As a consequence, increased levels of acetylcholine, an essential neurotransmitter, bring about respiratory and cardiovascular crises that can quickly lead to death. Terrorists should find little difficulty in learning about how to produce nerve agents. Information on the precursors and even synthesis steps for the production of toxic organophosphate compounds, including the military nerve agents (sarin, VX, etc.), are widely available in the open literature.

For the terrorist who operates in an improvised setting, other compounds, although less toxic than modern nerve agents (e.g., sarin, VX), may in some ways be easier to produce than the other classic war gases. Such substances may, in certain cases, also have legitimate medical or industrial uses and be available through specialty chemical suppliers. For example, James Dalton Bell, an individual in the United States who has held antigovernment attitudes and has chemistry training, was found with several dangerous chemicals at his home in 1997.

International terrorists may also be pursuing the development of nerve agents for attacks on civilian targets. Persuasive (albeit controversial) evidence suggests that members of the al-Qaeda terror network may have produced VX nerve agent while in the Sudan with the connivance of Iraqi chemical warfare scientists (Croddy, 2002).

### Tissue (Blood) Agents

Another important category, the so-called tissue (blood) agents, includes cyanide in its various forms.Ultimately, cyanide blocks the enzyme cytochrome oxidase, shutting down the energy transport (ATP) system. In the form of a salt (e.g., sodium cyanide), 200 to 300 mg of cyanide are necessary to cause death in most adults (Lovejoy & Linden, 1994). Solutions containing a cyanide salt can be made to evolve hydrogen cyanide vapor, capable of causing death within minutes. (This is the operating principle of the gas chamber used for capital executions in the United States.)

Because of its widespread use in the mining and other industries, bulk supplies of potassium or sodium cyanide salts are ubiquitous. As an adulterant, cyanide salts could be employed to poison food or beverages. But to utilize this compound as a mass casualty weapon, the terrorist would probably demand the production of hydrogen cyanide (HCN) gas. In 1993, the bomber Ramzi Yousef considered the possibility of using cyanide in the first bombing of the World Trade Center in New York City, but there is no evidence that cyanide was involved in this incident (Parzachini, 2000). It was either the technical difficulty in making such a weapon work or a lack of funds that forced Yousef to give up on the idea.

The group Aum Shinrikyo used devices that contained a cyanide salt (e.g., sodium cyanide, Tu, 2002). This was precisely the type of device discovered in a Tokyo subway restroom in 1995 (following the Tokyo sarin attack) and was neutralized before causing injury. When arrested, Krar was found with assorted literature linked to the radical right wing, and it is believed that Krar intended to release cyanide as a gas or disperse it via an explosive device (Monterey WMD Terrorism Database, n.d.).

Because its ubiquity, perhaps it is only a matter of time before a terrorist group successfully uses cyanide in an attack. It should be borne in mind, however, that a substantial amount of HCN is required to cause death in most humans. For example, approximately 2,500–5,000 mg-minute/m³ is estimated to be the median lethal concentration (Baskin & Brewster, 1997), compared to 100 mg-minute/m³ for sarin nerve agent (Sidell, 1997). One should also expect that successful attacks employing HCN, like other volatile agents, demand large quantities of agent and enclosed spaces. Even under such
Lung Irritants

Lung irritants attack the respiratory system, causing tightness in the airways, hypoxia, and in more severe cases, pulmonary edema (Urbanetti, 1997). Most known lung irritants require high volatilities or a gaseous form to cause injury to the alveolar spaces of the lungs. This also means that large concentrations or enclosed spaces are necessary to cause death or injury to many individuals. For a terrorist bent on using such compounds, the primary hurdles would be access to large quantities of agent and an effective delivery method for mass casualties. One case in particular demonstrates the effects of a very toxic lung irritant, methyl isocyanate, on an unprotected and unsuspecting civilian population.

On December 3, 1984, a release of methyl isocyanate (MIC)—a chemical intermediate used in the synthesis of a carbamate pesticide (Sevin)—killed as many as 3,800 people in Bhopal, India. Not only is this tragedy significant in terms of the scope of the disaster, but there is persuasive evidence that the Bhopal catastrophe was the result of sabotage (Kalelkar, 1988). In the Bhopal case, a disgruntled employee decided to strike back at his employer by deliberately disrupting operations. By directly introducing water into a large tank holding MIC, the resultant heat and violent reaction caused a massive plume of MIC gas to float over populated areas of Bhopal. Local inhabitants, gathering around the plant to get a better look at the unfolding disaster, were among the first casualties.

Other common chemicals could be deliberately released into the environment, putting wider populations at risk. This could occur within a facility or perhaps by sabotaging a container en route via train or road. During the Atlanta 1996 Olympics, for example, U.S. federal authorities considered potential threats from improvised chemical devices, including the use of high explosives to puncture a train car loaded with toxic chemicals (U.S. Army Medical Command, 1999).

Lung irritants can be produced from commercially supplied compounds, or as by-products of chemical reactions. There have been recorded cases of bombers trying to include chemicals together with their explosives with the apparent intent to emit a poisonous gas.

Vesicants

The so-called vesicants or blister agents, such as mustard gas and lewisite, have less utility for terrorists. In a classic World War I combat setting, these toxic compounds are highly effective casualty agents that cause (after about an hour delay) extreme irritation to eyes, skin, and respiratory tract. Concentrations of 100 mg-min/m³ create near incapacitation of vision from the effects on the conjunctiva, whereas the lethal dosage of a blister agent like mustard gas is generally estimated to be between 1 and 2 grams, topical or inhaled. Another irritating and vesicating agent, lewisite, possesses similar lethality, but its irritating effects are much more rapid (Sidell, 1997).

The manufacture of mustard gas is simpler than nerve agents, and lewisite is only marginally more difficult than mustard gas. In the mind of the terrorist, though, when comparing the vesicants to other CW agents, mustard gas and lewisite may not have sufficient toxicity to warrant the time and expenditure required for their development. Again, such applications of a blister agent are more the purview of military operations and state-sponsored sabotage than terrorism (Franke, 1967).

Psychoincapacitants

Psychotropic compounds such as the belladonna drug BZ (3-quinuclidinyl benzilate) or the hallucinogen LSD (lysergic acid diethylamide) have been considered by militaries for use in combat and for sabotage. Their performance on the battlefield, however, has largely been considered unpredictable and impractical (Compトン, 1987). Largely because of its unknown effects on enemy soldiers, the United States destroyed its BZ stocks during the 1980s. Because of its potency, BZ could present the terrorist with an agent for contaminating food or water. Aerosol dispersion is also possible, perhaps via solvent, but this may be technically problematic for improvised attacks. Effects on individuals would include delirium, hallucinations, and general mental confusion for at least 24 hours. Higher doses could be lethal, especially from complications that are due to its anticholinergic activity (e.g., hyperthermia). Other compounds may be extracted from plants of the belladonna variety and used as adulterants in food or beverages. These may not appear to be agents that are likely to be used by terrorists, neither can they be discounted if causing large disruptions is the goal of a terrorist.

Pesticides

Pesticides refer to a group of agents used to kill a number of different “pests,” such as weeds, insects, ticks, rats, and so forth. Pesticide compounds have also been used in various criminal and terrorist attacks. Here again, the critical issues remain the same: what is the delivery system and what toxic effects are to be expected?

Numerous types of poisons have been used to kill mammals (mostly rodents), including cyanide,
thallium, arsenic, sodium fluoracetate, and the anti-coagulant warfarin (most commonly used in developed countries). Because of their high toxicity, cyanide and fluoracetate types of compounds are among the more menacing. Others such as herbicides and organophosphate insecticides, although toxic in large doses, are generally more of a concern to poison control centers (e.g., accidental ingestion) than for chemical terrorism. But what happens when a terrorist threatens (or accomplishes) a large-scale chemical attack by poisoning food or water with some pesticide compound? Chances are that, at the very least, the anxiety this would produce and the disruption to health care delivery would be both significant.

In spring/summer 2002, Israeli intelligence reportedly found that some suicide bombing attacks have included rat poison in the detonating devices, whereas U.S. media also reported the use of rat poison by Palestinian suicide bombers. In these cases, terrorists may have hoped that contaminated shrapnel from the explosion could deliver poisons such as warfarin (an anticoagulant) into the victim’s body. Indeed, Israeli doctors reportedly noted excessive bleeding in some of the casualties, suggesting that rat poison was included in the bomb. However, the effects of warfarin are dependent on the depletion of vitamin K stores that mediate coagulation, and this occurs over some time (Shaw & Anderson, 1999). It is not likely, therefore, that increased hemorrhaging in this instance was the result of the rodenticide alone. It is significant and alarming enough that terrorists in Israel (and elsewhere) are attempting to devise crude chemical weapon devices.

Effects of Chemical Terrorism

The potential repercussions of a chemical terrorist event could be varied and far reaching. A large-scale attack using a nerve agent in a densely populated area would create havoc. In this instance one would expect to find many people disoriented, some with extreme cholinirhea and bloody exudate from the nose, all the while twitching uncontrollably (fasciculations). In high concentrations, cyanide gas would kill its victims quickly unless treated early, whereas other exposed individuals may be relatively unaffected. Lung irritants may have immediate and long-term effects that, in more severe cases of inhalation, include pulmonary edema and the production of bloody and frothy sputum. These signs, coupled with the necessity for respiratory assistance, are clearly ominous symptoms of a large dose exposure.

Some agents such as mustard gas (blister agent) and VX (the most lethal nerve agent ever produced for weaponization) are also persistent, meaning they present severe, long-term contamination hazards. Because these can act topically, secondary contact exposure may continue to cause injury. It is of obvious concern to hospitals that such agents may be involved in future chemical terrorist attacks. Full decontamination procedures would be most appropriate in the case of a VX release, whereas other agents—such as cyanide or gases—are largely diffused and diluted in the environment. Persons exposed to highly volatile agents generally will require little or no special decontamination efforts. However, casualties caused by CW agents such as sarin may require a judgment call. In the open environment, sarin aerosol or vapors will not present a long-term contamination hazard. On the other hand, a casualty who has liquid sarin agent soaked in trouser cuffs will definitely require full removal of clothing and at least a water bath of skin surfaces.

Chemical Contamination of Water, Food, Beverages, and Consumer Products

The security of water is currently among the greatest concerns in developed societies, as was recently demonstrated in Wisconsin. In a June 14, 2002, press release from the governor’s office, the following was reported:

Janesville [Wisconsin] authorities and the FBI are investigating a break in at a water facility reservoir. Earlier this week, it was discovered that barbed wire on a chain link fence was cut and a padlock on the reservoir had been forcibly removed. The Department of Natural Resources and the State Lab of Hygiene tested the water and so far all tests have been negative for any contaminants. Nonetheless, the decision was made by Janesville officials to isolate and drain the 5 million gallon reservoir and test the residue. (State of Wisconsin, 2002)

No toxic substances were found.

Although generally discounted as a threat because of dilution factors and chlorination, municipal water sources could nevertheless be targeted by terrorists using chemical agents. Given very large quantities of starting material, some highly toxic agents, such as organophosphates, may pose a threat to civilian water systems (Lohs, 1963). During the 1960s, East German chemical warfare specialists thought it possible to poison large water reservoirs using the right type of agent. Much of this assessment is based on calculations concerning the relatively long half-life of a given compound such as sarin in water at pH values ranging from 4 to 7. But we are talking about an operation on a large and sophisticated level, one that may be beyond the capabilities of most terrorists.

That terrorists are interested in poisoning water for at least isolated attacks was demonstrated in February 2002. In an apparent plot on the U.S. embassy in
Rome, foreign nationals were found with several pounds of potassium ferrocyanide and diagrams to the underground water pipes near the U.S. embassy. But if the intent to poison water was present, the means were not. The would-be terrorists might have looked at the name “ferrocyanide” and figured it was toxic, but in actuality potassium (or sodium) ferrocyanide has low toxicity in mammals (World Health Organization, 1974). Had the perpetrators actually introduced the compound into the water system, it is unlikely that anyone would have noticed anything other than a strange flavor or color.

To be successful in an attack on a water system, two major obstacles must be overcome by the terrorist: The very large volumes of water involved (dilution effect) and the redundant nature of modern water treatment systems (Croady, 2001). With regard to the latter, in 1951 the U.S. Army had determined that drinking water, even water containing 25 particles per million (ppm) of hydrogen cyanide or 20 ppm of lewisite (blister agent), could be safely drunk using purification measures at the time (Lohs, 1963). Residual chlorine and multiplicity of water sources make widespread poisoning of water in urban environments extremely difficult, and ongoing hydrolysis decreases the concentration of an agent over time.

One more factor needs to be considered. Most water is not used for drinking or cooking but for other high-volume applications, such as watering lawns, washing clothes, washing dishes, bathing, and so forth. Furthermore, in today’s world, fewer and fewer people drink directly from the tap but rather from bottled water sources. Large-scale contamination of food, beverages, or consumer products with a chemical agent presents many of the same challenges to the chemical terrorist as water, but perhaps to an even higher degree. The compound would have to be introduced at a point where mass distribution would take place (without being detected), and then would have to survive processing or storage. Heightened awareness in food and product safety is essentially an infectious disease problem, or public health in reverse. In keeping with this theme of bioterrorism, the act of biological terrorism (bioterrorism) involves the deliberate use of microbial pathogens or toxins. Unlike a chemical incident, the effects from bioterrorism may not be fully known until many hours or days after the event. In biological casualties, these are infections or intoxications that, except in specific instances such as an attack with anthrax spores, generally do not require special decontamination (as would be involved in a chemical incident), and despite widespread fears of epidemics—the gift that keeps on giving—most traditional BW agents are noncontagious. Containment measures are mandatory in the event of a smallpox outbreak, however, and for some hemorrhagic fevers and pneumonic plague.

**BIOTERRORISM**

The act of biological terrorism (bioterrorism) involves the deliberate use of microbial pathogens or toxins. Unlike a chemical incident, the effects from bioterrorism may not be fully known until many hours or days after the event. In biological casualties, these are infections or intoxications that, except in specific instances such as an attack with anthrax spores, generally do not require special decontamination (as would be involved in a chemical incident), and despite widespread fears of epidemics—the gift that keeps on giving—most traditional BW agents are noncontagious. Containment measures are mandatory in the event of a smallpox outbreak, however, and for some hemorrhagic fevers and pneumonic plague.

The notion of bioterrorism has a particularly frightening and intimidating aura for most people (including these writers) and may also possess an apocalyptic mystique for both terrorists and the public. Still, BW is essentially an infectious disease problem, or public health in reverse. In keeping with this theme of bioterrorism being the deliberate cause of infectious disease,
bioterrorists may choose among the following categories of pathogens:

- Bacterial agents (including rickettsial organisms)
- Viral agents
- Toxins (derived from plants or animals)
- Parasites (less likely)

As in the case of the chemical agents mentioned earlier, the bioterrorist may choose pathogens or toxins that are very different from those developed by the militaries of the former Soviet Union and the United States (Sobel, Khan, & Sverdlow, 2002). For example, in the military setting, bacteria that cause dysentery (Shigella dysenteriae) or typhoid (Salmonella typhi) have little value in the modern battlefield, although their use has been suggested in the past as sabotage agents (Cohen, 2001). These same pathogens could be used as bioterrorist weapons, however, chiefly as contaminants in adulterated food or beverages.

Also, some parasites such as Cryptosporidium parvum or Giardia lamblia might be utilized by bioterrorists bent on infecting targets through drinking water or contaminated food. For healthy individuals receiving adequate medical attention, these organisms usually do not cause life-threatening diseases, but if delivered efficiently, they could incapacitate large numbers of people.

Toxins such as botulinum toxin (the causative agent in botulism) may also be introduced to a target population. One training manual produced by al-Qaeda members includes references to producing ricin, for example, and other improvised toxins derived from plants and bacteria. These recipes, however, seemed geared more toward individual assassination than a mass casualty attack (Anonymous, 2001).

Bioterrorism and Delivery of BW Agents

Generally speaking, infectious agents and toxins are most efficiently delivered via aerosol, in particles ranging from about 1 micron to 10 microns. For the bioweapon terrorist, particles smaller than 1 micron are problematic in two major respects: Most pathogens in traditional BW are not much smaller than 1 micron (save for certain viruses), and very small particles (around 0.2 microns) are more likely to be exhaled right after being inhaled and will therefore not inoculate the host. Particles larger than 10 microns are much more apt to be caught in the fine hairs of the upper respiratory tract and brought out by the ciliary elevator. Somewhere around 5 microns is the sweet spot, where particles are more likely to deposit into alveolar spaces. It is at this point, as a U.S. expert in BW wrote during the late 1950s, that the “entrance and retention of infectious particles in the alveoli amounts almost to an intratracheal inoculation” (Fothergill, 1958).

The exact details of methods used to produce microbes or toxins, to prepare them for aerosolization, and to deliver these efficiently over a target are tightly guarded secrets. However, weaponization of a BW agent is largely an engineering problem that can be overcome with significant time and effort.

As in chemical terrorism, a contrast is made between the types of biological agent delivery devices developed for military use, and those weapons that could be employed in bioterrorism. In the military context, for example, BW agents such as anthrax spores (Bacillus anthracis) or tularemia bacteria (Francisella tularensis) are most efficiently aerosolized and disseminated over large, concentrated targets. However, as the United States has already seen in 2001, a bioterrorist could send pathogens—such as finely powdered anthrax spores—using a low-tech mode of delivery in an envelope. Although the results of the anthrax mailings were limited in terms of actual numbers of casualties (11 total inhalation anthrax infections, 5 of these fatal), the repercussions were serious enough to call into question the safety of millions of individuals.

Theoretically, any disease-causing microbe or toxin could be used as a biological agent, but only a relative few are practical for weaponization. In the military context, BW agents that have larger casualty-causing potential are those that can become aerosolized, while remaining stable and virulent on their way to the target. The only other possible routes available to the bioterrorist are attacks via ingestion or injection (such as a needle or contaminated object that punctures the skin). For various reasons, these are not efficient methods to create large numbers of casualties.

What Agents Might the Bioterrorist Use?

We have already seen that chemical terrorists or bioterrorists can be resourceful and creative in choosing their agents. Typical BW agents that have been studied and/or weaponized (i.e., prepared for a delivery device) in the past include those that are notoriously capable of infecting via aerosols and respiratory droplets. Terrorists will likely choose those BW agents that are easily found, cultured, grown, and weaponized for dissemination via some delivery device.

One may also hypothesize that factors for terrorists choosing among possible agents include high lethality and name brand recognition. For example, militaries have long studied and developed Coxiella burnetii, the causative agent in Q fever, for use in biological weapons. Although its infectivity is extremely high (some have estimated its infectious dose being one inhaled organism), Q fever is a relatively mild disease and death is...
Virus are so difficult to grow in culture that few would have succeeded in the Soviet Union (Alibek, 1999). Pathogens such as Hantaan virus presented problems even for large-scale bioweapons programs. The development of a plague weapon using Francisella tularensis, a highly infectious organism, was a significant challenge. Although efforts were made to weaponize plague, it is not clear that tularemia is what terrorists have in mind (Croddy & Krcalova, 2001).

Also potentially menacing in bioterrorism are other diseases like plague that can be spread via aerosol. But the isolation and culture of some organisms like Yersinia pestis, for example, presented problems even for large military programs. The development of a plague weapon using stigmatized bioweapons researchers in the United States (Henderson et al., 1998), whereas weaponizing Ebola virus presented problems for BW scientists in the former Soviet Union (Alikibek, 1999). Pathogens such as Hantavirus are so difficult to grow in culture that few would consider this a likely BW threat (Franz et al., 2001).

However, Bacillus anthracis, the causative agent in inhalation anthrax, still remains the premier bioterrorist threat today. The Bacillus anthracis spore is nearly ubiquitous in nature and is not terribly difficult to isolate and grow. Being a spore former, the anthrax bacterium can withstand environmental stress while maintaining its virulence, as well as being hardy enough to withstand chemicals, UV light, and processes used in its weaponization. Finally, especially nowadays, the word anthrax alone strikes a fearsome chord in most people.

Could a bioterrorist manage to take an organism, prepare it in large volume, and release an infectious cloud to affect thousands of people? It is not outside the realm of possibility. A salient example is a vulnerability test conducted by the U.S. military in 1950, during which 100 square miles were covered by an aerosol cloud of anthrax simulant (Fothinghill, 1958). Using a virulent strain of anthrax bacteria, such an attack could reliably infect at least thousands of people, although it must be emphasized that many conditions would affect the actual outcome. Nonetheless, it would not be too far fetched to predict that modern terrorists, using advanced spraying devices such as those employed in the agriculture industry, could duplicate such methods.

Smallpox

There is also heightened concern that a bioterrorist could release smallpox, a disease that has been eradicated from the globe since at least 1980. Officially, only two places on Earth maintain viable smallpox virus in cold storage: Novosibirsk, Russia, and Atlanta, Georgia, at the Centers for Disease Control and Prevention (CDC). Some unconfirmed reports allege that other countries, however, including North Korea and perhaps others, still hold on to smallpox virus specimens. Could a terrorist release smallpox, and how would it affect a mostly immunologically naive population?

Considering the extreme contagiousness of smallpox, and especially its ability to infect via respiratory droplets and aerosols, the mere thought of its re-emergence has been of enormous concern. Thus, in 2001 the United States began a massive stockpiling of enough smallpox vaccine for every person in the country (approximately 300 million doses) in the event of a smallpox outbreak (Gillis, 2001). Considering the consequences of smallpox, preparing a vaccine stockpile seems prudent. But with this heightened alert, there has also been some overreaction. With recent attention given to the threat of smallpox—including a network television program (ER) having aired an episode involving a smallpox outbreak—it is likely that incidents like the one described in the following may be repeated (McKenna, 2002).

On June 13, 2002, while aboard a domestic flight from San Francisco to Memphis, an off-hand remark by a passenger who said that he might have smallpox initiated an emergency response. In this particular incident, a nurse on board was asked to examine the person who reportedly had a rash. The flight crew also radioed ahead with the message that they might have an infectious disease-stricken passenger on board, and paramedics and emergency management officials were dispatched to meet the patient at the Memphis airport. An FBI supervisory agent concluded that the remark concerning smallpox, although unserving, “was absolutely not intended to be disruptive to the flight. But everybody kind of got raised up over the possibility that somehow this might be a situation involving infectious disease. It was not” (Lee, 2002, p. A1).

Sabotage (Food and Water Contamination) Threats

Because of its relative simplicity, among the more likely scenarios for bioterrorist attack remains the contamination of food or beverages. For example, botulinum toxin may not have the effectiveness once thought in aerosolized form, but it could be an extremely
potent food or beverage contaminant. Botulinum toxin is among the most toxic substances known, about 0.4 micrograms being sufficient to kill most adults (Kime & Lowe, 1971). Poisoning a water reservoir using botulinum toxin or other agents is not an effective route for a bioterrorist, though, as the combined effects of water treatment, residual chlorine, and simple (charcoal) water filters would eliminate most threats (Burrows & Renner, 1999). Smaller targets, such as water systems in buildings, may be vulnerable to BW agent attack, but the numbers of casualties would be therefore more limited.

We cannot dismiss the notion entirely, however, and accidental cases of contaminated drinking water are instructive. The 1993 Milwaukee, Wisconsin, outbreak of cryptosporidiosis, although causing few deaths, affected over 400,000 people with cramps and diarrhea (Petersen, 1995). Whereas this outbreak was due to an apparent failure at a water treatment facility, terrorists bent on creating havoc in a large metropolitan city could attempt the use of this or another hardy parasite. But to actually perpetrate such an attack would require the isolation, culturing, and delivery of these organisms through the municipal water system, all being very non-trivial exercises.

We have already seen a case of large casualties that was due to food contamination with a bacterial agent, the 1984 attack by the Rajneeshee cult with Salmonella typhimurium, although no deaths were directly attributable to this bioterrorist attack. This type of assault—basically a crime of opportunity using foodborne bacteria—is probably the more likely type of bioterrorist event we may encounter in the future.

Challenges Posed by Bioterrorism

In bioterrorism, one can separate the causes and effects of many disease processes into two basic categories: pathogenic microbes and toxins. Casualties from aerosolized toxins might present themselves within several hours, as compared with several days for most pathogenic microbes. Unlike chemical terrorism, where the effects of most agents are relatively quick and their detection straightforward, the confirmation of a biological agent attack might only come many days after a release. Furthermore, the actual bioterrorist attack itself—say a release of an aerosolized cloud of anthrax spores over a large city—is unlikely to be noticed. The first sentinel victims will complain of vague symptoms to their primary care physicians and perhaps only after some time will an epidemiological picture form. Where infection has occurred, several pathogens require rapid treatment or most victims will die without prompt treatment.

In a biological event, one of the major concerns will be how to treat those who have been exposed, while managing others who are not at risk of developing illness (the worried well). In early October 2001, even without evidence of a biological threat or attack, many worried people stockpiled antibiotics, including Ciprofloxacin, before the first case of inhalation anthrax was diagnosed (Ricks, 2001). If thousands are suspected of being exposed, one can multiply this number many times for those who may believe they too are going to become sick. Furthermore, despite the fact that most of the classic BW agents are not contagious, it might be easy for some to ascribe biblical portents to a bioterrorist release of an infectious agent. All of these ramifications need to be considered when trying to deal with the real threat of a chemical or biological attack, be it terrorism or even larger scale use by nation-states.

CASE EXAMPLES

Although there are many examples of terrorist plots and attempts to use CB agents, these case examples have been restricted to events that led to actual casualties. This allows a real-world appreciation of many of the concepts discussed earlier regarding the challenges facing the health care community in the event of a chemical or bioterrorist incident.

1. Avenging Israel’s Blood

One of the earliest uses in modern times of chemical agents by a subnational group was the large-scale poisoning of German POWs in 1946. After World War II had ended, a group of Jews calling themselves Avenging Israel’s Blood (Dahm Y’Israel Nokeam or DIN) plotted to take revenge on Germans for the murder of 6 million Jews during the Holocaust. The group was led by a former partisan named Abba Kovner, who formulated the group’s ideology of vengeance. In 1945, DIN developed Plan A, which involved poisoning water supplies across Germany in order to kill hundreds of thousands of Germans, civilians included. Logistical problems resulted in Plan A being subsequently abandoned in favor of Plan B. The latter called for the contamination of the food consumed by German POWs. Plan B targeted Stalag 13, an American prisoner of war camp for SS soldiers near Nuremberg (Sprinzak & Zertal, 2000).

Several members of Avenging Israel’s Blood found work in the camp and managed to smuggle bottles filled with a mixture of glue and arsenic into the camp’s bakery storeroom over a period of days. On the night of April 13, 1946, three members succeeded in entering the storeroom and spreading the arsenic-containing mixture on 2,580 to 3,000 loaves of bread (Sprinzak & Zertal, 2000). In order to avoid non-German casualties, the team only contaminated black rye bread, which was eaten almost exclusively by the German inmates.
Reports of casualties varied. A German newspaper reported that 2,283 inmates out of 15,000 fell ill after eating the tainted bread, and 207 of those were hospitalized, with no known fatalities. DIN sources estimated that 4,300 people were sickened, 1,000 hospitalized, and that 700 to 800 of those hospitalized were paralyzed or died within weeks of the incident.

Avenging Israel’s Blood, a group whose members came from a heavily brutalized community, can be considered as an example of a highly dangerous terrorist group. They sought redemption through violence, displayed a disregard for personal safety, and dehumanized their victims. These factors allowed them to attempt to inflict mass casualties on their enemies. This case also highlights the potential, under certain circumstances, for large-scale casualties presented by even a relatively simple, low-tech delivery system such as the poisoning of foodstuffs.

2. The Rajneeshees

In 1984, a cult called the Rajneeshees committed the only successful, large-scale biological attack in the United States. The Rajneeshee cult, followers of Bhagwan Shree Rajneesh, moved to rural Oregon from India in 1981 and soon developed hostile relations with the surrounding community. Within the cult, the person most involved in the acquisition and use of biological agents was Ma Anand Puja, a nurse who ran the Rajneeshee’s medical facilities.

The Rajneeshees purchased samples of the bacterium Salmonella typhimurium through their own medical facilities and grew these cultures in their laboratories. In August 1984, they distributed Salmonella-laced water to two local commissioners who opposed the cult. The cult leaders, including a woman known as Ma Sheela, also wanted to make voters sick to enable the group to win a local election. In September 1984, as part of a trial run, several members of the cult contaminated salad bars with Salmonella in 10 restaurants in the small town of The Dalles in Oregon. The leader of the group, Bhagwan, a professed pacifist, allegedly approved of this operation, reportedly saying that “it was best not to hurt people, but if a few died not to worry” (Carus, 2000). The result was that at least 751 people became ill with food poisoning. Local health care providers were overwhelmed by the number of patients, and, although no one died, several people became seriously ill. The Rajneeshees also made an unsuccessful attempt to contaminate local water supplies (Carus).

The Rajneeshees eventually abandoned their biological attacks when they realized that they could not win the elections, evidence that the attacks were carried out in order to achieve a specific objective and not for ideological reasons. One of the most important lessons of the Rajneeshee case is that the Salmonella outbreak was initially identified by authorities as a natural outbreak. It was only some time later that it was discovered that the outbreak was intentional and had been perpetrated by the Rajneeshees. This case highlights the difficulties, in certain contexts, of distinguishing between a natural epidemic and bioterrorism.

3. Aum Shinrikyo

One event stands out as having brought to public attention the potential for terrorist use of chemical weapons and WMD in general—the Tokyo subway attack by the Japanese cult Aum Shinrikyo on March 20, 1995. The attackers used the nerve agent sarin, which Aum had manufactured in its own laboratories. The result of this chemical attack was 12 fatalities, 1,039 injuries, and at least 4,000 people with psychogenic symptoms (the worried well). The attack also highlighted some of the difficulties that medical and emergency personnel will have to face in any future large-scale chemical attack.

Aum Shinrikyo was a religious cult dominated by Shoko Asahara, a leader who promulgated apocalyptic visions. Since the early 1990s the cult had been attempting to overthrow the Japanese government and impose a bizarre theocratic state. Asahara soon became fascinated by CB weapons and initiated a program to develop several warfare agents. It has been reported (Gurr & Cole, 2000) that Aum scientists managed to synthesize sarin, tabun, soman, VX, mustard gas, phosgene, and hydrogen cyanide. When it came to mass production, however, their results were poor, and the cult succeeded in producing only about 30 liters of sarin in total. In terms of biological agents, Aum attempted to acquire lethal strains of bacillus anthracis (the causative agent of anthrax) and clostridium botulinum (the source of the deadly botulinum toxin), although they failed to acquire and produce virulent organisms of either bacterium.

The Tokyo attack was neither the first nor the last attempt by Aum to employ dangerous chemical and biological agents. The Chronology of Aum Shinrikyo’s CBW Activities (Ballard, Fate, Ackerman, McCauley, & Lawson, 2001) reveals that between 1990 and 1995, Aum launched 17 known CB attacks. These were mostly aimed at assassinating individual enemies of the cult, and the results of the attacks varied from abortive failures to murder. Before the subway attack, Aum had used sarin on a significant scale in June 1994 in the town of Matsumoto, killing 7 people and injuring 144 in an attempt to assassinate judges ruling against the cult (Kaplan, 2000). Even after the subway attack, with the cult now being actively hunted by the police, Aum tried to set off devices that would release deadly hydrogen cyanide gas in the Tokyo subway system.
Yet, it was the attack on the Tokyo subway in March 1995 that brought to worldwide prominence the deadly designs of this apocalyptic organization. The attack was carried out simultaneously on five separate subway trains when Aum members punctured plastic bags containing a diluted solution of sarin using sharpened umbrella tips. As soon as the sarin vaporized, it began to affect passengers on the trains. Here is how one victim of the Tokyo subway attack describes the scene in one of the gassed train cars:

The train carries on—Shin-otsuka, Myogadani, Korakuen—and around Myogadani lots of people are beginning to cough. Of course, I'm coughing too. Everyone has his handkerchief out over his mouth or nose. A very odd scene, with everyone hacking away at the same time. As I recall, passengers started getting off at Korakuen. As if on cue, everyone was opening windows. Eyes itching, coughing, generally miserable...I didn't know what was wrong with me, it was all so strange... (Murakami, 2001)

On arriving at various subway stations, EMTs were forced to deal with the chaos of hundreds of disoriented and suffering passengers exhibiting the classic symptoms of nerve agent exposure—difficulty breathing, impaired vision, vomiting, and convulsions. As the emergency responders lacked any protective clothing or equipment, some of them began to show symptoms of sarin exposure themselves. Adding to the confusion, responders also used different radio channels and were unable to communicate with various agencies.

Following the sarin attack around 8:00 a.m., between 8:40 and 9:40 a.m. more than 500 patients presented themselves at St. Luke’s International Hospital (Okumura et al., 1998), located within 3 kilometers of the affected subway stations. Hospital personnel were at first greeted with fragmentary and confusing information, initially having been told to prepare for victims of a gas explosion. Even the television news had more data than did the emergency physicians on the scene. Further adding to the chaos was a preliminary, but incorrect, identification of the toxic chemical in question as acetonitrile, instead of what it really was—the toxic organophosphate sarin. Based on their training, medical personnel soon determined that another agent was at work, however, and suspected organophosphate poisoning. Finally, amidst all the confusion, blood tests on the victims, as well as a fortunate phone call from a physician who had treated victims of the Matsumoto attack and information from medical experts in Japan’s Self Defense Forces, pointed to sarin as the culprit. Hospitals in the area did not have adequate supplies of atropine and 2-pyridine-aldoxime-methiodide (2PAM), the standard treatment for victims of nerve agent exposure, and the lack of antidotes quickly became an issue. It did not help that many also suffered effects from secondary contamination in the health care setting (Smithson & Levy, 2000).

The final casualty figures were 1,038 victims, 17 of whom were identified as critical (requiring intensive care), 37 severely injured (gastrointestinal problems and muscular twitching), and 984 slightly injured (vision problems such as myosis). Ultimately, there were 12 fatalities (Woodall, 1997). However, more than 4,000 people who reported to hospitals (approximately 80% of the total number of patients) were actually psychogenic victims with no physiological signs of exposure (Smithson & Levy, 2000). The end result was that the main, central part of metropolitan Tokyo—one of the world’s largest cities—was paralyzed for several hours. The attack also revealed serious shortcomings in the city’s emergency response coordination and communication.

At first glance, the case of Aum Shinrikyo seems extremely alarming. Aum tried to kill thousands of people and came fairly close to succeeding. Even though the Tokyo subway attack caused limited fatalities, this was mostly because the sarin was of low quality and purity. Also, Aum developed a large variety of chemical and other agents and its use and possession of these weapons came as a total surprise to Japanese law enforcement and international intelligence agencies.

On closer analysis, however, the case of Aum Shinrikyo may not be as threatening as it first appears. Aum was a unique terrorist organization, with an estimated 40,000 followers including many highly skilled personnel and unprecedented financial resources (perhaps as high as $1 billion). Yet, despite devoting 5 years’ worth of research and resources toward developing chemical and biological weapons, the results were surprisingly limited. Their attempts at biological attacks were abortive failures and even the Tokyo subway attack utilized the incredibly crude delivery method of puncturing sarin-filled plastic bags using sharpened umbrella tips.

Nevertheless, the Tokyo incident certainly changed the way the world viewed terrorism—the prospect of true mass casualty events was brought home to many for the first time. Japan found itself ill-equipped to deal with a large-scale terrorist attack using chemical agents. Furthermore, some analysts concluded the Tokyo attack removed the taboo against the use of WMD by terrorists.

4. The 2001 Anthrax Attacks

Right on the heels of the events of September 11, 2001, the U.S. public was shocked by the first lethal terrorist attack using a biological warfare agent. Letters containing the deadly bacterium Bacillus anthracis, which causes anthrax, were sent through the mail to prominent politicians and media representatives. Despite hundreds
of anthrax hoaxes over the preceding years in the United States, this was the first time that actual anthrax spores were used. In total, 22 people were diagnosed with the disease. Eleven were diagnosed with inhalation anthrax, five of whom died. Another 11 people were diagnosed with the cutaneous form of the disease, with no deaths (Freirichs, 2002). The victims of the attacks included workers in the media and the U.S. postal service who came into direct contact with the letters, as well as cases of cross-contamination. Thus far, authorities have been unable to identify who sent these letters or how this person (or persons) managed to produce such a highly refined powdered form of anthrax. As of this writing, the investigation continues without any arrests.

The anthrax attacks hold two main lessons for the medical profession. The first is the necessity of having some knowledge of the agents most likely to be used in bioterrorist events and maintaining a high index of suspicion when confronted by atypical clinical cases. The sooner a case is identified as the result of bioterrorism, the sooner measures can be taken to mitigate its effects. Prompt diagnosis can not only save the lives of patients, but it can also forestall a potential epidemic in the case of contagious organisms such as smallpox. The second lesson taught by the anthrax attacks is the degree of psychological stress such events place on the public. This stress can have repercussions for the medical system. Officials from U.S. federal health agencies reported that 32,000 Americans took antibiotics out of concern brought on by the anthrax mailings. During that time, a poll (n = 1,015) taken by the Harvard School of Public Health indicated that 25% of those surveyed were “very or somewhat worried” that they might become infected with anthrax from letters or at the workplace. Almost 15% said that they had taken one or more extreme precautionary measures, including the purchase of gas masks, firearms, or stockpiling antibiotics (LaSalandra, 2001). Many concerned citizens approached health care providers with questions as to how to protect themselves against anthrax. It is likely that in future cases, physicians, nurses, and those answering 911 calls can expect to be inundated with anxious people looking for answers. Yet, it should also be pointed out that there were no overt signs of panic, generally speaking, in the United States following confirmation of the first inhalation anthrax cases.

Although the anthrax attacks are an unprecedented phenomenon, the incidents themselves occurred on a small scale, with the apparent intention of frightening rather than killing large numbers of people. However, if terrorists have indeed succeeded in achieving the capability to manufacture such a deadly form of the disease, the medical community must be prepared for the possibility that such targeted attacks could be followed by attempted mass-casualty assaults.

5. Food Contamination

The following two recent examples of food contamination indicate the ease with which toxic chemicals can be used to cause casualties, but also the difficulties associated with causing mass fatalities by this method.

On December 31, 2002, Randy Jay Bertram, a meat department worker at a grocery store in Grand Rapids, Michigan, mixed a nicotine-based insecticide into approximately 200 pounds of ground beef that he was preparing. The insecticide, known as “Black Leaf 40,” is believed to have sickened 111 people, several of whom sought hospitalization. None of the victims of the poisoning died (Boulton et al., 2003). Apparently Bertram poisoned the meat in an attempt to cause trouble for a supervisor with whom he was having a dispute. Bertram received a sentence of 9 years in federal prison, followed by 3 years of supervised release (Pritchard, 2003).

In October 2003, a woman named Chen Xiaomei poured Dushuqiang, a rat poison banned because of its toxicity (Croddy 2004), into the rice served at her husband’s funeral in a rural area in central Hubei province, China. Soon after consuming the contaminated rice, the guests reportedly began vomiting and shivering violently. One guest died approximately 5 minutes thereafter, with nine further guests dying either at the table or in transit to the local hospital. In total, the poisoning resulted in 10 deaths and 23 nonfatal injuries. It is believed that the remote location of the village contributed to the high mortality rate by delaying the receipt of medical attention. Chen had used the poison in order to punish her son and apparently did not intend any guests to die from the poisoning (Attention-craving mother, 2003).

The cases described herein are only a small percentage of the total of terroristic incidents involving chemical and biological agents, but they do serve to illustrate the diversity of perpetrators, delivery methods, and agents used. The cases also highlight some of the difficulties involved in detecting, identifying, and responding to these attacks and should drive home the necessity for health care professionals to gain a sober, well informed, and practical understanding of the nature of chemical and biological terrorism.

MASS PSYCHOCIGENIC ILLNESS

In addition to the physiological injuries they may cause, attacks or even threats involving chemical or biological weapons will have certain negative effects on both those in the vicinity of the attacks and the general population. One possible effect is mass psychogenic illness. Psychogenic illness describes a constellation of disease symptoms in a group of individuals, but the cause of their ailments cannot be determined. Usually this
occurs within a group of people sharing a similar venue or experience who believe that their illness is caused by an environmental toxin or pathogen. Again, no etiological agents are identified in these incidents, although an unspecified odor is often reported that probably serves as a trigger. Mass psychogenic illness tends to affect women and girls more than their male counterparts (Taylor & Werbicki, 1993). Attention from the media usually causes more consternation among the most affected, and, ironically, a dedicated response from emergency responders often makes their psychogenic symptoms worse.

However, rarely is the topic of psychogenic illness covered to an appreciable degree in medical or public health education. Furthermore, many in the public (including some promoters of alternative medicine) do not respond well to suggestions that psychogenic illness really exists. Certain people believe that no matter what, a toxic agent must be involved (Gormley, 2000). Until a definite etiological agent is identified, health care providers are forced to rule out every possible toxic compound, a rather lengthy and frustrating process for all concerned. Occasionally, when no specific agent is found, popular notions of a conspiracy or cover-up by the authorities often coalesce around the victims (Jones et al., 2000).

Many people in modern developing and industrialized societies have heightened awareness of environmental hazards. This, coupled with high stress—including tension from current events involving terrorism—can contribute to instances of mass hysteria. The psychological effects of bioterrorism on the population at large—and even some trained professionals in emergency response—cannot be underestimated. Some authors note that the signs of a bioterrorist event may be very similar to mass psychogenic illness (Jones et al., 2000). Similarly, there may be an increased incidence of psychogenic illness along with heightened concerns over chemical and biological terrorism.

Although the effect of environmentalism has been largely salubrious, it has also sensitized many people to unwarranted fears involving chemicals and other unseen toxins (Petrie & Wessely, 2002). Especially when played up by the media, anxiety of toxic exposures can lead to mass hysteria/psychogenic illness in a variety of situations, especially in school settings. Following the 9/11 terrorist attacks, for example, paint fumes sent 16 students and a teacher to a hospital (September 29, 2001), and more than a thousand students in the Philippines—complaining of general cold or flu-like symptoms—also sought medical attention because of unfounded rumors of bioterrorism (Wessely et al., 2001).

Another example occurred at a flea market in Palm Beach, Florida, approximately a month after the first inhalation anthrax case was confirmed in neighboring Boca Raton. In this incident, 67 people complained of irritated throats and eyes, and emergency responders were brought in to investigate. The 911 call initially reported that there were shoppers who had difficulty breathing, with itchy and runny eyes. A few complained of mild nausea. Using an APD 2000 chemical warfare agent detector (manufactured by Environmental Technologies Group, Baltimore, MD), a special operations division of the local fire department initially detected VX nerve agent in the shopping center (Bhatt, Caputo, & Hain, 2001). This was probably due to the high sensitivity but relatively low specificity of the detection device. In any event, the symptoms and relatively good health of those affected seemed to contradict this initial reading. Emergency responders then called for those affected to remove all clothing and to be taken to nearby hospitals. (As one representative of Dr. Flea’s International Flea Market complained, “They forced people to strip; their rights were violated. There are vendors who saw other vendors nude, and they don’t like it.”) The local newspaper reported that nurses and doctors in full scrubs waited at St. Mary’s for the ambulances to arrive. They sat outside the ER impatiently as the minutes ticked by without word of what had happened or when victims would be released to hospitals from decontamination showers. (Bhatt, 2001)

After ruling out VX, investigators considered the gas Freon (a commonly used chlorinated fluorocarbon for refrigeration) as the culprit, possibly issuing from an idle refrigerator in the market. Some speculated that Freon could have somehow converted into phosgene, a potent lung irritant in high concentrations, but this was fanciful. It might also have been a release of pepper spray from a leaking spray bottle or by a prankster. Whatever the actual cause—and it appears to have been mass hysteria—the total costs including hospital charges that resulted from the incident were more than $100,000. Psychologically speaking, the long-term effects of a real or perceived chemical/bioterrorist event will likely make continued demands on the health care system. In the event of an actual chemical or bioterrorist attack on civilians, the psychological dimension of its long-term consequences is likely to be profound. If recent (and sensationalized) claims of Gulf War syndrome, environmental illness, and other loosely defined ailments are any indication, a certain percentage of those in the vicinity of the attack will claim a variety of unexplained symptoms long after a chemical or biological attack. How to reconcile these health complaints with the lack of clinical data or even the existence of a plausible etiologic agent will take the combined efforts of many disciplines.
In the context of chemical or biological terrorism, mass psychogenic illness presents several significant challenges for health care personnel. First, although obviously erring on the side of caution, emergency personnel need to be able to distinguish as quickly as possible between an actual chemical or biological attack and an instance of mass hysteria. This will prevent wasting valuable time and resources. It will also help lower public anxiety by foregoing unnecessary, costly, and potentially humiliating decontamination procedures. It will also allow health care workers to appropriately deal with the concerns of worried patients. Second, following an actual chemical or biological attack, emergency personnel need to be aware of the probability that many of those presenting themselves for treatment may not actually have been exposed to the agent. They must, therefore, be able to differentiate as quickly and accurately as possible between the physiological victims of the attack and the worried well and deal with each accordingly. In the case of a nerve agent release, for example, one would obviously want to reserve the use of antidotes for those who were actually exposed.

**SUMMARY**

A terrorist attack using chemical or biological weapons is an alarming prospect, all the more so after the tragedy of 9/11. Although the likelihood of a large-scale chemical or biological terrorist attack is not as great as some media reports would have us believe, there are at least some terrorist groups and individuals who could attempt to attack civilians with CB agents. This makes preparing for such an event essential.

We have already seen that chemical incidents are relatively quick-acting and limited, whereas biological incidents would take time before they are recognized for what they are. In general, one can consider a chemical release or attack to be a “lights and sirens” affair, that is, rapid response and (hopefully) expeditious treatment of casualties. In a bioterrorist event, however, people would be unlikely to know that they were exposed to an infectious agent or toxin until the first symptoms appear, at the very least several hours following the event.

Little can be said with certainty as to what would actually happen, or how the public at large would respond in the event of a major chemical or bioterrorist attack. There is general agreement, though, that should a chemical or biological agent be used in a violent act, the effects of this kind of terrorism will extend far beyond its immediate danger to the public. It is, therefore, incumbent on every health care provider to understand all aspects of this threat and to train and prepare for an event all hope will never occur.

### STUDY QUESTIONS

1. A 33-year-old patient presents with a maculopapular rash of no discernible pattern, and he is very agitated and concerned. He says that he had chicken pox as a child, and the books and magazines he has read indicate that it all leads to one conclusion: smallpox. What might you say to this individual to calm his fears? Why?

2. Which groups appear to be interested in using chemical and biological agents? Why do you think they find these attractive?

3. If one were forced to choose between equipping ambulances with extra atropine autoinjectors in the event of a nerve agent release or instead equip these with cyanide antidote kits, which would you choose? Why?

4. In 2002, a state of mysterious rashes appeared in schoolchildren in the United States and Canada. According to the CDC’s Monthly Morbidity and Mortality Report (June 21, 2002), “The sex distribution of cases varied among the schools, ranging from 33 percent to 100 percent female.” An etiologic agent has yet to be found. Why did the CDC find it relevant to note the gender of the distributed cases?

5. Someone receives an envelope and on opening it discovers a white powder along with a letter that reads, “You have just been exposed to anthrax.” What should that person do?

6. Working in the Emergency Room, you receive notification that there has been a confirmed attack on an office building using chlorine gas. What type and number of casualties should you prepare for?

7. Your neighbor tells you that he refuses to drink tap water because he fears that terrorists might contaminate it. Should you follow suit? Why?

### REFERENCES


Anonymous. (2001). Declaration of Jihad against the country’s tyrants (Military Series, Lesson Sixteen: Assassinations Using Poisons and Cold Steel. UK/BM-153-160, Trans.) (This is a bona fide document, a military manual written by and/or for al-Qaeda. But no one has claimed authorship; intelligence sources believe it is authentic. Copies were seized by Manchester, UK, police in 2001 and translated the same year. No more details are yet known.)


Chapter 10 Biological and Chemical Terrorism


CASE STUDY

19.1

Preparation for WMD in Omaha, Nebraska

Patricia A. Lenaghan and Celeste M. Felix
Nebraska Methodist Hospital and Omaha Metropolitan Medical Response System

In 1996, the federal government passed the Nunn-Lugar-Domenici Act, which created Metropolitan Medical Response Systems (MMRS) to better prepare cities for terrorism, including nuclear, chemical, and biological attacks. Since 1996, the Office of Emergency Preparedness has funded multiple cities. Omaha received these federal funds in 2000 to prepare the health care community to handle weapons of mass destruction (WMD). Because the contract covered a 25-mile radius, Council Bluffs, Iowa, and surrounding communities were included in the planning. This also involved two Council Bluffs hospitals.

Before funding, a steering committee was created in the Omaha metropolitan area to assess the health care community’s preparedness for terrorism. In 1998, the Omaha Fire Department invited all hospitals to attend a Department of Defense-sponsored nuclear, biological, and chemical training entitled “Domestic Preparedness.” With this training came the realization that health care workers were not knowledgeable regarding nuclear, biological, and chemical agents, and hospitals were not prepared to provide decontamination to patients or protect their health care workers. Based on this, a hospital-led multiagency steering committee was established. The steering committee is made up of representatives from all the Omaha-Council Bluffs health systems, fire departments, EMS, law enforcement (including city police, county sheriff, state patrol, and the FBI), state and local emergency management agencies, public health, state public health lab, poison control, air force base, National Guard, VA hospital, coroner’s office, medical society, behavioral health, critical incident stress management, airport authority, representatives from the mayor’s office, technical communications experts, media, public works, veterinarians (zoo and humane society), public schools, Red Cross, United Way, Chamber of Commerce, U.S. attorney’s office, funeral directors, and health supply companies. About a dozen physicians representing specialties of emergency medicine, infectious disease, psychiatry, and pathology have also been involved on committees, in consultation and in policy/procedure review. The steering committee evolved to include agencies that have fundamental roles in disaster management, community response, or health care. The steering committee has grown to include more than 40 agencies and 200 members.

Initial subcommittees formed included laboratory/surveillance/infection control, community response plans, hospital plans, communications, pharmacy, and equipment/training. These committees appointed chairpersons and began monthly meetings to lay out plans to complete specific MMRS objectives. Later, mental health, media, and alternate care facility subcommittees were added to address specific agendas related to mental health care, media coordination, and alternate care sites.

The steering committee and subcommittees continue to meet monthly. All 200 members are invited to attend the steering committee where each committee reports on progress of work. Budget items are discussed and agreed on by the entire group. Networking opportunities allow members to share ideas and elicit support for plans. The group has had guest speakers to discuss National Disaster Medical System (NDMS), including Disaster Medical Assistance Teams (DMAT), Disaster Mortuary Operational Response Team (DMORT), and Incident Command.

The MMRS contract has more than 300 objectives and 11 deliverables to be completed in 3 years. A deliverable is a government-required report on the progress of the objectives. Each objective was assigned to a subcommittee for inclusion in planning. The first five deliverables were completed during the first 12 months of the contract. The second five deliverables were completed by the end of 18 months. One final deliverable is due at the end of the 36th month.

Significant accomplishments to date include the installation of decontamination capabilities at each of the 12 hospitals, decontamination and hazardous material overview training, drug and treatment reference cards for nuclear, biological, and chemical agents for both hospital and prehospital care providers, purchase of drugs to treat chemical agents, a plan for delivery and purchase of antibiotics, a hospital plan, a media plan, a mental health plan, and purchase of WMD equipment for law enforcement personnel.
The leadership, cooperation, and commitment by members have been exceptional. The working draft plan is well designed because of the vast experience and the depth of knowledge of those individuals who know how the systems should function and work together during a disaster. The final preparations of hospital and citywide preparedness are in draft form and soon will be implemented, thanks to committed volunteers who began their work well before September 11, 2001.

CASE STUDY


Sherri-Lynne Almeida, 2002 President, Emergency Nurses Association

Statement of Problem

Weapons that involve biologic, nuclear, incendiary, chemical, or explosive components are no longer exclusive to the military. Suicide bombings, explosive-laden vehicles driven/flown into populated buildings, release of radioactively laced explosives, and hazardous biologic organisms are examples of weapons of mass destruction used against civilian targets worldwide. Because all communities are vulnerable, they must be prepared to deal with the aftermath of an attack.

Association Position

- Emergency Nurses Association (ENA) supports the active participation of emergency nurses in planning and implementing hospitals’ responses to the aftermath of WMD incidents. Active participation in community, state, regional, and national planning efforts focused on WMD is encouraged.
- ENA believes that an effective response to WMD incidents will require an integration of community resources to augment the health care response. This will require an integration of police, fire, emergency medical services, health departments, medical examiners, and emergency management agencies.
- ENA believes that response plans must include care of victims across all age groups and diverse populations.
- ENA supports development of basic and advanced continuing education courses and training to prepare emergency nurses in the care and treatment of victims of WMD. Such courses and training would include incident command systems, triage systems, surveillance systems, knowledge of hazardous materials, and decontamination procedures.
- ENA supports the inclusion of content on WMD in core curriculums for health care professionals.

Rationale

The threat of WMD is a reality. Health care professionals with the skills, knowledge, and resources that are integrated with a communitywide plan offer victims the best hope for survival.

REFERENCES


2002 Weapons of Mass Destruction Workgroup

Approved by the ENA Board of Directors. July 2002.

Key Messages

- A key function of surveillance systems is the detection of biological events.
- An effective public health response to a biological event is dependent on early detection and recognition.
- New approaches to surveillance that focus on pattern recognition may enhance the timeliness of event detection.
- An emergency information system that facilitates rapid and timely exchange of data in a suspected outbreak is an essential component of a surveillance system for biological events.
- Community service organizations can contribute to public health surveillance systems as formal or informal surveillance partners.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the process of infectious disease transmission.
2. Describe the key activities in a surveillance system.
3. Describe the concept of syndromic surveillance.
4. Give examples of health or health care behavior patterns that may be indicators of a biological event.
5. Describe the role of community service organizations in infectious disease surveillance.
Surveillance Systems for Detection of Biological Events

Erica Rihl Pryor

CHAPTER OVERVIEW

This chapter provides a brief overview of systems currently in place for the detection of biological events, either naturally occurring disease outbreaks or deliberate bioterror events. Basic concepts related to infectious disease epidemiology and surveillance are presented. Different types of surveillance systems, including syndromic surveillance, are described. The roles of the local and state health departments in the national disease surveillance systems overseen by the Centers for Disease Control and Prevention (CDC) are outlined, along with the potential role of community service organizations as surveillance partners. Online resources about surveillance systems are also provided.

INTRODUCTION

At the end of the last decade, there was a growing recognition of the need to improve capabilities for the recognition and detection of infectious disease threats, whether from newly emerging diseases or from deliberate acts of bioterror (CDC, 1998; World Health Organization, 1998). During that time, the CDC developed and implemented strategic plans to address these threats (CDC, 1998, 2000, 2002). These plans included specific elements related to improving the national capabilities for monitoring the occurrence of infectious diseases through surveillance.

HOW DOES INFECTION OCCUR?

A classic model used to describe the process by which infectious disease occurs is the epidemiologic triangle (Mausner & Kramer, 1985). The three points of the triangle are the infectious agent, a susceptible host, and the environment in which the agent and host interact. One end point of this interaction may be infection (CDC, 1992).

Infections agents can enter a susceptible host in various ways, which are identified as its mode, or modes, of transmission. These modes of transmission include direct contact with the source, including contact with
aerosols generated from coughing or sneezing, and various indirect methods including breathing in infectious particles (i.e., airborne transmission), eating or drinking contaminated food or water, or being bitten by an insect or other vector carrying the agent (CDC, 1992; Giesecke, 2001). Some agents are transmitted in only one way; others, including several of the CDC Category A agents, can enter a host through several routes and may produce different symptoms depending on how the agent entered the host’s body (Dennis et al., 2001; Ingleby et al., 1999, 2000; U.S. Army Medical Research Institute of Infectious Diseases [USAMRIID], 2005). Much of the attention focused on bioterror agents is related to the respiratory forms of disease that would be produced by a deliberate release and subsequent airborne transmission of such agents.

After an appropriate incubation period, clinically apparent illness is one of the outcomes of infection (Giesecke, 2001). The clinical manifestations of the illness may be characteristic for that particular infectious disease or they may present as a more general pattern of signs and symptoms that, by itself, does not point to a specific disease. For example, influenza-like symptoms may be seen in the early clinical phase of several CDC Category A agents following airborne transmission, including anthrax, plague, and tularemia (Franz et al., 2001; USAMRIID, 2005).

**HOW CAN INFECTION BE PREVENTED?**

Health care providers can employ several strategies to prevent infection from occurring. One approach is to alter the susceptibility of the host by giving vaccines or immune globulins. Another approach is to use protective equipment such as gloves and masks to prevent transmission of the organism. Early recognition of exposure to certain agents can also provide an opportunity for prophylaxis with appropriate antimicrobials. In addition, early treatment of infected individuals can prevent further spread of the organism (Mausner & Kramer, 1985). In a deliberate biological event, initiating effective treatment early may also lead to improved clinical outcomes, as shown in the anthrax outbreak in 2001 (Jernigan et al., 2001). Early recognition is therefore imperative for an effective response that minimizes morbidity and mortality through implementation of appropriate preventive measures.

**HOW IS DISEASE OCCURRENCE MEASURED?**

Epidemiologists use several terms to describe disease occurrence in a population. A frequency of disease that is considered expected or baseline is referred to as the endemic level of a disease (Gordis, 2004). When that expected level is clearly exceeded, then the occurrence is considered to have reached an epidemic level, and public health officials may term that occurrence an epidemic or an outbreak. An epidemic occurring on a global scale is termed a pandemic (Gordis). Public health surveillance data are used to determine endemic or baseline levels of disease occurrence, which allow detection of changes or unusual patterns that may indicate an outbreak is occurring (CDC, 2004b).

**WHAT IS PUBLIC HEALTH SURVEILLANCE?**

In the field of public health, the term surveillance refers to “the ongoing, systematic collection, analysis, interpretation, and dissemination of health data” (CDC, 2001b, p. 2). The data collected and analyzed through surveillance systems provide information about patterns of disease occurrence in a population. In turn, this information forms the basis of action by public health officials in designing, implementing, and evaluating interventions to control or prevent disease (CDC, 1992).

The activities carried out in a surveillance system are described briefly in the following.

**Data Collection**

Several types of data are routinely collected related to infectious disease surveillance, including morbidity, mortality, and health indicator data (CDC, 1992). Each state has requirements for mandatory reporting by health care providers and facilities, including laboratories, of cases of notifiable infectious diseases. There is a national notifiable disease list as well, for which reporting is voluntary, with data compiled through the National Notifiable Disease Surveillance System (CDC, 2004d, 2006).

**Data Analysis and Interpretation**

Following data collection, data are summarized and analyzed in terms of person, place, and time, and examined to identify changes in patterns of occurrence (CDC, 1992, Janes et al., 2000). These pattern changes are then examined and possible explanations evaluated. If an increase in an infectious disease occurrence is noted, a key question is whether this is a naturally occurring increase or the result of a deliberate attack (CDC, 2004b).

**Data Dissemination**

The final step in the surveillance process is dissemination of information back to the original providers...
and to public health officials at various levels so that appropriate actions for control and prevention can be taken (CDC, 1992). The Morbidity and Mortality Weekly Report (MMWR), available in print and online at http://www.cdc.gov/mmwr, is one of the principal methods used to disseminate such data in the United States. The Health Alert Network is another system recently developed by CDC to rapidly send information electronically to stakeholders (CDC, 2007c). At the international level, surveillance information is routinely disseminated through the Weekly Epidemiological Record, prepared by the World Health Organization (WHO, 2007).

**WHAT TYPES OF SYSTEMS ARE USED TO COLLECT SURVEILLANCE DATA?**

The first indicator of a biological event may come from routine public health surveillance systems (Institute of Medicine [IOM] & National Research Council [NRC], 1999). Traditional systems for surveillance fall into four general categories:

- **Passive:** In a passive system, health care providers or institutions initiate case reports, which are compiled at the local level and subsequently at state and national levels (CDC, 1992). The National Notifiable Disease Surveillance System (NNDSS) is an example. An important point is that it is only after individual case reports are compiled that an outbreak may be apparent (Bréb, 1986), so timely reporting is essential for effective control.
- **Active:** With active surveillance, the health department actively searches for cases (CDC, 1992). As this process typically requires many more resources than a passive system, its use is usually limited to outbreak situations. For example, the New York Department of Health used an active case finding approach during the 1999 West Nile virus outbreak (Fine & Layton, 2001).
- **Sentinel:** Sentinel systems can take several forms. One type of sentinel system used by the CDC collects data on selected diseases from predetermined groups of health care providers or institutions. An example is the primary care provider network that supplies weekly information on influenza activity (CDC, 2004e). Another type of sentinel system involves periodic monitoring of specific animal or insect populations for evidence of certain infections (CDC, 1992).
- **Special systems:** Special systems focus on a particular disease or type of surveillance data, and may include a combination of several different types of surveillance systems. Examples of special systems are the surveillance system designed to monitor West Nile virus, which includes passive and active reporting, and a sentinel system that monitors flocks of birds and insect vectors (CDC, 2003; National Center for Infectious Diseases [NCID], 2004b), and the system in place to monitor influenza (CDC, 2004e).

**What Elements Are in the Influenza Surveillance System?**

Influenza surveillance is of particular interest to public health officials because an increase in influenza-like illnesses may be an indicator of a bioterror event (Franz et al., 2001). The surveillance system currently in place for influenza includes several components. One component is a sentinel system of primary care providers who report weekly on the percentage of clients in their practices presenting with flu-like illnesses (CDC, 2004e). Other components include weekly reports on the numbers and types of influenza isolates submitted for testing through a laboratory-based system, weekly estimates of flu activity from the respective state and territorial health department epidemiologists, and data on deaths from pneumonia and influenza reported from the 121 Cities Mortality Reporting System (CDC, 1992, 2004e). Data summaries from these and other components are updated weekly and are available online (CDC, 2004g) and are also disseminated through periodic updates in the MMWR.

**What Other Infectious Disease Surveillance Systems Are in Use?**

There are many infectious disease surveillance systems currently in use, operating from the local to international levels (WHO, 1998). In the United States, the CDC has the primary role in overseeing national-level surveillance and prevention/control activities related to infectious diseases (CDC, 1998). The CDC has oversight of an array of infectious disease surveillance systems, a few of which have been mentioned in previous sections. A complete listing and description of these surveillance systems is available on the CDC Web site. Several components are described in the following.

Among the most recognized national surveillance system is the NNDSS (CDC, 2004d). Table 20.1 gives the 2006 list of diseases notifiable at the national level (CDC, 2006). The list is reviewed annually by the CDC and the Council of State and Territorial Epidemiologists, and it includes most of the diseases identified as potential bioterror agents (CDC, 2000). Each of the diseases on the list has criteria defining a confirmed case of that illness (CDC, 1997). These definitions are also updated periodically and are also available online. NNDSS data are collected through the National
WHAT SURVEILLANCE INITIATIVES HAVE OCCURRED IN RESPONSE TO BIOTERROR THREATS?

As part of the strategic plan to respond to infectious disease threats, several surveillance programs have been initiated through the CDC to strengthen the capacity for timely disease detection (CDC, 1998). One program initiative is the Epidemiology and Laboratory Capacity (ELC) program, which was designed to enhance laboratory-based surveillance capabilities in state health departments and selected local laboratories in major U.S. cities (NCID, 2003b). Particular emphasis has been placed on capabilities to identify potential bioterror agents.

The Emerging Infections Programs (EIP) includes several surveillance initiatives that specifically focus on emerging infections (NCID, 2003a). One of these systems is the Foodborne Diseases Active Surveillance Network (FoodNet), a collaborative program with the U.S. Department of Agriculture and the Food and Drug Administration that focuses on identifying cases of diarrheal illness resulting from foodborne pathogens (CDC, 2004a). Another system is the Unexplained Deaths and Critical Illnesses Surveillance System, which focuses on such cases that are suspected of having an infectious etiology (Hajjeh et al., 2002; NCID, 2004b). As with FoodNet, this is also an active surveillance system.
Provider-based surveillance networks that focus on emerging infectious diseases have also been established. Examples include the GeoSentinel network discussed previously (NCID, 2004a) and the network of more than 500 infectious disease specialists who participate in the Infectious Disease Society of America (IDSA) Emerging Infections Network (CDC, 1998). Another example is the sentinel network of urban emergency departments participating in the EMERGEncy ID NET system (NCID, 2004a; Talan et al., 1998).

THE ROLES OF STATE AND LOCAL HEALTH DEPARTMENTS IN INFECTION DISEASE SURVEILLANCE SYSTEMS

State and local health departments play important roles in infectious disease surveillance, as well as in prevention and control activities during outbreaks (CDC, 2001, 2004b). State health regulations establish mandated reporting for specific infectious diseases and provide health officials with legal authority for certain prevention and control activities, for example, investigating outbreaks (CDC, 2001). The NNDS represents a compilation of infectious disease surveillance data provided by the state and territorial health departments (CDC, 2004d). In addition, the CDC collaborates with selected state health departments for special systems, such as the Emerging Infections Program (NCID, 2003a).

A key component of the national bioterrorism response plan developed by the CDC is strengthening state-level surveillance capabilities to detect potential bioterror events (CDC, 2000). This is being accomplished through (1) enhanced laboratory capabilities to identify agents, (2) improved communication systems for emergency notification, and (3) increased personnel to perform surveillance activities (Koplan, 2001). These enhancements are being implemented with the active involvement of state and local health departments (CDC, 2001). Most of the activities concerning infectious disease surveillance occur within the county or city health departments that compose a state public health system (CDC, 2004b). It is therefore likely that the initial opportunity for detection of a biological event will occur at the local level (CDC, 2000; Franz et al., 2001). That opportunity may be provided through a case report from an individual clinician.

THE ROLE OF CLINICIANS IN INFECTION DISEASE SURVEILLANCE

A report from an alert clinician in an emergency department or primary care facility may trigger the initial public health response to a biological event (CDC, 2001a). The timeliness of such case reporting is critical to an effective response, but early detection of biological events may be difficult to achieve (CDC, 2000; Henderson, 1999). Clinically apparent illness will occur several days to weeks after exposure, depending on the incubation period of the agent used (CDC, 2004b; Franz et al., 1997). Affected persons may be in widely dispersed locations and present to different health care providers (CDC, 2000). Decisions made by clinicians in those facilities regarding what tests and treatments are ordered may ultimately determine whether a case is correctly diagnosed and reported.

How can clinicians contribute to early detection of biological events? First, health care providers should be familiar with the usual clinical presentations for potential bioterror agents. For example, smallpox produces an acute illness with fever and a characteristic rash (Henderson et al., 1999), and botulism presents with a characteristic pattern of paralysis (Arnon et al., 2001). Second, clinicians should be alert for unusual patterns of illness among their clients, that is, a cluster of cases that does not fit the expected epidemiological pattern (Franz et al., 2001). For example, a single patient presenting to an emergency department with rapidly progressing pneumonia would not be unexpected, but an influx of several similar cases over a short period of time should raise the index of suspicion that a biological event may be occurring. Some examples of patterns that would be suggestive of a deliberate bioterror event are listed in Table 20.2 (CDC, 2001; USAMRIID, 2005).

Case reports from physicians and other health care providers are a key data capture method in traditional public health surveillance and will continue to be an important data source in spite of less than optimal timeliness and completeness of such reporting (CDC, 2004b; IOM & NRC, 1998). At the same time, given the importance of early detection to the effectiveness of the response plan, additional surveillance approaches are being developed and tested that are designed to improve the timeliness and sensitivity of a biological event detection. Many of these new approaches are categorized as syndromic surveillance.

SYNDROMIC SURVEILLANCE

Syndromic surveillance refers to “surveillance using health-related data that precede diagnosis and signal a sufficient probability of [a] case or an outbreak to warrant further public health response” (CDC, 2004a, p. 1). Such surveillance occurs in real-time or near real-time to achieve what has been termed “pre-emptive surveillance” (Teich, Wagner, Mackenzie, & Schafer, 2002, p. 6). The primary purpose of syndromic surveillance systems is earlier and more complete detection of outbreaks (CDC, 2004b), although systems to monitor other health
20.2 Epidemiological Patterns Suggesting a Covert Biological Attack

1. A cluster of cases with similar clinical presentation and at a similar stage of illness.
2. A cluster of unexplained illness in a defined population, such as that associated with a specific location or event.
3. Unusually severe disease or higher mortality than expected for a given agent.
4. A cluster of cases with an unusual or uncommon mode of transmission for a given agent.
5. Multiple or serial outbreaks of different diseases in a defined population.
6. A disease atypical for a given age category.
7. A disease unusual for the region and/or season.
8. Clusters of the same illness in dispersed locations.
9. Clusters of illness or deaths in animals or livestock occurring in a similar time frame as human illness.

Conditions are also being evaluated (Henning, 2004). The general process for early detection of biological events is shown in Figure 20.1 (CDC, 2004b).

The term syndromic is something of a misnomer as it implies a focus solely on syndromes, or collections of signs and symptoms. Many syndromic systems have been designed to capture presenting symptoms suggestive of a biological event; however, other types of indicators have also been used (Buehler, 2004; CDC, 2004b; Henning, 2004). Examples include laboratory test requests, over-the-counter medication sales, and work or school absenteeism. The use of indicator data rather than clinical diagnoses is one characteristic that distinguishes syndromic surveillance from traditional public health surveillance (CDC, 2004b).

Because many bioterror agents may initially present with nonspecific symptoms, one limitation of systems based on presenting symptoms is the lack of positive predictive value; that is, the system will identify many potential cases that are unrelated to an event (i.e., false positives) along with the cases that may truly be related to an event (Buehler, 2004; Henning, 2004). Syndromic surveillance is therefore most useful as a first step in identifying clusters of cases in need of further epidemiologic investigation rather than for identifying individual cases of a specific infectious disease (Henning, 2004; Teich et al., 2002).

Syndromic surveillance systems have developed in tandem with advances in information technology. A major component of many syndromic systems is the use of available electronic databases to capture health indicator data. With such computerized data, automated search algorithms can be applied to detect unusual patterns that may signal an outbreak and can provide that signal earlier than is feasible using traditional surveillance methods (CDC, 2000; Lazarus et al., 2002; Polyak, Elbert, Pavlin, & Kelley, 2002; Teich et al., 2002).

Signals detected by such systems must be examined to determine which ones are in need of further investigation because many of the signals will not represent outbreaks. The goal is to correctly identify outbreaks that are occurring as soon as possible, while not exhausting resources investigating alerts that are false alarms (Buehler, 2004; Henning, 2004). Use of multiple indicators and combining data from multiple health systems are approaches that may improve computerized signal detection (Henning, 2004; Teich et al., 2002).

Syndromic surveillance is a “work in progress.” There is a need for continued development of standardized signal detection methods and signal response protocols (Henning, 2004). Also, whereas reporting of patient information as part of traditional public health surveillance has been deemed exempt from the confidentiality guidelines in the Health Insurance Portability and Accountability Act of 1996 (HIPAA), how those guidelines may be applicable to syndromic surveillance systems remains unclear (Buehler, 2004).
A detailed discussion of the various systems that are under investigation is beyond the scope of this chapter. Three examples are given in the following. The interested reader is referred to the resources at the end of the chapter for links to additional examples.

- **New York City.** The New York City Department of Public Health and Mental Hygiene collects health indicator data on emergency department visits, retail pharmacy sales, and ambulance dispatch logs, along with one employer’s worker absenteeism rates, as part of an integrated, citywide surveillance system (Helfer nan et al., 2004).

- **Real-Time Outbreak and Disease Surveillance (RODS) Project.** Rods, which began in western Pennsylvania in 1999, now collects data from emergency departments, urgent care facilities, and clinical laboratories in several states (Wagner et al., 2004). In 2003, the system became available as open-source software, and it is now also in use in several foreign countries (RODS, 2006).

- **BioSense:** Biosense is a CDC initiative that is aimed at providing a national level system for early detection of bioterror events. The system provides public health officials at all levels with secure, near real-time access to health indicator data from participating health care organizations (CDC, 2007b).

### VETERINARY SURVEILLANCE

An often over-looked aspect of surveillance for bioterror events is surveillance of animal populations. Several of the agents considered to have bioterror potential are diseases of animals, for example, anthrax and brucellosis (Fritz et al., 2001; Inglesby et al., 1999; USAMRIID, 2005). A covert attack may first become apparent when animals become ill. The need to coordinate information from medical and veterinary sources was illustrated by the epidemiologic investigation during the 1999 West Nile Virus outbreak in New York City. Investigators found that there had been an outbreak in birds several weeks prior to the human outbreak (Fine & Layton, 2001). The current surveillance plan for monitoring West Nile Virus infection in the U.S. includes sentinel surveillance of several animal populations (CDC, 2003).

### HOW DO EMERGENCY INFORMATION SYSTEMS FIT INTO A SURVEILLANCE SYSTEM?

Whereas syndromic surveillance systems may enhance detection of outbreaks, the information generated is not of use unless it can be rapidly disseminated to the stakeholders responsible for implementing prevention and control efforts. Such dissemination requires a communication infrastructure that facilitates the rapid exchange of information (CDC, 2000; Koplan, 2001). Establishing and publicizing an emergency contact system for reporting to public health authorities is one strategy that has been implemented to improve communication related to biological events (CDC, 2001). The Internet-based Health Alert Network is another initiative that has been developed to provide rapid notification of health alerts and provide access to surveillance data by local and state health officials and other clinicians (CDC, 2007c). The CDC has also established the Clinicians Outreach and Communication Activity (COCA) program to provide clinicians with information about emergency preparedness through email updates, conference calls, webcasts, and a telephone response system (CDC, 2007a). Another strategy has been the establishment of designated Web sites for dissemination of information. The CDC has compiled an array of information for health care providers and the public on emergency and disaster planning for biological and chemical events. The entry page for this site is available at http://www.bt.cdc.gov/.

### WHAT IS THE ROLE OF COMMUNITY SERVICE ORGANIZATIONS IN SURVEILLANCE?

One suggested strategy for enhancing local surveillance has been the identification of surveillance partners (CDC, 2001). These partners provide additional health indicator data to the local health authorities that can assist with identifying unusual patterns of illness that may signal a biological event. Two examples of health system surveillance partners are pharmacies and emergency medical services. Community service organizations can also play a role as surveillance partners. As one type of community representative, their perspective would assist in the development and evaluation of syndromic surveillance systems (Buehler, 2004).

Community service organizations can play a direct role in providing specific health indicator data that would contribute to a syndromic surveillance system. Worksite absenteeism or patterns of health care behavior among clients are examples of potential indicators, but issues related to the confidentiality of such information under HIPAA have yet to be fully addressed. Even if no formal surveillance partnership to provide data exists, community service organizations should still consider themselves as stakeholders in the overall community response plans for biological events. They should also publicize the emergency public health contact information within their organizations. Table 20.3 lists several specific actions that community service...
20.3 Potential Action Steps for Community Service Organizations as Surveillance Partners

- Establish linkages with the local and/or state health department.
- Identify where the service organization fits into the community and/or state preparedness and response plan for biological events.
- Establish a reporting process for unusual patterns of health indicator data.
- Recognize the potential role of community service organization as surveillance partners for detection of biological events.
- Establish a plan with local health officials to monitor selected health indicator data within the organization.
- Identify sources of additional information about preparedness and response for biological events.

WHAT ABOUT BIOSENSORS?

Concurrent with the development of syndromic surveillance methods, advances are occurring in biotechnology that offer the potential for direct detection of the biological agents, either in exposed patients or in the environment (Mothershead & Dahrling, 2003). These biosensors may allow active, sentinel surveillance for bioterror agents in high-risk populations or locations, thereby adding another component to an early warnings system for biological events. Many such detection systems are currently undergoing development and testing.

WHAT INFORMATION RESOURCES ARE AVAILABLE ABOUT SURVEILLANCE?

The following are selected links to online resources related to surveillance systems discussed in this chapter. Additional links are provided in the reference list.

CDC Surveillance Systems

- A summary listing and description of surveillance resources is available at: http://www.cdc.gov/ncidod/ost/site/surv_resources/surv.
- Nationally Notifiable Diseases:
  - The list of nationally notifiable diseases is available at: http://www.cdc.gov/epo/dphsi/phs/infdis.htm.

WHAT INFORMATION RESOURCES ARE AVAILABLE ABOUT SURVEILLANCE?

- Influenza surveillance:
  - Weekly reports of influenza activity are located on a designated CDC Web site available at: http://www.cdc.gov/flu/weekly/.
  - The description of the influenza surveillance system components is available at: http://www.cdc.gov/flu/weekly/fluactivity.htm.

- West Nile virus surveillance:
  - The home page for the surveillance components for the West Nile virus surveillance system is available at: http://www.cdc.gov/ncidod/dvbid/westnile.

- GeoSentinel system:
  - Additional information about GeoSentinel can be accessed through the International Society of Travel Medicine home page available at: http://www.istm.org/index.html.

Syndromic Surveillance Systems

- A listing of CDC resources related to syndromic surveillance is available at: http://www.cdc.gov/epo/dphsi/syndromic.htm.
- Annotated bibliography
- National conference report

SUMMARY

Public health surveillance is an essential process for detection of biological events. The traditional notifiable disease reporting system remains an important component of infectious diseases surveillance; however, new approaches are being implemented that may enhance capabilities for early detection of events. The increasing availability of electronic health data and advances in information technologies provide opportunities for active, real-time surveillance systems (Teich et al., 2002). Syndromic surveillance systems that rely on alternative health indicators and detection of unusual patterns have
shown promise in providing earlier detection of biological events, but such systems are not a replacement for traditional surveillance (Henning, 2004). Community service organizations may also play a role in public health surveillance as formal or informal surveillance partners. There are specific action steps that these organizations can implement to become integrated into a coordinated local surveillance system for infectious diseases.

**STUDY REVIEW QUESTIONS**

1. What is public health surveillance?
2. Compare and contrast passive, active, and sentinel surveillance.
3. How does syndromic surveillance differ from traditional notifiable disease surveillance?
4. For your community, identify the process that is used to report a notifiable disease to the local health department.

**REFERENCES**


Chapter 20  Surveillance Systems for Detection of Biological Events  399

CASE STUDY

20.1   Northeastern Border Health Initiative

Paul Kuehnert

Though the Canadian–U.S. border stretches for some 1,200 miles across four northeastern states, infectious disease needs no passport to cross. The Northeastern Border Health Initiative recognizes that reality and one more: Health care providers on both sides need to be able to share vital information so they can monitor and contain those diseases.

“You have to draw a border for political reasons,” but contaminated food, water and infectious diseases don’t recognize those lines, says Mary Jude, Maine’s tribal epidemiologist, who with Sally Lou Patterson, Director of Maine’s Division of Infectious Disease, started talking with other states and provinces about forming a coalition in 2004.

Informal conversation soon turned into a fledgling initiative between Maine, New Hampshire, Vermont, New York, and Canadian provinces Quebec, New Brunswick, and Nova Scotia. The initiative has some ambitious goals but also some formidable obstacles. Language is one, but not nearly as big a barrier as constitutional law. States, after all, aren’t allowed to make contracts with foreign countries.

How, then, could the states create a compact with several Canadian provinces to share sensitive health data? It’s not easy, it turns out. What’s needed are Terms of Reference, a waiver from the State Department, and subsequent memorandums of understanding, says Richard Buck, New York State’s Border Health Manager, who also staffs a similar Great Lakes Border Health Initiative. That group includes New York, Michigan, Minnesota, Wisconsin, and Ontario. “There’s nothing binding about [the Terms of Reference],” he explains. “It structurally lays out the goals in writing and structurally lays out a steering committee and structurally lays out a plan to meet the grant objectives.”

The grant is from the CDC’s Early Warning Infectious Disease Surveillance (EWIDS) program, created in response to the post-9/11 anthrax scare that focused attention on our vulnerability to infectious disease attacks. All states with international borders are eligible for funds, but the amounts vary widely and depend on the number of border crossings a state can count. New York State, with its more highly populated border, gets more funding than rural states like Vermont, New Hampshire, and Maine, even though Maine’s border with Canada is 611 miles long. It makes sense, Buck says, to collaborate because all of the states are supposed to meet the same goals even if they don’t get the same amount of money. Collaboration allows the states to stretch those dollars further even if they don’t formally pool the funds.

The compact calls for three subcommittees—laboratory, legal, and disease surveillance—and requires participants hold regular conference calls about those issues. The Terms of Reference also spell out exactly why the compact was formed: to identify opportunities to improve collaborative early warning infectious disease surveillance and surveillance information sharing between the previously mentioned states and Quebec, New Brunswick, and Nova Scotia.

The states and provinces are working to develop a round-the-clock response protocol for early warning infectious disease surveillance and information sharing including appropriate contacts in all jurisdictions, and to develop a memorandum of understanding for infectious disease surveillance information sharing, such as the EPI-X system that alerts epidemiologists to outbreaks.

Sharing health data has always been shrouded in privacy, so setting aside age-old cautions and clarifying legal issues about distributing that information are obstacles. Buck has worked with Canadian officials to sign a memorandum of understanding for the sharing of epidemiological data. Sharing lab samples or providing surge capacity are other issues to sort out. “There’s always another domino in this,” Buck says. “You don’t just ship specimens across the border without reaching a very high international threshold of security. Each aspect brings up another question.”

The compact spells out that New York, with its larger share of the EWIDS dollars, is to provide the initiative’s administrative support. Buck’s office sets up and pays for conference calls and provides legal expertise to draft the Terms of Reference and memorandums of understanding.

Developing a system to share data may turn out to be one of the biggest—and most complex—goals of the grant. The goal is to create an interoperable disease surveillance system that health care workers on both sides of the border can access. It would provide an alert system and a database with common coding and commonly reported diseases. Though it may sound simple,
creating this kind of electronically based system is sens- 
itive politically and a bit complicated technically. 

When the states and provinces began talking nearly 
2 years ago, they were taking the first steps to create a co-
hesive communication plan for the region. Even though 
many officials talked informally with each other, there 
were big gaps in their contact lists. Initially health of-
cials participated in monthly conference calls to dis-
cuss infectious disease surveillance—indeed the project 
was initially called the Northeastern Border Infectious 
Disease Surveillance Initiative—and assemble contact 
information for all state epidemiologists, each state’s 
surveillance projects, emergency contact information 
for each state’s disease control unit, each state’s re-
portable disease list and maps of surveillance projects 
and acute care hospitals. 

“Our main focus is on communication,” says Sally 
Lou Patterson, Director of Maine’s Division of Infectious 
Disease. “It was very individual person driven [before 
the Initiative]. Now we have contact lists maintained.” 

A meeting in Bangor, Maine, in 2005 brought some state 
and Canadian officials face to face for perhaps the first 
time—at least formally. 

A second year passed and in March 2006 a larger 
conference took place in Burlington, Vermont. For the 
first time Quebec health officials participated, allow-
ing for more cohesive collaboration all along the bor-
der. The conference featured discussions about disease 
Surveillance procedures and alerts and included a table-
top exercise about a foodborne bacterial outbreak that 
crossed state and Canadian borders. The exercise 
allowed health officials to hear how their counterparts 
in other states and provinces would handle the informa-
tion they had. Who would they tell? When? And how? 

It turned out that the states and provinces had more 
in common than not, with similar thresholds for noti-
fying neighbors, though the tools might differ. For ex-
ample, Canadians use a system called CIOSC to send 
epidemiological alerts. Health officials in the states use 
the Health Alert Network or Epi-X or simply call a con-
tact in another state. Recently certain Canadian health 
workers were given permission to subscribe to Epi-X so 
they can monitor infectious disease that might be head-
ing their way and tell the states about disease heading 
south. The coalition is still working on gaining access 
to CIOSC for U.S. health officials. 

For Dr. Maureen Baikie, Nova Scotia’s Deputy Chief 
Medical Officer, the Burlington conference was uninva-
able. It allowed her to put names with faces and learn 
how things are done in the states, as well as who does 
them. Though her involvement with the coalition has 
been limited mostly because of a staffing shortage, she 
plans to be more involved now. Last fall when Nova 
Scotia had a small mumps outbreak, Dr. Baikie said she 
had to “root around” to figure out who to call in the 
states to tell them mumps was on their doorstep. Now 
that she has a contact list for the border states and has 
met many of the contacts, she knows exactly whom to 
call. “The [formal] way we normally do business is if I 
have an outbreak of infectious disease or a case of 
something that I think is related to a state, I go to the 
public health agency [in Canada] and they talk to the 
CDC and they talk to the state. Our public health agency 
shouldn’t be the last to know if there’s an outbreak in 
our region and a neighboring state, but I don’t always 
want to wait” to notify others or to ask for information 
from the states. Now Baikie knows whom to contact 
directly in the border states. “It’s a valuable initiative.” 

Although Nova Scotia doesn’t share a land border 
with New England, water passage is another story. The 
province shares many connections through tourism, 
particularly through cruise ships and ferries, which 
run regularly from Bar Harbor and Portland, Maine, to 
Yarmouth, Nova Scotia. Cruise ships, which travel up 
the eastern seaboard, often dock in Halifax, Nova Sco-
tia, and it is through these visits that infectious disease 
can spread most readily.
Key Messages

- The Centers for Disease Control and Prevention (CDC) Category A biological agents present unique threats to public health as well as to health care professionals who may care for patients exposed to these diseases.
- Attention to pertinent details of an exposed patient’s history and physical condition may provide important diagnostic clues, allowing early institution of appropriate therapy and biosafety precautions.
- Infection control issues raised by these biological agents of concern raise serious threats to health care professionals, including clinical and laboratory personnel who may encounter patients or clinical specimens suspected of harboring highly lethal bacteria or viruses.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe the CDC system for the categorization of biological agents of concern, with particular attention to Category A agents.
2. Identify the Category A biological agents and the diseases caused by these agents.
3. Describe the clinical presentation of patients infected with Category A agents.
4. Describe available therapies for these agents, including vaccines, if available, as well as the role of postexposure prophylaxis.
5. Describe the biosafety level (BSL) system, including the major elements of BSL-2, BSL-3, and BSL-4, as well as indications for personnel protective equipment and isolation.
6. Discuss the potential public health impact of an outbreak involving any Category A agent as well as the appropriate public health agencies involved in managing such an outbreak.
This chapter is designed to be an introduction to biological agents of concern, that is, a group of highly pathogenic bacteria and viruses with the potential to cause significant public health impact in terms of morbidity and mortality, as well as social disruption and public panic, particularly when deployed as a biological weapon. The Centers for Disease Control and Prevention has developed a hierarchical classification system for biological agents, ranking specific agents in Categories A, B, and C, where Category A agents are the most virulent and pose the greatest public health threat. This chapter provides detailed descriptions of the Category A agents with special attention to epidemiology, pathogenesis, clinical diagnosis, treatment, and nursing care issues.

This chapter is intended to introduce a number of biological agents with potential for causing significant human morbidity and mortality, particularly when used as a biological weapon. When most of us hear the term biological weapon, we think of anthrax-laden envelopes and vials of smallpox hermetically sealed in secret laboratories. Biological agents (including the categories of viruses, bacteria, fungi, and others, including toxins produced by biological agents), while they include these two well-known examples, also comprise real threats that are much less exotic. Bioterrorism is generally referred to as the intentional use of a biological organism or one or more of its components to cause disease, social disruption, and panic. The intentional contamination of Oregon salad bars with Salmonella typhimurium in 1984 by followers of Bhagwan Shree Rajneesh was just as much an act of biological warfare as the anthrax attacks of late 2001 (Torok et al., 1997).

Potential agents of biological warfare range from the extremely rare to the very common, from Ebola virus to E. coli. They vary widely in degree of infectivity, route of infection, and natural hosts. We will pay special attention to those agents whose extreme pathogenicity or ease of use as a biological weapon places them in a distinct category in comparison with other causes of human disease. The CDC, one of very few centers in the world with the capability for research and containment of the more virulent organisms, such as smallpox, has created a hierarchy that ranks these biological agents in order of their potential for causing life-threatening infection in humans (CDC, 2001c).
CLASSIFICATION OF BIOLOGICAL AGENTS OF CONCERN

In 1999, the Centers for Disease Control and Prevention, in conjunction with selected civilian and military infection control and biological warfare experts, established a graded system of risk assessment and prioritization for potential biological warfare agents (CDC, 2000a; Rotz, Khan, Lillibridge, Ostroff, & Hughes, 2002). Biological Agent categories A, B, and C were created in order to classify these biological agents of concern. Agents were ranked based on several factors, including public health impact in terms of disease and mortality rates, dissemination potential, public perception, and the need for special public health preparations. The most dangerous are placed in Category A, followed by Categories B and C, whose potential for causing life-threatening disease, while still significant, are considered less of a public health risk than those in Category A.

Category A agents are among the most deadly microbes known to man. They can be easily disseminated, or transmitted, from person to person, or they have high mortality rates as well as the potential for severe public health consequences, including public panic and social disruption. Their high infectivity poses a danger not only to those infected with the disease, but also to those who are treating the infected patients, including laboratory personnel who may come in contact with the infecting organism. Laboratory precautions for these pathogens are extremely strict, so much so that very few laboratories in the United States have the capability for working with these organisms. The CDC as well as the United States Army Medical Institute of Infectious Diseases (USAMRIID) are the only two locations in the United States approved to diagnose, contain, and conduct research on these Category A agents (USAMRIID, 2001).

Category A Agents

- Anthrax (Bacillus anthracis)
- Botulinum toxin (Clostridium botulinum)
- Plague (Yersinia pestis)
- Smallpox (Variola major)
- Tularemia (Francisella tularensis)
- Hemorrhagic fever viruses (including Ebola, Marburg, Lassa, and the South American arenaviruses, such as Machupo, Junin, and Guanarito)

Category A agents are among the most deadly microbes known to man. They can be easily disseminated, or transmitted, from person to person, or they have high mortality rates as well as the potential for severe public health consequences, including public panic and social disruption. Their high infectivity poses a danger not only to those infected with the disease, but also to those who are treating the infected patients, including laboratory personnel who may come in contact with the infecting organism. Laboratory precautions for these pathogens are extremely strict, so much so that very few laboratories in the United States have the capability for working with these organisms. The CDC as well as the United States Army Medical Institute of Infectious Diseases (USAMRIID) are the only two locations in the United States approved to diagnose, contain, and conduct research on these Category A agents (USAMRIID, 2001).

Category B agents are the second-highest priority risk agents as determined by the CDC. They share certain characteristics such as the potential for moderate morbidity and lower mortality, compared with Category A agents. They are moderately easy to disseminate and require specific diagnostic capabilities, as well as increased disease surveillance for detection. Several of these agents are extremely toxic but are not placed in Category A due to difficulties with dissemination or lower infectivity as compared to the Category A agents. All represent a significant public health risk if used as a biological weapon.

Category B Agents

- Brucellosis
- Epsilon toxin of Clostridium perfringens
- Food safety threats (Salmonella, Shigella, E. coli, etc.)
- Melioidosis
- Psittacosis
- Q fever
- Ricin toxin (from castor beans)
- Staphylococcal enterotoxin B
- Typhus fever
- Viral encephalitis (from alphaviruses such as VEE, EEE, WEE)
- Water safety threats (e.g., Vibrio cholerae, Cryptosporidium parvum)

Category B agents are the second-highest priority risk agents as determined by the CDC. They share certain characteristics such as the potential for moderate morbidity and lower mortality, compared with Category A agents. They are moderately easy to disseminate and require specific diagnostic capabilities, as well as increased disease surveillance for detection. Several of these agents are extremely toxic but are not placed in Category A due to difficulties with dissemination or lower infectivity as compared to the Category A agents. All represent a significant public health risk if used as a biological weapon.

Category C agents represent “emerging” agents, that is, potential future infective threats, such as Nipah fever and Hantavirus. Increased resources for research into the epidemiology and pathogenicity of these agents have been widely recommended.

These biological agents—although here separated into distinct groups—represent, as a whole, an array of infective organisms with significant potential for biological weaponization and damaging public health impact. The Category A agents, however, are particularly notable for their degree of lethality and potential for creating widespread morbidity and mortality among the general public. The remainder of this chapter will examine each of the Category A agents in depth.

ANTHRAX

History

Anthrax is a zoonotic disease, generally found in herbivores such as sheep, goats, and cattle that ingest spores from contaminated soil. The causative agent for anthrax is a spore-forming bacterium, Bacillus anthracis (see Figure 21.1). Human disease generally comes from contact with infected animals or animal products or, as evidenced by the events of late 2001, by intentional exposure (Inglesby et al., 2002). Anthrax has been present for centuries, and was previously identified as “wool sorters’ disease” when detected among workers in woolen mills in 19th-century England (Islam & Eltzen, 1999). It was thought that inhalation of aerosolized
anthrax spores from goat’s wool was responsible. The spores are extremely resilient and can remain viable for decades. In 1942, British scientists tested an “anthrax bomb” on the Scottish island of Gruinard, rendering the island uninhabitable for over 40 years until government-sponsored cleanup efforts destroyed the still-infectious spores (Aldhous, 1990).

The potential use of anthrax as a biological weapon has been acknowledged for decades. An outbreak of inhalational anthrax in the area surrounding the Russian city of Sverdlovsk in 1979 was later attributed to Soviet efforts to create an anthrax-based biological weapon (Abramova, Grinberg, Vampolskaya, & Walker, 1993; Meselson et al., 1994; Sepkowitz, 2001). Iraq’s biological weapons program, developed between 1985 and 1991, was known to include anthrax as well as other potent biological agents such as botulinum toxin (Zilinskas, 1997). The World Health Organization (WHO) estimated in 1970 that an airborne release of 50 kg of anthrax over an urban center of 5 million people would infect approximately 250,000 persons, causing 100,000 deaths, without adequate immediate treatment.

Epidemiology

Anthrax occurs in nearly every continent and in almost all countries. It predominantly presents as a cutaneous infection but may occur in gastrointestinal and inhalational form. Human disease predominantly occurs in two settings: agricultural and industrial. In agriculturally derived cases of anthrax, patients contract the disease from contact with infected animals, typically sheep, goats, and cattle, although other animals can be affected. In industrial cases, contact with animal products such as contaminated wool, meat, or bone meal has led to anthrax infection. Human-to-human transmission of anthrax has not been reported (Inglesby et al., 1999).

The worldwide incidence of anthrax is unknown but is estimated at several thousand cases per year. This number likely represents significant underreporting of the disease. In the United States, less than one case per year is typically reported. In 2006, one case of naturally occurring pulmonary anthrax was diagnosed in Pennsylvania in an African drum maker who was in contact with spores through mechanically scraping animal hides (CDC, 2006). Previously, the last case of naturally occurring inhalational anthrax had been reported in the United States in 1978 (Inglesby et al., 1999). The most recent acts of bioterrorism in the United States led to 23 identified cases of anthrax (11 inhalational, 12 cutaneous) between late 2001 and early 2002 (CDC, 2002). Creation of an anthrax aerosol capable of dissemination and causing inhalational anthrax is likely confined to those entities with access to sophisticated biotechnology, making an anthrax attack by a lone individual or small group less probable.

Classification and Etiology

The causative agent for anthrax, *Bacillus anthracis*, is an aerobic, gram-positive, spore-forming bacterium (Agency for Healthcare Research and Quality, 2003). The life cycle of *B. anthracis* has four major phases: the vegetative phase (from spores to replicating bacteria), an intense growth phase, a stationary phase, and the sporulation phase. Anthrax spores have a relatively high level of resistance to high temperatures and disinfectants (http://www.bioterrorism.uab.edu/CategoryA/Anthrax/etiology.html). The anthrax bacterium also secretes a powerful exotoxin (anthrax) toxin).

Based on the 2001 outbreak, CDC established a set of criteria for the confirmation of anthrax infection (CDC, 2002). A confirmed case of anthrax is defined as

1. A clinically compatible case of either cutaneous, inhalational, or gastrointestinal disease that is laboratory confirmed by isolation of *B. anthracis* from an affected tissue or site.

2. Other laboratory evidence of *B. anthracis* infection based on at least two supporting tests.

Anthrax occurs in three distinct forms, cutaneous, inhalational, and gastrointestinal. Although the cutaneous form represents the majority of anthrax cases, the inhalational form is responsible for virtually all anthrax-related mortality. Cutaneous anthrax is typically contracted by contact with aed skin by products...
derived from infected herbivores, such as sheep, cattle, and goats. Inhalational anthrax has recently been associated with intentional aerosolization of anthrax spores but has historically been contracted by inhalation of spores from infected animals. The last case of naturally occurring inhalational anthrax occurred secondary to scraping animal hides in a poorly ventilated workspace. The worker did not use any personal protective equipment and anthrax spores were detected in his workshop upon subsequent investigation. Gastrointestinal anthrax is presumably rare and is contracted via the consumption of meat from infected animals (Cieslak & Eitzen, 1999).

Pathogenesis

Inhalational Anthrax. Inhalation of anthrax spores represents the initial step in the pathogenesis of inhalational anthrax. Spores are phagocytosed in the lungs then transported to lymphoid tissue, particularly in the mediastinum, by macrophages. During a 1–6-day incubation period, the spores germinate and multiply dramatically, producing bacteremia. With worsening bacteremia, accumulation of the anthrax exotoxin progresses, resulting in severe edema and hemorrhagic mediastinitis (see Figure 21.2). Respiratory failure, septic shock, and death follow. Death from inhalational anthrax is essentially universal in untreated patients. Autopsy findings show evidence of multiple organ hemorrhage and necrosis as well as hemorrhagic meningitis in up to 50% of cases (Cieslak & Eitzen, 1999).

Cutaneous Anthrax. Cutaneous anthrax occurs when anthrax spores enter the skin through cuts or abrasions. The affected area develops a small macule or papule that then ulcerates. A black painless eschar then follows, associated with extensive local edema and painful regional lymphadenopathy (see Figure 21.3). Systemic symptoms can follow.

Gastrointestinal Anthrax. Gastrointestinal (GI) anthrax is contracted by germination of ingested spores in the upper or lower GI tract. The GI forms of the disease are generally an upper GI form and a lower GI form. In the upper GI form, oral or esophageal ulcers develop with associated edema, lymphadenopathy, and sepsis. In the lower GI form, partial necrosis of the GI tract can occur with symptoms including bloody diarrhea, acute abdomen, ascites, or sepsis.

Clinical Manifestations and Diagnosis. Diagnosis of inhalational anthrax in its early stages is very difficult as the patient’s clinical presentation may be nonspecific (i.e., easily mistaken for viral upper respiratory illness or atypical pneumonia), such as nonproductive cough, chest pain, sore throat, myalgias, low-grade fever, and malaise (Mayer, 2001). In later stages however, after bacteremia becomes more pronounced, patients rapidly worsen with development of respiratory failure, associated with the onset of bulky, hemorrhagic mediastinitis, manifesting as widened mediastinum on chest radiograph. Other causes of widened mediastinum must be excluded, such as thoracic aortic aneurysm or dissection or superior vena cava syndrome. Severe generalized edema, hemorrhagic pleural effusions, and hemorrhagic meningitis are also common. Meningitis has...
21.1 Clinical Manifestations of Anthrax Infection

<table>
<thead>
<tr>
<th>Subjective Symptoms</th>
<th>Objective Findings (I.E., Physical Exam, Lab, Imaging Studies)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalational anthrax</td>
<td>Lymphadenopathy, widened mediastinum on chest radiograph, pleural effusions.</td>
<td>Signs/symptoms progress to respiratory failure, sepsis, and hemodynamic collapse in preterminal stages.</td>
</tr>
<tr>
<td>Meningeal signs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutaneous anthrax</td>
<td>Ulcer with black eschar, moderate to severe localized edema and lymphadenopathy.</td>
<td>Time course is 1–7 days until appearance of typical ulcer.</td>
</tr>
<tr>
<td>Gastrointestinal anthrax</td>
<td>Diarrhea may be bloody, Acute abdomen may be present with or without ascites.</td>
<td>Fluid volume loss may be severe.</td>
</tr>
</tbody>
</table>

been shown to be uniformly fatal in a recent review of reported cases (Holty, 2006). Subarachnoid hemorrhage due to various causes should not be mistaken for the hemorrhagic meningitis seen in inhalational anthrax. Patients following this clinical course, particularly when presenting in temporal or geographic clusters, should raise suspicions of a biological weapon attack due to inhalational anthrax (Inglesby et al., 1999).

The diagnosis of cutaneous anthrax, likewise, is initially difficult. A history of skin contact with anthrax spores or potentially anthrax-contaminated animal products is helpful. In early stages, the skin lesion is very nonspecific, but the later presence of a painless black eschar accompanied by severe localized edema is essentially pathognomonic for the diagnosis. Other causes of painful lymphadenopathy such as staph, strep, plaque, and tularemia may mimic cutaneous anthrax. Cutaneous anthrax lesions can also resemble the necrotic ulcerated lesions due to brown recluse spider bite.

Gastrointestinal anthrax has never been reported in the United States. A history of eating contaminated meat or dairy products from infected animals, including abdominal pain, vomiting, diarrhea, development of acute abdomen, edema, or ascites, should suggest the diagnosis of gastrointestinal anthrax. Other causes of abdominal pain, ascites, or gastrointestinal symptoms should be entertained as well. Clusters of similarly affected patients who have also ingested anthrax-contaminated food items should also raise the suspicion of gastrointestinal anthrax. The final diagnosis of anthrax is made by isolation and confirmation of the presence of B. anthracis DNA from a clinical specimen such as from blood cultures or ulcer fluid, by immunofluorescent staining, or by confirmation of the presence of B. anthracis DNA in clinical specimens by PCR (polymerase chain reaction; Cieslak & Eitzen, 1999). (See Table 21.1.)

Biosafety Issues, Protection, and Isolation

Biosafety Level II (BSL-2) precautions are recommended for laboratory personnel who may come in contact with anthrax specimens, including handling of specimens in a laminar flow hood with protective eyewear, using gloves pulled over lab coats, and avoiding activities that may produce aerosol or droplet dispersal. Biosafety Level III (BSL-3) precautions are recommended for personnel who work extensively with anthrax specimens, including producing quantities for research purposes. These include precautions similar to BSL-2 as well as respiratory protective equipment as needed, controlled access to lab, decontamination of all waste, and negative air pressure system in laboratory. A case of laboratory-acquired cutaneous anthrax was confirmed in June 2002, involving a laboratory worker who contracted the disease by using ungloved hands to handle anthrax-containing vials (CDC, 2002).

Health care workers who come in contact with patients in whom anthrax is suspected should use universal precautions at all times, including the use of rubber gloves, disposal of sharps, and frequent hand washing. No human-to-human transmission of anthrax has been reported and respiratory isolation precautions are not needed. Patients with inhalational or cutaneous anthrax should be placed on contact isolation, due to the potential for contact with open wounds or wound drainage.
Public Health Implications

Even a single case of inhalational anthrax is a significant public health event because of its rarity and extreme pathogenicity. Given recent events, the presence of inhalational anthrax implies an act of bioterrorism until proven otherwise. Notification of appropriate public health authorities is appropriate if any case of anthrax is suspected or confirmed. Initial steps should include notification of the hospital infection control officer and local and state health departments. Laboratory personnel should alert state public health laboratories and also use the Laboratory Response Network for Bioterrorism to facilitate rapid, appropriate triage from the Rapid Response and Advanced Technology Laboratory at the CDC (CDC, 2000a). In light of recent acts of bioterrorism involving anthrax, health care personnel should increase their vigilance for cases of suspected anthrax, especially among mail handlers.

Vaccination and Postexposure Prophylaxis

An anthrax vaccine is available but its use is currently reserved for laboratory personnel who may come in contact with the disease and for military personnel. The vaccine currently in use by the United States military is a sterile, acellular vaccine known as AVA (Anthrax Vaccine Adsorbed). It is not currently licensed for use with civilian populations, although there are protocols under investigation.

Postexposure prophylaxis is not recommended for contacts of patients infected with B. anthracis, or for health care workers who may treat anthrax patients. It is also not recommended for the prophylaxis of cutaneous anthrax. It is currently only indicated for persons who may have been exposed to airspace contaminated with aerosolized B. anthracis (Bell, Kozarsky, & Stephens, 2002). The duration of therapy is generally determined to be 60 days of either ciprofloxacin or doxycycline, with amoxicillin as an option for children and pregnant or lactating women. The U.S. Department of Health and Human Services has recently announced additional options for prophylaxis of inhalational anthrax, especially for those in whom inhalational exposure may have been significant. These options include 60 or 100 days of prophylaxis, as well as 100 days of prophylaxis plus anthrax vaccine as an investigational agent (CDC, 2001a; Nass, 2002).

Treatment

The treatment of anthrax is with ciprofloxacin or doxycycline plus additional antimicrobials and adjunctive therapies for inhalational anthrax. The current CDC treatment protocols for cutaneous anthrax include a 60-day oral course of either ciprofloxacin or doxycycline. Case fatality rates for cutaneous anthrax are less than 1% with treatment.

The recommended management of inhalational anthrax involves a 60-day intravenous course of either ciprofloxacin or doxycycline plus one or two additional antimicrobials to which anthrax has historically been sensitive, such as aminoglycosides or clindamycin. Anthrax has traditionally been resistant to cephalosporins, including broad-spectrum cephalosporins such as ceftriaxone. Because of the rapid and recurrent accumulation of hemorrhagic pleural effusions, chest tube drainage of pleural fluid has produced dramatic improvement in clinical status. In the most recent outbreak of inhalational anthrax, 6 of 11 patients survived (Inglesby et al., 2002; Jernigan et al., 2001). In previous outbreaks of inhalational anthrax, case fatality rates have been as high as 86%, despite therapy (Meselson et al., 1994). A recent study has found that multidrug antibiotic regimens, pleural fluid drainage, and initiation of antibiotics in the prodromal phase significantly lowered mortality from inhalational anthrax (Holty, 2006).

BOTULISM

History

Botulism is a neuromuscular, primarily foodborne illness first described in 1897 (CDC, 1998). The disease is caused by a toxin produced by the anaerobic bacterium Clostridium botulinum. Although botulism is rare, it can kill rapidly and foodborne botulism is a public health emergency carrying significant risk for widespread disease and death, as potentially preventable deaths may occur if the source of botulism is not discovered and eliminated. There are classically four major types of botulism: foodborne botulism, infantile botulism, wound botulism, and intestinal botulism.

The form with which most of the public is familiar is foodborne botulism. There are approximately 30 cases of foodborne botulism reported in the United States each year, most of which are related to home processing of foods. The botulinum toxin produced by C. botulinum is actually a group of distinct toxins with similar paralytic effects on the neurologic system. Botulinum toxin is the most poisonous substance known to mankind; less than one microgram is a fatal dose for an adult (Arnon et al., 2001).

The idea of a bioterrorist attack involving botulism stems largely from the extreme lethality of the botulinum toxin. Unsuccessful attempts have already been made to aerosolize botulinum toxin by a Japanese cult between 1990 and 1995. The United States
Chapter 21
Biological Agents of Concern

409

Biological weapons program produced botulinum toxin during World War II. The former Soviet Union and Iraq have both admitted creating large stores of concentrated botulinum toxin. Much of Iraq’s production of botulinum toxin, some 19,000 liters, remains unaccounted for. About 10% of persons within 0.5 km downwind of an aerosol release of botulinum toxin would be incapacitated or killed (Patrick, 1998, as cited in Arnon et al., 2001).

Recently, the extreme potency of botulinum toxin has led to multiple medical uses of this substance, including the treatment of cervical torticollis, strabismus, and other musculoskeletal disorders, as well as in cosmetic plastic surgery as “Botox” for the elimination of facial lines or wrinkles (Lemonick, 2002). The irreversible action of botulinum toxin on nerve transmission when used in minute amounts leads to prolonged therapeutic effects of greater than 3 months in duration. An iatrogenic form is also reported secondary to adverse effects of local injection of the toxin in cosmetic procedures or in patients with spasticity (Tugnoli, 2002).

Epidemiology

Foodborne botulism accounts for approximately 1,000 cases per year worldwide, of which approximately 30 occur in the United States. Home processed foods account for 94% of U.S. cases. Infantile botulism, a form of the disease in which C. botulinum spores are ingested by infants due to food contamination, occurs in approximately 60 children per year in the United States, more than half of which are in California. Wound botulism, typically involving intravenous drug users who either inject drugs intravenously or in the subcutaneous tissue (a practice known as “skin-popping”), is reported one to three times per year in the United States. It can also occur in other types of contaminated wounds such as a severe crush injury or other areas of contaminated avascular tissue. Botulism due to intestinal colonization by C. botulinum is extremely rare; only seven cases have been reported in the literature (CDC, 1998).

Classification and Etiology

Botulism is caused by the neuroparalytic toxin produced by the bacterium, C. botulinum, a common soil contaminant. This toxin has been divided in several groups. Types A, B, and E are the major types producing disease in humans, with Type A accounting for 44%, Type B, 36%, and Type E, 12.5% of cases. Type A botulism generally occurs in the western United States, while Type B is typically found in central and northeastern states. The majority of Type E botulism cases are found in Alaska. Types A and B are associated with the consumption of home-canned vegetables, fruits, and meat products, while Type E is seen with marine products.

Infantile botulism involves the ingestion of botulism spores. The most common identified vehicle for this ingestion in several case series was honey, involving approximately 20% of cases. In the majority of cases of infantile botulism, however, ingestion of honey was not reported. Other possible sources of botulism spores include foods and household dust. Because of the association between the ingestion of honey and infantile botulism, CDC recommends that honey not be fed to infants (CDC, 1998).

Pathogenesis

Clostridium botulinum is extremely widespread in soil, dust, and on the surfaces of many foods. The botulinum toxin is heat labile and botulinum spores are killed by boiling at 100 °C. The toxin, once ingested, blocks acetylcholine release from peripheral cholinergic nerve terminals. Adrenergic and sensory nerve endings are not affected. This neurotransmitter blockade is irreversible, requiring the growth of new nerve endings for nerve conduction to resume.

Clinical Manifestations and Diagnosis

Botulism presents as a progressive, descending, symmetric weakness or paralysis. It invariably begins with cranial nerve palsies, including dilated or nonreactive pupils (ophthalmoplegia) in 50%. This paralysis progresses to involve the respiratory musculature causing respiratory failure and death if unrecognized and untreated. The need for prolonged ventilatory support is common in botulism. Two-thirds of patients with Type A botulism need intubation and mechanical ventilation. The average duration of ventilatory support is 6–8 weeks but it may be as long as 7 months. Prolonged fatigue and exercise intolerance are common after botulism, lasting up to 2 years or more.

In foodborne botulism, complaints of nausea, vomiting, and diarrhea may accompany the initial neurologic symptoms. In later stages of the disease, constipation becomes more prominent. In infantile botulism, constipation is often the main symptom, along with characteristic flaccidity (the “floppy baby”), poor suck reflex, poor feeding, and poor head control.

Pitfalls in the diagnosis of botulism include failure to recognize the symptoms and to institute adequate ventilatory support. Botulism is likely underdiagnosed and can be mistaken for a number of neuromuscular and neurologic disorders. Diphtheria, encephalitis, poliomyelitis, Guillain-Barré syndrome, congenital...
neuropathies and myopathies, myasthenia gravis, as well as mushroom (muscarinic) poisoning are diagnoses potentially similar in presentation to botulism. The laboratory diagnosis of botulism is made by the identification of \textit{C. botulinum} toxin in serum, stool, and gastric aspirate or food samples. \textit{C. botulinum} cultures can also be obtained.

**Laboratory Issues, Protection, and Isolation**

Botulinum toxin is extremely poisonous to humans. Coats, gloves, face shields, and protective cabinets are recommended for handling botulism specimens. Ideally, laboratory personnel should be vaccinated with \textit{C. botulinum} antitoxin. Universal precautions should be used when caring for patients suspected of botulism. Isolation is not necessary but droplet precautions should be instituted (Arnon et al., 2001).

**Public Health Implications**

Every case of foodborne botulism should be treated as a public health emergency. The potential for additional cases from a single contaminated food source is high. Every effort should be made to eliminate toxin-containing food items still available for public consumption to avoid additional morbidity and mortality. Cases of botulism that appear in temporal or geographic groups should prompt rapid investigation into foodborne sources of illness as well as raise the possibility of bioterrorism in the form of inhalational botulism. Any suspected or confirmed case of botulism should prompt immediate contact with local and state health departments.

**Vaccination and Postexposure Prophylaxis**

A botulinum toxoid vaccine is made available as an investigational agent through CDC for lab workers who work regularly with botulinum toxin or \textit{C. botulinum}. Postexposure prophylaxis is not recommended at this time for asymptomatic patients (Arnon et al., 2001).

**Treatment**

The mainstays of botulism therapy include ventilatory support as well as the administration of botulinum antitoxin. Botulinum antitoxin is a trivalent, equine antitoxin that provides antibodies to botulinum toxin Types A, B, and E. It acts only against unbound toxin and therefore its efficacy is greatest early in the patient’s clinical course. Cathartics and enemas have also been recommended for elimination of botulinum toxin from the GI tract. Antibiotics are not recommended except for the treatment of secondary infectious complications such as pneumonia. Asymptomatic patients suspected of ingesting contaminated food items should be closely observed for any signs of illness. For infantile botulism, the human-derived Botulism Immune Globulin (BIG) is effective. Administration of the equine-based antitoxin has not proven beneficial for infants (CDC, 1998).

**PLAGUE**

**History**

Plague is possibly the most feared infectious disease in the history of humankind. More than 200 million people have died from plague. In its most notorious manifestation, the so-called Black Death of the Middle Ages, plague was responsible for a pandemic that affected Europe between the 8th and 14th centuries, decimating nearly 40% of the population (McGovern & Friedlander, 1997).

The potential use of the bacterium responsible for plague, \textit{Yersinia pestis}, as a bioweapon has been a subject of research both in the United States as well as the Soviet Union in the post-World War II era. A WHO study of a deliberate aerosolization of \textit{Y. pestis} over an urban population estimated nearly 25% mortality among those infected with the pneumonic form of plague (WHO, 1970) (See Figure 21.4).

**Epidemiology**

Plague is still present worldwide. The introduction of the disease to human populations occurs when plague-infected fleas, which typically infest rodent hosts, cause the death of these rodents in large numbers. Fleas...
then move from their natural hosts to humans, causing outbreaks of plague. In the United States, an average of 13 cases per year are reported, typically in western states. WHO reported 2,861 cases in 1995 worldwide (Inglesby et al., 2000).

Classification and Etiology

Plague is caused by *Yersinia pestis*, a nonmotile gram-negative bacterium. Transmission to humans is typically through the bite of an infected flea, although droplet spread from patients with pneumonic plague is another route of infection. Plague occurs in three forms: bubonic, pneumonic, and septicemic. The most common form of plague, and that responsible for the European pandemics, is bubonic plague. This form presents with painful, swollen lymph nodes, the “bubo” of bubonic plague, following by generalized bacteremia. In septicemic plague, the infected flea vector is the same, but rather than develop buboes, patients develop sepsis followed by multiple organ failure. Pneumonic plague is spread by droplet dispersal from infected patients and severe pulmonary involvement is the cardinal sign.

Pathogenesis

The exact pathophysiology of plague is unknown. In bubonic plague, the patient is injected with *Y. pestis* via an infected flea. Bacteria then migrate to local lymph nodes and then multiply, causing development of a bubo, a large, swollen, extremely tender lymph node, usually in the groin, axilla, or neck. Plague bacteria continue to multiply, resisting phagocytosis by macrophages, leading to bacteremia, sepsis, shock, disseminated intravascular coagulation (DIC), and ultimately coma and death. In septicemic plague, patients, although bitten by infected fleas, do not develop the typical bubo, but instead progress to sepsis and DIC, often with gangrene and necrosis of fingers and toes.

Pneumonic plague, the most deadly form of the disease, occurs when *Y. pestis* infects the lungs, causing severe hemorrhagic, necrotizing bronchopneumonia; dyspnea; chest pain; cough; and hemoptysis. This process can either occur by hematogenous spread of the bacterium (secondary pneumonic plague) or by droplet spread from infected persons directly to the patient via inhalation (primary pneumonic plague). The most recent case fatality rates for pneumonic plague were 57%, despite therapy (Inglesby et al., 2000).

Clinical Manifestations and Diagnosis

Patients with plague present with fever, chills, and myalgias, as well as swollen, painful lymph nodes in bubonic plague. Nausea, vomiting, and cough productive of bloody sputum are also seen. Chest pain, dyspnea, and hemoptysis are later symptoms typical for pneumonic plague. A history of contact with infected rodents or fleas is important to elicit. In the United States, ground squirrels, prairie dogs, and rats have been reported as plague vectors, particularly in New Mexico, Arizona, Colorado and California (see Figure 21.5; CDC, 2000b).

Other diagnoses that may present in a similar fashion to plague include Adult Respiratory Distress Syndrome, cat scratch disease, cellulitis, DIC, pneumonia, empyema and lung abscess, gangrene, and necrotizing fasciitis. Laboratory diagnosis of plague is confirmed by identification of plague bacterium on gram stain, or by culture of blood, sputum, or bubo aspirate.

Biosafety Issues, Protection, and Isolation

Biosafety Level II precautions should be used for specimens from patients suspected of *Y. pestis* infection. Biosafety Level III precautions are needed only if extensive work with infected specimens is expected. Strict isolation should be maintained for all patients suspected of *Y. pestis* infection. Gowns, gloves, masks, and eye protection should be worn for at least the first 48 hours of treatment.
Public Health Implications

Plague is a nationally notifiable disease and represents a potential public health emergency due to the extreme infectivity of *Y. pestis* as well as mortality rates associated with plague. Local and state health departments should be notified if the presence of plague is suspected or confirmed.

Vaccination and Postexposure Prophylaxis

A plague vaccine was previously available in the United States, but production was discontinued in 1999. This vaccine protected against the bubonic form of the disease but did not provide protection against pneumonic plague. It was previously administered to military personnel working in plague endemic areas, laboratory personnel working with *Y. pestis*, or researchers working with plague-infected animals or fleas. Research is ongoing into a vaccine against pneumonic plague (Titball & Williamson, 2001). Encouraging results have been obtained in mice (Elvin et al., 2005).

Antibiotic prophylaxis is recommended for contacts (including health care workers) of patients infected with plague as well as close surveillance of contacts refusing antibiotics. In May 2000, the Working Group on Civilian Biodefense, in their *Journal of the American Medical Association* review of plague as a potential agent of bioterrorism, recommended doxycycline and ciprofloxacin as postexposure prophylaxis for adults, children, and pregnant women. Tetracycline, sulfonamides, and chloramphenicol are also effective as postexposure prophylaxis against the disease.

Treatment

The historical antibiotic of choice for the treatment of plague has been streptomycin. Gentamicin is another preferred antibiotic. Alternative regimens include doxycycline, ciprofloxacin, and chloramphenicol. Patients with pneumonic plague may also require advanced medical supportive therapy in addition to antibiotics.

TULAREMIA

History

Tularemia is a highly infectious zoonotic disease caused by the bacterium, *Francisella tularensis*. It was first described in Tulare County, California, in 1913 (Francis, 1925). The first recognized human case of tularemia was reported in 1914. Tularemia can cause fever, skin or mucous membrane ulceration, lymphadenopathy, and occasionally life-threatening pneumonia. Its major threat (and its bioweapon potential) comes from its extreme infectivity; inhalation or inoculation of as few as 10 organisms is enough to cause disease (Dennis et al., 2001).

In addition to its infectivity, *F. tularensis* can produce severe disease and death, if untreated. Outbreaks of tularemia affected tens of thousands of soldiers on the eastern European front during World War II. It has been suggested that these epidemics may have been intentional in origin, part of an act of biological warfare (Alibek, 1999). Like other biological agents of concern, both the United States and the former Soviet Union stockpiled stores of tularemia bacteria for potential use during the 1960s and 1970s.

Epidemiology

Primarily a rural disease, tularemia has been reported in every state in the United States except Hawaii. It has also been reported worldwide, primarily in Eurasia, although its true incidence is likely underrecognized and underreported. Fewer than 200 cases are reported per year in the United States and the case fatality rate is less than 2%. Although males tend to be more often infected than females, this finding is probably related to the specific outdoor activities that may predispose individuals to contracting tularemia, such as farming, hunting, trapping, and butchering (Dennis et al., 2001).

Classification and Etiology

*Tularemia*, as previously noted, is caused by an aerobic, gram-negative bacterium, *Francisella tularensis*. It can present clinically in several different forms: ulceroglandular, glandular, oculoglandular, oropharyngeal, pneumonic, typhoidal, and septic forms. Tularemia is typically found in animals such as rabbits and rodents, and can be transmitted to humans in several ways. Contact with infected animal carcasses; ingestion of contaminated meat, soil, or water; inhalation of the bacterium (especially in laboratory workers); inoculation of the bacterium via cuts or abrasions; as well as via the bite of infected arthropods such as ticks are among the ways tularemia can be contracted.

Pathogenesis

*Francisella tularensis* is a facultative intracellular bacterium that can infect humans via the skin, mucous membranes, GI tract, and lungs. The bacterium then multiplies inside macrophages, preferentially affecting lymph nodes, lungs and pleura, spleen, liver, and kidney. Inhalational exposures cause hemorrhagic airway involvement with bronchopneumonia. The absence of
fulminant, rapid onset of respiratory failure, shock and death, despite antibiotic therapy, can distinguish inhalational tularemia from inhalational anthrax.

Clinical Manifestations and Diagnosis

Although tularemia can present in a myriad of ways—ulceroglandular, glandular, oculeoglandular, oropharyngeal, pneumonic, typhoidal, and septic forms—the ulceroglandular and typhoidal forms make up the majority of tularemia patients. Ulceroglandular tularemia is the most common, comprising approximately 75% of cases (Edlow, 2001).

Tularemia initially presents with abrupt onset of high fever, headache, rigors, coryza, and sore throat. Dry cough, sweats, fever, and chills occur as the disease continues. The ulceroglandular form of tularemia presents with skin and mucous membrane ulcers, lymphadenopathy, or both. A cutaneous chancre-like ulcer is the most common finding (see Figure 21.6). The typhoidal form has less significant lymph node involvement and skin lesions are absent. Pulmonary involvement is prominent, particularly with the typhoidal form. The differential diagnosis of tularemia also includes other diseases with prominent skin manifestations or pulmonary findings such as plague, diphtheria, psittacosis, Q fever, and other tickborne diseases. The definitive diagnosis of tularemia is by culture, typically from sputum. ELISA, bacterial agglutination, and immunofluorescent techniques are also available.

Biosafety Issues, Protection, and Isolation

Tularemia is extremely infectious in aerosol form. Laboratory personnel have contracted inhalational tularemia simply by examining an open culture plate. Biosafety Level II precautions should be used for initial evaluation then specimens should be forwarded to a BSL-3 laboratory for further testing (Dennis et al., 2001).

Despite its infectivity, human-to-human transmission of tularemia is not a risk, and therefore isolation is not needed. Universal precautions are recommended for patients suspected of tularemia infection.

Public Health Implications

Tularemia is a nationally notifiable disease, and its significant infectivity via inhalation makes this agent a potential choice for bioterrorism. As for other Category A agents, any suspected or confirmed case of tularemia is an indication for immediate notifications of the hospital infection control officer, and local and state health departments.

Vaccination and Postexposure Prophylaxis

A live attenuated vaccine derived from a less virulent form of *F. tularensis* is available for laboratory personnel who routinely work with tularemia. Postexposure prophylaxis for contacts of tularemia patients is not recommended, as person-to-person transmission is not known to occur. For persons who may have been exposed to *F. tularensis*, for example, by an act of bioterrorism, a 14-day oral course of ciprofloxacin or doxycycline is indicated (Dennis et al., 2001).

Treatment

As for the treatment of plague, streptomycin and gentamicin are the drugs of choice. Doxycycline and chloramphenicol have also been used, but more treatment failures have been reported with these regimens. Ciprofloxacin is another alternative therapy. For the first-line regimens as well as ciprofloxacin, a 10-day course of intravenous antibiotics is recommended. For second-line therapies, 14 days are recommended.

**SMALLPOX**

**History**

Smallpox is a disease that has been present for centuries. Epidemics of this viral disease, unique to humans, have been reported since ancient history. Once one of the most feared of all diseases, smallpox was declared eradicated worldwide by WHO in 1980 (WHO, 1980). The last case occurred in Somalia in 1977. A worldwide vaccination program against smallpox was responsible for the elimination of the disease. Routine vaccination of the general U.S. population against smallpox ended more
than 25 years ago, leading to a population whose susceptibility to the disease is greater now than at any other time in recent history.

The first use of smallpox as a biological weapon probably originated during the French and Indian Wars (1754–1767), when British soldiers offered blankets that had been used by smallpox patients to American Indians. Outbreaks ensued, accounting for up to 50% mortality in some tribes. Ken Alibek, a former Soviet biological weapons expert, reported that after 1980, the Soviets had developed the capability to produce smallpox virus in large quantities and were capable of adapting it for use in bombs and intercontinental ballistic missiles (Alibek, 1999). After smallpox was declared eradicated in 1980, WHO recommended that all remaining stores of smallpox be either destroyed or transferred to one of two locations—CDC in Atlanta, Georgia, or the State Research Centre of Virology and Biotechnology in Novosibirsk, Russia (Bremen & Arita, 1980). Later recommendations from WHO in 1999 were that all stockpiles of smallpox be destroyed. After questions about further research into smallpox and smallpox vaccines were raised, the deadline for the destruction of remaining smallpox stores was delayed until 2002. In May 2002, the World Health Assembly decided to authorize the retention of existing Variola virus stockpiles for research purposes at the two locations named previously (World Health Assembly, 2002). It is believed, however, that other laboratories within Russia, as well as in other countries, may still hold quantities of smallpox virus, raising the specter of unscrupulous scientists or groups selling stockpiles of smallpox for financial gain (Henderson et al., 1999).

Epidemiology

Smallpox occurs in two forms: variola major (the most dangerous and formerly widespread form of the disease) and variola minor. Case fatality rates among the unvaccinated from variola major were 30% or higher. Person-to-person transmission of the disease occurs by droplet spread from infected persons or by contact with contaminated clothing or bedding. Smallpox is highly contagious. The amount of virus sufficient to cause disease in 50% of susceptible persons is fewer than 10 viral particles. The virus is very hardy, remaining viable on clothing or other contaminated objects for months (Henderson et al., 1999).

Classification and Etiology

Smallpox, a DNA virus, is a member of the genus orthopoxvirus, like monkeypox, vaccinia, or cowpox. It contains a large, complex viral genome and is the only orthopox virus to be readily transmitted from person to person.

Pathogenesis

The main portal of entry is the respiratory tract. Skin, conjunctival, and transplacental infection are less common. Once inoculation with the virus occurs, the smallpox virus survives and replicates successfully, despite the presence of an active host immune response. Infectivity rates are higher at the onset of the rash. The virus survives because of its ability to acquire and modulate host immune and inflammatory genes. Pox viruses are unique in their ability to replicate in the cytoplasm of infected cells.

Clinical Manifestations and Diagnosis

Variola major consists of three types. The classic form represents 90% of all cases. Flat and hemorrhagic smallpox occur in 7% and 2% of cases, respectively and have a significantly worse prognosis (Moore, 2006). Initially, persons who have been exposed to smallpox are asymptomatic during the incubation period. This typically lasts from 7 to 14 days, although estimates for an intentional smallpox exposure are from 1 to 5 days. After the incubation period, patients develop prodromal symptoms for 2 to 3 days, including high fever and nonspecific constitutional symptoms such as headache, backache, fatigue, and malaise. As the fever subsides, the rash of smallpox appears. The smallpox rash begins with a maculopapular rash that begins on the face, then spreads to the extremities. The initial rash of smallpox is indistinguishable from that of varicella (chickenpox) but is later characteristic in appearance. Smallpox lesions become vesicular then pustular, and are deeply embedded in the dermis. Although varicella lesions appear in “crops” in varying stages over the body, all smallpox lesions develop at the same pace. Smallpox lesions affect the face and extremities preferentially and also affect the palms and soles, unlike chickenpox, which primarily involves the trunk (see Figure 21.7). This manifestation stage lasts from 8 to 9 days.

Toxemia develops during this period due to circulating immune complexes and variola antigens, and is the primary cause of death. Secondary bacterial infection is uncommon. During the second week of illness, either death or recovery usually results (Henderson, 1999).

Biosafety Issues, Protection, and Isolation

Laboratory diagnosis of smallpox is essential and specimens should be obtained by people vaccinated against
Because of its high infectivity, pathogenicity, and ease of person-to-person transmission, Biosafety Level IV (BSL-4) containment procedures, protective equipment, and facilities are necessary for evaluation of potential smallpox samples. These procedures include specially designed laboratory space secured with airlocks and decontamination rooms. Personnel working in these spaces must wear a one-piece positive pressure suit equipped with HEPA-filtered life-support system. Multiple redundant backup systems and other safeguards are also in place with BSL-4 to prevent release of these extremely dangerous microbes (Department of Health and Human Services, 1999).

All patients in whom smallpox is suspected should be placed in strict respiratory isolation in negative pressure rooms. Contacts of patient should be vaccinated and placed under surveillance. Isolated in-home or non-hospital facilities are preferable, due to the high risk of transmission of smallpox via aerosol within hospital environments (Henderson et al., 1999).

Public Health Implications

Any potential or confirmed case of smallpox represents an international public health emergency. Local and state public health officials should be notified immediately, with assurances that national public health officials will also be made aware. Strict quarantine with respiratory isolation for all contacts of the index patient is mandatory.

Vaccination and Postexposure Prophylaxis

Until recently, smallpox vaccine was approved by the U.S. Food and Drug Administration for use only in persons in special-risk categories, including laboratory workers who work with smallpox or other related orthopox viruses. In July 2002, however, the Advisory Committee on Immunization Practices in preliminary recommendations recommended vaccinating roughly 500,000 health care and emergency workers against smallpox, given the possibility of terrorist attacks involving smallpox (Broad, 2002). From late 2002 through 2003, approximately 39,000 individuals received smallpox vaccination in the United States as part of this program. U.S. smallpox vaccination efforts were associated with a low rate of complications (~2%) although some serious reactions occurred, including myopericarditis and encephalitis (Casey et al., 2003). Under epidemic circumstances, WHO recommends immediate and widespread vaccination of the general public.

Smallpox vaccine is not recommended for use in certain groups who may be at risk for complications of the vaccine. In up to 0.2% or more of immunized populations, immunosuppressed individuals, pregnant women, and patients with atopic dermatitis may develop complications related to vaccinia, the orthopox virus used in smallpox vaccine. Vaccinia Immunoglobulin can be given to those at risk for these complications. Smallpox vaccine can also be given up to 4 days postexposure as postexposure prophylaxis with significant reduction in mortality.

Treatment

The treatment for smallpox is primarily supportive. Research is ongoing into antiviral therapies for smallpox but currently therapy for patients infected with smallpox remains supportive, with intravenous fluids, pain medications, and antibiotics as needed for secondary bacterial infections (Henderson, 1999). Cidofovir, an antiviral agent used primarily against cytomegalovirus infection, has shown some promise against orthopox viruses such as vaccinia and cowpox in animal studies (De Clercq, 2002). Currently it is approved in its IV form for use in the treatment of adverse effects of smallpox vaccination (CDC, 2003).

VIRAL HEMORRHAGIC FEVERS

Viral hemorrhagic fevers (VHF) are a group of febrile illnesses caused by RNA viruses from several viral families. They include the filoviruses (Ebola and Marburg), the arenaviruses (Lassa and New World arenaviruses), bunyaviruses such as Rift Valley fever, and the flaviviruses (yellow fever, among others). These highly infectious viruses lead to a potentially lethal disease syndrome characterized by fever, malaise, vomiting, mucosal, and GI bleeding, edema, and hypotension. The most notorious member of this group is Ebola,
outbreaks of which have been associated with case fatality rates of up to 90%. These diseases are generally contracted via an infected animal or arthropod vector. The natural reservoirs for some VHF, such as Ebola and Marburg, remain unknown, although recent epidemiologic studies have suggested that bats may be the natural reservoir for Ebola (Leroy et al., 2005).

In 2002, the Working Group on Civilian Biodefense published an analysis of the potential of VHF for use as a bioterrorist weapon (Borio et al., 2002). They emphasize the great infectivity, ease of transmission, risk to public health, and high mortality associated with these infectious agents as reasons for their biological weapon potential. The potential for droplet or aerosol spread of these viruses has been largely responsible for intense academic and military interest in these agents. Hemorrhagic fever viruses have been weaponized by the former Soviet Union and the United States as part of previous biological weapon programs, but no confirmed use of these agents has been reported. (See Figure 21.8.)

Epidemiology

No human cases of Ebola or Marburg virus infection have been reported in the United States. A 1989 outbreak of an Ebola subtype in Reston, Virginia, popularized by Richard Preston in his 1994 novel, *The Hot Zone*, was noted to be lethal to nonhuman primates but caused only subclinical infection in humans (Preston, 1994). Sporadic outbreaks of Ebola and Marburg virus have been reported, mainly in central Africa. In 2000, an Ebola outbreak in Uganda was responsible for 224 deaths. Fourteen (64%) of 22 medical personnel were infected, despite the institution of isolation wards and infection control measures (CDC, 2001b). Once stricter infection control measures were instituted, disease containment was achieved. A recent outbreak of Marburg virus infection in Angola was responsible for 374 patients and 329 deaths (88% case fatality rate), significantly higher than had been reported in previous outbreaks (Fisher-Hoch, 2005).

Lassa virus, an arenavirus still very common in western Africa, is responsible for 100,000 to 300,000 cases of Lassa fever per year. The last case of Lassa infection in the United States occurred in 2004, in a traveler from an endemic region (CDC, 2004). The natural reservoir for Lassa virus is the *Mastomys* rodent. The South American arenaviruses (e.g., Machupo, Sabia, Junin) are also spread by rodent contact, typically among farm workers. Rift Valley fever, caused by a bunyavirus, is transmitted by the bite of an infected mosquito and is responsible for intermittent outbreaks in Africa. Also transmitted by infected mosquitoes, yellow fever occurs only in Africa and South America. Although likely underdiagnosed, several hundred thousand cases of yellow fever occur worldwide every year, the vast majority of which are in Africa. Like yellow fever, Omsk hemorrhagic fever and Kyasanur Forest disease are also caused by flavivirus-carrying arthropods. In the case of these two diseases, transmission occurs via tick bite (Borio et al., 2002).

Classification and Etiology

The VHF agents are divided into four major viral families: filoviruses, arenaviruses, bunyaviruses, and flaviviruses. Table 21.2 categorizes these RNA viruses by viral family, disease, natural distribution, vector and incubation period.

Aerosol transmission of certain VHF viruses has been theorized and has been seen in animal experiments. Case-fatality rates for VHF infections vary widely, ranging from less than 1% for Omsk hemorrhagic fever to up to 90% for Ebola (subtype Zaire; Borio et al., 2002).

Pathogenesis

The primary defect in patients with VHF is that of increased vascular permeability. Hemorrhagic fever viruses have an affinity for the vascular system, leading to mucous membrane hemorrhage with accompanying hypotension and shock. All of the viruses can also lead to thrombocytopenia and depletion of clotting factors, via either hepatic dysfunction or DIC. During extreme viremia, activation of multiple cytokines leads to increased vascular permeability, shock, and fatal circulatory collapse. On autopsy, frank necrosis of visceral organs (such as liver, spleen, and kidneys) has been seen in association with Ebola virus infection (CDC, 1995; Figge, Shope, & McGovern, 2005).
### 21.2 Viral Hemorrhagic Fevers

<table>
<thead>
<tr>
<th>VIRUS FAMILY</th>
<th>DISEASE (VIRUS)</th>
<th>NATURAL DISTRIBUTION</th>
<th>USUAL SOURCE OF HUMAN INFECTION</th>
<th>INCUBATION (DAYS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filoviridae</td>
<td>Filovirus</td>
<td>Africa</td>
<td>Unknown</td>
<td>3–16</td>
</tr>
<tr>
<td></td>
<td>Marburg and Ebola</td>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arenaviridae</td>
<td>Arenavirus</td>
<td>Africa</td>
<td>Rodent</td>
<td>5–18</td>
</tr>
<tr>
<td></td>
<td>Lassa fever</td>
<td>Africa</td>
<td>Rodent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Argentine HF (Junin)</td>
<td>South America</td>
<td>Rodent</td>
<td>7–14</td>
</tr>
<tr>
<td></td>
<td>Bolivian HF (Machupo)</td>
<td>South America</td>
<td>Rodent</td>
<td>9–15</td>
</tr>
<tr>
<td></td>
<td>Brazilian HF (Sabia)</td>
<td>South America</td>
<td>Rodent</td>
<td>7–14</td>
</tr>
<tr>
<td></td>
<td>Venezuelan HF (Guanarito)</td>
<td>South America</td>
<td>Rodent</td>
<td></td>
</tr>
<tr>
<td>Bunyaviridae</td>
<td>Phlebovirus</td>
<td>Africa</td>
<td>Mosquito</td>
<td>2–5</td>
</tr>
<tr>
<td></td>
<td>Rift Valley fever</td>
<td>Africa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flaviviridae</td>
<td>Flavivirus</td>
<td>Tropical Africa</td>
<td>Mosquito</td>
<td>3–6</td>
</tr>
<tr>
<td></td>
<td>Yellow fever</td>
<td>South America</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Omsk hemorrhagic fever</td>
<td>Central Asia</td>
<td>Tick</td>
<td>2–9</td>
</tr>
<tr>
<td></td>
<td>Kyasanur Forest disease</td>
<td>India</td>
<td>Tick</td>
<td>2–9</td>
</tr>
</tbody>
</table>

#### Clinical Manifestations and Diagnosis

The incubation period for hemorrhagic fever viruses ranges from 2 to 21 days and initial symptoms may be variable, depending on the specific agent. These generally nonspecific early symptoms may include high fever, headache, myalgias, arthralgias, fatigue, flushing, and abdominal pain. Patients with Ebola infection often demonstrate a petechial rash by day 5 (Peters & LeDuc, 1999). Jaundice is common in patients with yellow fever and Rift Valley fever. Later symptoms include hematemesis, hematuria, bloody diarrhea, and generalized mucous membrane hemorrhage. The presence of altered mental status and cardiovascular collapse are preterminal events.

The differential diagnosis includes a number of viral and bacterial diseases, including influenza, meningococcemia, Rocky Mountain spotted fever, malaria, and others, as well as noninfectious causes such as idiopathic and thrombotic thrombocytopenic purpuras, hemolytic uremic syndrome, and DIC (disseminated intravascular coagulation).

Clinical diagnosis is typically based on a history of travel to an endemic area or inadvertent contact with a VHF virus in laboratory setting combined with clinical findings. In the event of a bioterrorist attack, geographic or temporal clusters of patients with similar clinical presentations are highly suggestive.

Laboratory verification is essential but potentially extremely hazardous. In 1994, a Yale virologist working with Sabia, a Brazilian HF virus, accidentally contracted the disease, and fortunately survived (Ryder & Gandsman, 1995). Clinical microbiology laboratories and public health laboratories are not equipped to diagnose or handle VHF specimens. The only two laboratories in the United States with this capability are located at CDC and USAMRIID. Methods of VHF laboratory diagnosis include ELISA, PCR, antibody assays, and viral isolation. (See Figure 21.9.)

#### Biosafety Issues, Protection, and Isolation

BSL-4 precautions are necessary when handling specimens from patients suspected of VHF infection. Every effort should be made to ensure that specimens from these patients are secured and properly sealed for transportation to laboratories with the capability for VHF diagnosis. In their analysis of VHF as a biological weapon, the Working Group for Civilian Biodefense...
makes specific management recommendations for patients suspected of having VHF infection, including:

- Strict hand washing
- Double gloving
- Impermeable gowns
- N-95 masks or powered air-purifying respirators and negative pressure isolation rooms
- Leg and shoe coverings
- Face shields and goggles
- Restricted access to patient rooms
- Environmental disinfection
- If multiple patients are present, they should be cared for in one area of the hospital to minimize exposure to other patients and health care personnel.

All medical personnel who have had close contact with patients suspected of VHF infection before the safeguards were instituted should be placed under medical surveillance (Borio et al., 2002).

Public Health Implications

Like the other diseases discussed previously, any suspected or confirmed case of VHF infection represents a significant public health emergency. Immediate notification of local and state health departments as well as of CDC is mandatory for patients suspected of VHF infection.

Vaccination and Postexposure Prophylaxis

No approved vaccine exists for any of the VHF infections other than yellow fever. A Lassa virus vaccine currently under development at USAMRIID has shown good efficacy in nonhuman primates (Geisbert, 2005). Collaborative efforts between the Canadian Special Pathogens Program and researchers from USAMRIID have led to the development of an experimental filovirus vaccine that also provides protection to nonhuman primates in a laboratory setting (Feldmann, Jones, Schnittler, & Geisbert, 2005).

Ribavirin, a nucleoside analog, is recommended for postexposure prophylaxis for Lassa and possibly for other arenavirus infections, but only if signs of infection are present. Ribavirin has no efficacy against filovirus or flavivirus infection (Borio et al., 2002).

TREATMENT

The treatment for VHF infection is mainly supportive, including intravenous fluids and electrolyte replacement. Hemodialysis, invasive monitoring, and vasopressor therapy may also be needed. Care should be taken to avoid intramuscular injections, and the use of aspirin or other nonsteroidal anti-inflammatory drugs and anticoagulants.

For patients with Lassa and some other arenavirus infections, mortality benefits have been obtained through the use of intravenous ribavirin, particularly when administered early in the patient’s clinical course.

The use of convalescent plasma, that is, plasma from previously infected, recovering VHF patients, has been controversial. Some anecdotal reports have shown a benefit while others have not. Data regarding the use of passive immune therapy like convalescent plasma in the treatment of VHF are extremely limited (Peters & LeDuc, 1999). (See Figure 21.10.)

SUMMARY

Clearly, the CDC Category A biological agents of concern—anthrax, botulism, plague, tularemia, smallpox, and the viral hemorrhagic fevers—represent grave public health risks, particularly if deployed as a biological weapon. This chapter provides the health care professional with a historical and epidemiologic background as well as a standardized, effective evaluation, and management approach for highly pathogenic viral and bacterial diseases. Key elements of the patient’s history and physical, including a history of travel and animal or arthropod exposure, are essential to making the diagnosis. The principles of infection control that begin with universal precautions have been expanded upon in this chapter to enable the effective management of patients infected with even the most deadly infectious agents. Further research into the diagnosis and therapy of these agents is ongoing, and advances in this area will continue to provide safer and more effective management strategies for patients with these potentially lethal infections.
STUDY QUESTIONS

1. First-line therapy for Lassa fever infection includes which of the following?
   a. Gamma globulin
   b. Ribavirin
c. Third-generation cephalosporins
d. Plasmapheresis
e. Convalescent serum

2. Which of the following Category A agents require BSL-4 laboratory facilities?
   a. Smallpox and plague
   b. Anthrax and tularemia
c. Viral hemorrhagic fevers and smallpox
d. Botulism and plague
e. Smallpox and anthrax

3. Which of the following is the natural reservoir for Ebola virus?
   a. Small rodent
   b. Mosquito
c. Green monkey
d. Tick
e. The natural reservoir is unknown

4. Which of the following Category A diseases does not require contact isolation?
   a. Ebola
   b. Plague
c. Anthrax
d. Smallpox
e. Tularemia

5. Which of the following Category A diseases is still endemic in the southwestern United States?
   a. Lassa fever
   b. Plague
c. Anthrax
d. Smallpox
e. Tularemia

6. Which Category A agent classically causes a hemorrhagic mediastinitis, with rapid progression to respiratory failure?
   a. Botulinum toxin
   b. Plague
c. Anthrax
d. Smallpox
e. Tularemia

REFERENCES


Part IV Disasters Caused by Chemical, Biological, and Radiological Agents


Key Messages

- Early recognition and detection of biological events is crucial to maximize the opportunity for early initiation of effective treatment of exposed persons and to minimize the opportunity for transmission of the agent.
- Focusing on unusual patterns or clusters of illnesses can provide epidemiological clues to the occurrence of a covert attack.
- Centers for Disease Control and Prevention (CDC) Category A agents produce several key clinical syndromes. Recognition of these syndromes can assist clinicians in early detection of biological events.

Learning Objectives

When this chapter is completed, readers will be able to

1. Describe at least three key differences between a chemical and a biological event.
2. Give examples of unusual patterns of disease occurrence that might indicate a deliberate release of a biological agent.
3. Describe the primary syndromes associated with CDC Category A agents.
4. Describe the structure and functions of the Laboratory Response Network.
Early Recognition and Detection of Biological Events
Erica Rihl Pryor

CHAPTER OVERVIEW
The biological agents designated as Category A agents by the CDC are described in detail in Chapter 21. These agents are considered the highest priority for response planning because they pose the greatest potential threats if used in biological attacks. The focus of this chapter is on early recognition and detection of such biological events so that prevention and control efforts can be instituted quickly, thereby limiting morbidity and mortality. Attention is focused on the role nurses can play in recognizing and detecting potential outbreaks in their practice settings. Both clinical and epidemiological approaches to recognition are described. For clinical recognition, emphasis is placed on using a syndromic approach. Laboratory methods for detection are also briefly discussed.

INTRODUCTION
Early recognition of a biological event presents several challenges compared with a chemical event (CDC, 2000; Henderson, 1999). A chemical event will typically be overt, with a sudden onset in a localized area. First responders in a chemical attack will most often be traditional emergency personnel, usually from local police and fire departments, along with state and local hazardous materials (HAZMAT) response teams. Containment of the agent and decontamination of affected persons are key elements in the response (Henderson, 1999). In contrast, an unannounced, or covert, attack is considered more probable for a biological event (CDC, 2000). The onset will be delayed by the incubation period of the agent, that is, the time between exposure and onset of symptoms (Giesecke, 2001). Depending on the agent, a period from 1 to 2 days up to several weeks may elapse after the exposure before the event becomes apparent (Franz et al., 1997). In addition, the outbreak may be occurring over a dispersed geographic area. Both factors may make recognition and detection of the scope of the event more difficult. As individuals with clinically apparent disease begin to seek medical care, it is likely that emergency room personnel or community-based health care providers will be the first individuals...
in a position to recognize and respond to an event (CDC, 2000).

Early recognition and detection of a biological event is important for two reasons. First, this will maximize the opportunity for early initiation of effective prophylactic treatment of exposed or potentially exposed persons. Second, early recognition leading to early control efforts will minimize the opportunity for transmission of the agent. Epidemiological models have demonstrated that early intervention in an outbreak can significantly reduce morbidity and mortality in the affected population (Kaufman, Meltzer, & Schmid, 1997). How then can the “window” between exposure and clinical recognition be minimized?

EARLY RECOGNITION OF EVENTS

Surveillance

Recognition by routine surveillance systems (local, state, and federal) may be the first indicator of a bioterror event (Institute of Medicine [IOM] & National Research Council, 1999). Background data on disease occurrence are needed so that an unusual pattern can be detected above the endemic (i.e., usual “noise”) level. Current public health surveillance systems related to bioterrorism preparedness, including syndromic surveillance systems, are discussed in detail in chapter 20.

Since 1998, there has been a sustained effort to enhance the nation’s surveillance infrastructure for detection of biological events by increasing surveillance personnel at state and local health departments and developing rapid data collection networks (Koplan, 2001). Case reporting by individual clinicians remains a principal component of many of these systems. The result is that emphasis must be placed on early recognition and reporting of potential biological events in the clinical setting. Depending on the agent involved, both clinical recognition and identification through syndromic surveillance may be important for recognition of a bioterror event (Buehler, Berkelman, Hartley, & Peters, 2003).

Clinical Recognition

Acute Care Settings. The hospital emergency department is likely to be an initial setting in which the victims of bioterrorist events first seek medical care. This was illustrated in the anthrax outbreak in October–November 2001. Of the 11 patients with inhalational anthrax, 9 presented for initial care to a hospital emergency department (ED), and the remaining 2 patients ultimately sought care in an ED as their symptoms worsened (Barakat et al., 2002; Jernigan et al., 2003). Clearly, health care providers in the ED and other acute health care settings are in a key position to help detect an outbreak, identify the pathogen, and alert public health authorities.

How can early recognition be enhanced in the acute care setting? Three interrelated mechanisms can facilitate early recognition. The first mechanism is to raise the awareness of clinicians of the potential threats posed by infectious diseases, whether because of a deliberate release of an agent or from a naturally occurring outbreak. Clinicians must expand their frame of reference from a routine list of differential diagnoses to one that includes the possibility of deliberate exposures to infectious agents as the etiology for illnesses they see in their clinical areas (Franz et al., 2001). This applies to practitioners working in various specialties within the hospital, including the emergency department, medical intensive care units, and infection control departments, among others. Hospital-based clinicians must also recognize that they may truly be the “first responders” in a biological attack. Their clinical decisions regarding what tests are ordered, what treatment is offered, and who is notified may ultimately affect the course of the outbreak.

A second mechanism essential to early recognition of bioterrorist attacks is an increased attentiveness to unusual patterns of disease occurrence. Looking at patterns requires an epidemiological perspective, that is, a collective view of clients in a given clinical setting. Clinicians must develop an eye for unusual patterns at this group level. This ability to detect patterns that are exceptions or departures from what is expected has been identified as a core competency in emergency preparedness for nurses (Gebbie & Qureshi, 2002).

The third mechanism to facilitate early recognition is use of a syndromic approach in the recognition of disease patterns. Using this approach, clinicians incorporate knowledge of typical clinical presentations of potential bioterror agents into their routine differential diagnosis lists and have a heightened attentiveness for these patterns of disease in their clinical settings. The syndromic approach to recognition of rare infections is discussed in more detail later in the chapter.

Early recognition is essential to enable early interventions in the event of a bioterrorist attack, but public health measures to investigate and contain the outbreak will not be implemented until public health officials are notified. Thus, an essential next step after identifying an unusual case or cases is reporting them to designated public health officials (CDC, 2000c; Fine & Layton, 2001). In addition, since individual clinicians may only see one or two patients, an outbreak may not be apparent until investigators combine these separate reports.

Community-Based Settings. Although hospitals are clearly part of the communities they serve, a distinction is often made between the acute care setting and health care provided in nonhospital settings. Examples
of community-based settings where nurses practice include physician offices, ambulatory care centers, and mental health clinics. Clinicians in these settings must also perceive themselves as having a role in preparing for and responding to a biological event.

How can early recognition be enhanced in community-based settings? The approaches are essentially the same as for hospital-based clinicians. One component is a heightened awareness of potential bioterror agents by practitioners. A second component is increased attentiveness to unusual patterns of disease occurrence. A third component is use of a syndromic approach to clinical recognition of disease patterns. As with acute care clinicians, community-based clinicians must recognize that they may fill the role of first responders in a biological attack.

Community Health Settings. In contrast to community-based practice settings, which maintain a focus on individual clients or families, nurses practicing in community health settings provide health care in the context of the community (Clemen-Stone, 2002). Community health nurses may focus their practice on specific population aggregates within the community, such as school-aged children or working adults, but the community as a whole is viewed as the client. As in acute or community-based practice settings, community health nurses must also consider their potential role as first responders should a biological event affect their client (i.e., the community). They should also be familiar with the agents posing the greatest potential threats (i.e., CDC Category A agents) and the key syndromes associated with these agents. In contrast to practitioners in other settings, community health nurses typically have had educational preparation in considering disease from a population viewpoint, that is, in viewing disease patterns from an epidemiological perspective (Clemen-Stone, 2002).

EPIDEMIOLOGICAL APPROACH TO RECOGNITION

Recognition of Unusual Patterns. Recognition of unusual patterns requires a population-based or epidemiological approach to data analysis and interpretation. What would constitute an unusual pattern of disease occurrence? Essentially, it is a cluster that does not fit. A cluster is “an aggregation of cases of a disease or other health-related condition . . . which are closely grouped in time and place” (CDC, 1992, p. 429). Again, baseline information is needed for comparison to evaluate what is unusual.

Health Indicator Data. Many types of health indicator data can be used as baseline information (Franz et al., 2001). The type of data available will vary by practice setting. For example, hospitals and clinics typically collect data on patient diagnoses in the form of International Classification of Diseases, Ninth Revision (ICD-9) codes. Within the hospital, emergency departments track visit volume, while infection control departments maintain data on organisms and antimicrobial susceptibilities of agents causing nosocomial (i.e., hospital-acquired) infections. At the local and state levels, health departments maintain records on the numbers and rates of reportable infectious diseases. The medical examiner or coroner maintains records on unexplained deaths, and schools and worksites typically maintain records on absenteeism. Changes in one or more of these indicators may be a sign of a deliberate biological event (Franz et al., 2001).

Epidemiological Clues to a Biological Event. With awareness of the baseline data for their practice setting, nurses should be alert for unusual patterns of disease or health-related indicators. Representative examples of unusual patterns of diseases that might suggest a bioterrorist act are presented in Table 22.1 (U.S. Army Medical Research Institute of Infectious Diseases [USAMRIID], 2005; U.S. Department of Health and Human Services [USDHHS], 2001).

The value of spotting the unusual has been demonstrated by a number of infectious disease outbreaks in the United States. A classic example is the initial reports of the human immunodeficiency virus epidemic. Alert clinicians in California and New York City noted clusters of rare illnesses, Kaposi’s sarcoma and Pneumocystis carinii pneumonia, among homosexual male clients in their practices (CDC, 1981a, 1981b). In May 1993, a New Mexico medical examiner reported two deaths from acute respiratory failure 5 days apart (CDC, 1993).
Both persons had lived in the same residence. These were the first reported cases in the Hantavirus outbreak that occurred that year in the southwestern United States. In the 1999 West Nile virus outbreak in New York City, a physician noted that patients with similar clinical signs had presented for treatment at the same hospital and alerted public health authorities (Asnis, Conetta, Teixeira, Waldman, & Sampson, 2000; Fine & Layton, 2001). In each of these examples, it was the recognition of an unusual pattern that prompted further investigation and the ultimate discovery of new or newly emerging pathogens.

SYNDROMIC APPROACH TO RECOGNITION

Many different infectious disease agents or biological toxins could potentially be used as weapons, but the CDC has identified certain agents and toxins that are considered as having a higher likelihood for use in a bioterrorist attack. CDC has categorized these potential bioterror agents by how readily they can be disseminated or spread, their potential for significant morbidity and mortality, and the resulting consequences for public health preparedness (CDC, 2000). Category A agents include anthrax, smallpox, plague, botulism, tularemia, and viral hemorrhagic fevers such as Ebola. These are the agents most likely to cause mass casualties in the event of a deliberate aerosolized release, and are therefore seen as the highest priority for preparation and training (CDC, 2000).

Since many different agents could be used in a bioterrorist attack, and many of these agents have disease patterns that are initially nonspecific, it is important for clinicians to think from an epidemiological perspective and be able to recognize syndromic patterns suggestive of a deliberate agent release (Franz et al., 2001). For example, one case of rapidly progressive febrile illness during the traditional “flu season” may not be cause for suspicion, but a pattern of several such cases with the same clinical presentation over a short period of time should raise the index of suspicion for a bioterror event.

Syndromic recognition relies on the clinical presentation of the patient, plus other clues to suggest specific agents. Laboratory or radiological tests can then assist with confirmation. Experience with the anthrax outbreak in 2001 suggests that, even in the early stage of illness, clues may be present to assist clinicians with their differential diagnosis (CDC, 2001a). Evaluation of the initial symptoms of the 11 patients with inhalational anthrax showed that rhinorrhea was uncommon, while shortness of breath and nausea and vomiting were common. This disease pattern is in contrast to the usual symptoms seen with influenza, where rhinorrhea is more common and shortness of breath, nausea, and vomiting are uncommon. In addition, the anthrax cases all had abnormal chest radiographs, which are not typically seen with influenza (CDC, 2001a). More recently, in a report of 10 cases of H5N1 avian influenza from Vietnam, all of the cases presented with fever, cough, and shortness of breath and seven cases presented with diarrhea (Hien et al., 2004). The latter two symptoms are not common for human influenza infection (CDC, 2001a). Consideration of other epidemiologic clues may also be important. In the avian influenza case series, all cases had documented exposure to poultry affected by H5N1 (Hien et al., 2004) As another example, a travel history to an area with reported cases of severe acute respiratory syndrome (SARS) was an important element in case identification during the 2003 global outbreak of that disease (CDC, 2003a).

Syndromes Associated With CDC Category A Agents

Most of the Category A agents, and many other potential bioterror agents, produce an initial prodrome of flu-like or nonspecific symptoms before progressing to one or more syndromic patterns. In 2003, several agencies developed syndromic definitions for these agents based on the ICD-9, Clinical Modification (ICD-9-CM) codes (CDC, 2003b). These 11 syndrome definitions are summarized in Table 22.2 and discussed briefly below. A detailed discussion of the diagnosis of each of the CDC Category A agents is presented in Chapter 21.

Botulism-Like Syndrome. Of the agents on the Category A list, only botulism produces the unique neurological syndrome described in the table. The pattern of proximal to distal descending paralysis, coupled with a lack of sensory deficits, is characteristic of the botulinum toxin (Arnon et al., 2001). Patients may initially present with symptoms such as difficulty swallowing and double vision, with progressive paralysis. In the case of severe intoxication, paralysis may progress to respiratory failure. Any cluster of patients with this syndromic presentation is suggestive of a botulism outbreak, and if clinical case histories rule out a potential common food source, this increases the suspicion of an inhalational exposure (Arnon et al., 2001; CDC, 2001c).

Hemorrhagic Illness. The viral hemorrhagic fevers include diseases caused by a number of different viruses. The clinical manifestations are characteristically severe, including shock, disseminated intravascular coagulation (DIC), and other signs of increased vascular permeability (Borio et al., 2002; Franz et al., 1997). A macular or petechial rash is also typical for many of the viral hemorrhagic fevers.
22.2 Syndromes Associated With CDC Category A Agents

<table>
<thead>
<tr>
<th>SYNDROME</th>
<th>DEFINITION</th>
<th>CATEGORY A CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Botulism-like</td>
<td>Acute paralytic conditions consistent with botulism such as cranial nerve palsy, ptosis, decreased gag reflex</td>
<td>Botulism</td>
</tr>
<tr>
<td>2. Hemorrhagic Illness</td>
<td>Acute condition with multiple organ involvement that may be consistent with exposure to VHF</td>
<td>VHF</td>
</tr>
<tr>
<td>3. Rash</td>
<td>Acute condition that may present as consistent with smallpox</td>
<td>Smallpox</td>
</tr>
<tr>
<td>4. Lymphadenitis</td>
<td>Acute regional lymph node swelling or infection (painful bubo)</td>
<td>Plague (bubonic)</td>
</tr>
<tr>
<td>5. Localized Cutaneous Lesion</td>
<td>Acute localized edema or lesion that may be consistent with cutaneous anthrax or tularemia</td>
<td>Anthrax (cutaneous), Tularemia</td>
</tr>
<tr>
<td>6. Gastrointestinal</td>
<td>Acute infection of the upper and/or lower gastrointestinal (GI) tract</td>
<td>Anthrax (gastrointestinal)</td>
</tr>
<tr>
<td>7. Respiratory</td>
<td>Acute infection of the upper and/or lower respiratory tract</td>
<td>Anthrax (inhalational), Tularemia (pneumonic)</td>
</tr>
<tr>
<td>8. Neurological</td>
<td>Acute neurological infection of the central nervous system (CNS)</td>
<td>Not applicable (NA)</td>
</tr>
<tr>
<td>9. Fever</td>
<td>Acute potentially febrile illness of origin not specified</td>
<td>NA</td>
</tr>
<tr>
<td>10. Specific Infection</td>
<td>Acute infection of known cause not covered in other syndromes</td>
<td>NA</td>
</tr>
<tr>
<td>11. Sudden Illness or Death</td>
<td>Acute onset of shock or coma from potentially infectious causes</td>
<td>NA</td>
</tr>
</tbody>
</table>

Rash. Whereas fever is characteristic in many different infectious and noninfectious processes, the concomitant occurrence of a rash should provoke further clinical evaluation. In particular, clinicians should be familiar with the characteristic rash produced by smallpox and the features that distinguish it from the rash produced by varicella (Henderson et al., 1999). The initial vesicular lesions of smallpox progress to large, firm pustules. The lesions are synchronous, that is, at the same stage of development, and centrifugal, that is, more numerous on the face and extremities than on the trunk. This pattern of lesions is a key feature for clinical recognition of smallpox (Henderson et al., 1999).

Respiratory Syndrome. Several of the Category A agents produce rapidly progressive respiratory symptoms, including anthrax, plague, and tularemia (Dennis et al., 2001; Franz et al., 1997; Inglesby et al., 1999; Inglesby et al., 2000; USAMRIID, 2005). Additional clues can suggest a particular pathogen from the differential diagnosis list. Chest radiography and computed tomography, along with gram stain and culture of body fluids, are particularly important. Although naturally occurring respiratory infections can occur with all three agents, primary respiratory disease is an uncommon presentation with natural infections. Therefore, when any of these agents are suspected as the etiology for rapidly progressive pneumonia, a deliberate, aerosolized exposure should be suspected (Dennis et al., 2001; USAMRIID, 2005).

Other Syndromes. These three bacterial pathogens produce different clinical manifestations depending on
the mode of transmission. *Lymphadenitis*, with painful buboes in the groin axilla or neck is characteristic of the bubonic form of plague (Inglesby et al., 2000). Anthrax and tularemia may present with cutaneous forms of disease (Dennis et al., 2001; Inglesby et al., 1999). These produce characteristic cutaneous lesions. Anthrax may also present with a *gastrointestinal syndrome* (Inglesby et al., 1999).

**Clinical Presentations for Other Potential Bioterror Agents**

Although emphasis has been placed on Category A agents because of their potential severe impact on public health, it is important to remember that other agents have the potential for use in deliberate acts of bioterror. As with the CDC Category A agents, several Category B agents, such as Q-fever, brucellosis, and glanders, may present with nonspecific flu-like symptoms or respiratory symptoms, while other agents such as *E. coli* 0157 and cholera produce predominantly gastrointestinal symptoms (Franz et al., 1997; USAMRIID, 2005). Even common agents may be used, as was the case in 1984 when a restaurant-associated outbreak of *Salmonella typhimurium* occurred following deliberate food contamination (Torok et al., 1997). Again, recognition of unusual patterns of disease, including clusters of patients with similar syndromic presentations can be the early indicator of a biological event, regardless of the etiologic agent (Franz et al., 1997).

**LABORATORY DETECTION**

Laboratory personnel are another category of health care provider who will need increased attentiveness to unusual patterns. They are in a position to detect changes in the number of culture requests or an increase in uncommon specimen types such as pulmonary aspirations (CDC, 2001c). In addition, laboratory records of culture patterns may show increases in unusual strains, or strains with resistance patterns not usually seen in a given facility or locality (USAMRIID, 2005; USDHHS, 2001).

**Laboratory Methods for Detection**

Laboratory tests are an important adjunct in confirming the presence of suspected bioterror agents. Laboratory identification requires several approaches (Henchal, Teska, Ludwig, Shoemaker, & Ezell, 2001). One component is the use of culture methods. For the bacterial pathogens of interest (*Bacillus anthracis*, *Yersinia pestis*, and *Francisella tularensis*), initial staining and microscopy results are available rapidly, and can assist clinicians with a differential diagnosis. Efforts have been made to improve laboratory capabilities for detecting these agents through provision of training and resources to laboratories nationwide (CDC, 2000; Koplan, 2001). In contrast to the bacterial pathogens, the Category A viral pathogens (i.e., smallpox and the viral hemorrhagic fevers) require the highest level of containment for culture procedures, and specimen collection and handling must be done with special precautions (Henchal et al., 2001).

Another component to identification is gene amplification techniques (Henchal et al., 2001). Gene targets have been identified for all of the Category A agents. Although sensitive, they take time and require specialized equipment and training for personnel. The third component to identification is immunoassays (Henchal et al., 2001). These rely on antigen-antibody reactions specific for a given agent. Immunoassays can be less sensitive than culture or gene amplification approaches. Some early assays required a threshold concentration to give a “positive” reading, and some had problems with cross-reactivity with related organisms, which limited their specificity (CDC, 2001d; Henchal et al., 2001). Efforts are under way to develop improved immunodiagnostic tools for a variety of agents and toxins that will allow rapid diagnosis during the initial phases of illness.

**Laboratory Response Network**

Part of the response plan for bioterrorism has been the development of the Laboratory Response Network (LRN; CDC, 2000). The system was established in 1999, with the goal of enhancing capabilities for identification and characterization of potential bioterror agents through links between hospital and public health laboratories (CDC, 2000; see Case Study 22.1). Initially, the classification system for laboratories included four levels, denoted A, B, C, and D, representing increasing levels of expertise and technologies to manage potential bioterror agents. The current system is categorized into three levels: sentinel, reference, and national laboratories (CDC, 2005). Sentinel laboratories have capabilities to perform microbiological testing for recognition and rule out of potential bioterror agents. Their role is one of early detection and referral to an appropriate reference laboratory. Reference laboratories have additional capacities for confirmatory testing of specific agents. Their role is one of investigation and referral. In 2005, there were over 100 LRN reference laboratories. In addition to laboratories at state and local health departments and a few international reference facilities, the LRN also includes veterinary, agricultural, and environmental laboratories (CDC, 2005). National laboratories have the specialized expertise and facilities needed to handle organisms, such as smallpox, that require the
highest biosafety level. Their role is to provide definitive characterization of agents (CDC, 2005). Nurses should be familiar with the laboratory capacities of the health facilities in which they work and understand the tiered response structure of support provided by the LRN in the event of a biological attack.

**OUTBREAK INVESTIGATION**

From an epidemiological standpoint, the general process of investigating a potential bioterror event and the objectives are the same as for any other infectious disease outbreak (Franz et al., 2001). Investigation of an outbreak involves a number of activities. These activities are adapted from a list developed by the CDC (1992):

1. Confirm that an outbreak is occurring.
2. Establish or verify a causative agent or diagnosis.
3. Formulate a case definition and identify cases.
4. Describe the outbreak in terms of person, place, and time.
5. Formulate and test hypotheses regarding the cause/source of the outbreak.
6. As needed, gather additional data, such as environmental samples.
7. Institute prevention and control procedures appropriate for the agent or diagnosis.

These activities represent objectives to be achieved and several steps may be in progress simultaneously.

Although listed last, communicating information regarding the event to public health officials, area clinicians, and to the public through the media must occur in an ongoing manner. Dissemination of information about the event to clinicians and the public can assist with identification of cases, so that appropriate treatment can be started rapidly. For a disease that is transmitted person to person, such as smallpox or pneumonic plague, identifying contacts of cases so that prophylaxis can be initiated is critical to containing the epidemic. Actively engaging the assistance of area clinicians in case finding and contact identification can assist with these control measures.

Environmental sampling may be an important component of the investigation, particularly with a suspected bioterror event (CDC, 2001b; Reingold, 1998). The purpose of the sampling is to provide evidence regarding probable exposure sites or vehicles. This information can assist in defining persons who may require follow-up and prophylaxis, but the tests are not diagnostic (CDC, 2001b). The sampling methods used may include cultures or nucleic acid or immune-based detection systems. Based on experience with environmental testing in the anthrax outbreak in 2001, the CDC (2001d) recommended further research to establish the validity, sensitivity, and specificity of these detection systems compared with culture results. Since then, considerable resources have gone toward development of improved detection systems for bioterror agents.

**FUTURE DIRECTIONS FOR DETECTION**

**Biosensors**

Even before the anthrax attack in 2001, a variety of detection systems had been developed for potential bioterror agents. A systematic review published in January 2004 identified publicly available articles on 55 such systems (Bravata et al., 2004). Various technologies were represented, including biomass indicators and identification systems targeting toxins, metabolic byproducts, antigens or DNA for selected agents. A key point made by the authors was that only eight of the published articles included evaluation data, and they identified system evaluation as an important area for further research.

Air sampling detection systems are currently in use in the U.S. as part of the BioWatch program, which is a component of the Laboratory Response Network. (CDC, 2005) The location of these monitoring systems remains undisclosed, with monitoring occurring continuously. Filters from the sampling system undergo frequent, nucleic acid-based testing at designated LRN laboratories.

Most biosensor development has focused on two broad types: nucleic acid-based detection systems and immunologic-based detection systems (Iqbal et al., 2000). Nucleic acid detection focuses on the genetic components (DNA or RNA) of the agents themselves. Immunologic detection focuses on the immune-based responses to the organism or its products. The advantage of systems based on nucleic acid detection is that they are generally better at correctly identifying true cases and true noncases; that is, they have better sensitivity and specificity. Immunologic detection systems are typically more rapid and have a broader range of targets, including bacterial cells and spores, viruses, and toxins (Iqbal et al., 2000).

Recent developments in detection technologies have led to incorporation of both types of systems in to a single detection system. An example of such a device is the Autonomous Pathogen Detection System developed by researchers at the Lawrence Livermore National Laboratory (Hindson et al., 2005). In this system, the sample first undergoes simultaneous immunomagnetic testing to multiple agents. If this testing produces a responsive assay, the sample is then submitted for a confirmatory assay using nucleic acid testing. Further details on current research and development projects related to biosensors are presented throughout this chapter.

**Biosensors**

Recent developments in detection technologies have led to incorporation of both types of systems in to a single detection system. An example of such a device is the Autonomous Pathogen Detection System developed by researchers at the Lawrence Livermore National Laboratory (Hindson et al., 2005). In this system, the sample first undergoes simultaneous immunomagnetic testing to multiple agents. If this testing produces a responsive assay, the sample is then submitted for a confirmatory assay using nucleic acid testing. Further details on current research and development projects related to biosensors are presented throughout this chapter.
Syndromic Surveillance

Another area that has received attention from researchers in the field of informatics is the development of electronic systems that can provide ongoing, real-time surveillance for unusual patterns of illness that would suggest a biological event (Teich, Wagner, Mackenzie, & Schauer, 2002). As noted in chapter 20, public health surveillance traditionally has relied on tabulation of individual case reports from providers or positive culture reports to monitor disease trends. The use of such passive systems has meant that representativeness and timeliness were less than optimal (IOM, 1999). Even before the 2001 anthrax attacks, several groups of researchers were examining alternate sentinel surveillance strategies that relied on early indicators of unusual patterns (Teich et al., 2002). These syndromic systems use computer search algorithms on various types of medical record data, such as ICD-9 codes or laboratory tests orders from hospital admissions, to provide early indications of changing patterns. These indicators may lack specificity but can help spot patterns that may need further investigation (Teich et al., 2002).

These surveillance approaches use secondary analyses of available data sources for early detection (Lober et al., 2002). In their discussion of six systems that were operational in 2002, Lober et al. (2002) noted that the systems collected similar types of data, largely relying on computerized medical records. All of the systems they reviewed collected data from emergency departments or emergency medical system dispatch records, underscoring the importance of the acute care setting for detection of outbreaks. The authors stressed the need to integrate these surveillance systems with the appropriate investigative responses from public health authorities. Factors that will facilitate this applied informatics approach to detection include gathering medical record data from multiple health systems within a geographic area, and including other community health indicators in the models (Teich et al., 2002). The syndromic systems highlighted in chapter 20 incorporate these concepts.

Diagnostic Decision Support Systems

The preceding discussion focuses on the ability of individual clinicians to detect and recognize infectious processes that may be related to a bioterrorist event. To a certain extent, this relies on the art of clinicians— their expertise and clinical detective skills, which will clearly vary among practitioners. A number of electronic systems have been developed that provide diagnostic decision support to clinicians. Typically, these systems provide the clinician with a differential diagnosis list based on patient signs and symptoms and the pretest likelihood of different diagnoses (Bravata et al., 2004). In an extensive literature review, Bravata and colleagues identified 23 such systems with at least some relevance for bioterrorism-related diseases. Only two reports provided evidence of system testing specific to potential bioterror agents and the authors concluded that the usefulness of available systems to assist with diagnosis of bioterror agents is limited. Development of new systems to assist clinicians in recognition and response to bioterror events is an area in need of future research.

EDUCATIONAL PREPARATION

Education of acute care and community-based practitioners is the cornerstone of preparation for a potential event (CDC, 2000). Educational preparation related to recognition and detection of bioterror agents has two general components: awareness and performance (American College of Emergency Physicians & USDHHS Office of Emergency Preparedness, 2001). Content for the awareness component should focus on areas that would facilitate early recognition of biological events. These areas include epidemiological principles, the natural history of potential bioterror agents, and syndromic recognition of such agents. In addition, clinicians need to know how to access/initiate additional resources such as local and state health departments and the CDC. The second component of education is performance-based training. This type of training may be achieved through simulation exercises and drills that emphasize clinical and administrative decision making in response to hypothetical bioterrorist scenarios (Pryor et al., 2006).

SUMMARY

Nurses practicing in acute care, community-based, or community health settings have a potential role in detecting a bioterrorist attack. Several mechanisms can assist clinicians in the early recognition and detection of these events. In evaluating individual patients, clinicians should consider potential bioterror agents on their differential diagnosis lists and be alert for syndromic patterns suggestive of a bioterrorist attack. In addition, nurses can use an epidemiological approach with their patient populations to look for unusual patterns of disease. These content areas are important to include in the educational preparation of clinicians on responding to bioterror events.
Laboratories play a major role in detection and confirmation of potential bioterror agents. The LRN provides tiered capabilities for confirmatory testing. Surveillance systems are also important in providing indications of changing patterns of disease. Current research projects hold the promise of rapid diagnostic and screening tests and computerized surveillance systems that can quickly identify potential bioterror events. Even with the development of such technologies, it remains the responsibility of clinicians, including nurses, to think of themselves as potential first responders in a bioterror event and to acquire the knowledge necessary to assist with early detection, recognition, and reporting of such events.

**STUDY REVIEW QUESTIONS**

1. Why is it necessary to have baseline surveillance data to evaluate disease patterns?
2. What are the three mechanisms that can facilitate early recognition of biological events by clinicians?
3. The characteristic rash of smallpox is described as synchronous and centrifugal. What does that mean with regard to the pattern of lesions on an affected individual?
4. Identify examples of health indicator data that are collected in the clinical setting in which you practice.
5. Which of the following case scenarios are suggestive of an intentional biological release?
   a. You are working in the emergency department (ED) of a large urban hospital. It is early winter. You have seen six patients this morning, ages 22 to 64, with a 1- to 4-day history of fever, chills, cough, and rhinorrhea. None report having received an influenza vaccination the previous fall.
   b. You are working in the ED of a medium sized community hospital. During your shift today, you have seen four otherwise healthy young adults present with a history of fever and chills for 4 days, followed by rapidly progressive dyspnea and productive cough. Two of the patients were so hypoxic that they required endotracheal intubation and mechanical ventilation in the ED. The other two patients were admitted to the ICU, and were also intubated later in the day.
   c. In the local ED where you work, an emergency medical system call is received stating that five patients are being transported to your hospital. All five patients were found in the same building, and one of the patients is in respiratory distress. The other four are having blurred vision, difficulty swallowing, slurred speech, and difficulty walking. On examination, you find that all of the patients are afebrile and have flaccid paralysis.

**USEFUL LINKS/INTERNET-BASED ACTIVITIES**

1. This is the Web site on bioterrorism developed by the Centers for Disease Control and Prevention. Go to http://www.bt.cdc.gov/bioterrorism. Select “List of Agents by Category” under Specific Bioterrorism Agents. On that next page, select “Anthrax” under Category A. Review the material under “What You Need to Know” and any other “Specific Topics” of interest.
   Using this information:
   - Construct a case-based scenario that would suggest inhalational anthrax resulting from a deliberate release of aerosolized spores.
   - Construct a case-based scenario that would suggest a naturally occurring cutaneous anthrax infection.
   (See Question 5 under Study Review Questions for examples of case-based scenarios.)
2. This link leads to the summary reports of notifiable diseases in the United States from 1993 to 2005. Go to http://www.cdc.gov/mmwr/summary.html. Select the 2000 issue. Scroll down to “Part I: Summaries of Notifiable Diseases in the United States, 2000.” Use the data in Table 2, which gives cases by geographic region, to make a list of states with reported cases of plague for that year. Similarly, make a list of states with reported cases of plague in 1999 and 2001.
   Using this information:
   - Identify states or region of the United States where a single case of plague might be a naturally occurring infection.
3. The link leads to the summary reports of notifiable diseases in the United States. Go to http://www.cdc.gov/mmwr/summary.html. Select the 2000 issue. Scroll down to “Part I: Summaries of Notifiable Diseases in the United States, 2000.” Use the information in Tables 1 through 6 to compile information on the cases of tularemia that were reported that year.
   Using this information:
   - Prepare a one-paragraph summary of the person, place, and time characteristics of the 142 cases of tularemia that occurred in the United States in 2000.
Discuss how a clinician might use this information to help distinguish between a cluster of naturally occurring infections and one that was the result of a deliberate release of the agent.

REFERENCES


ci.pdf


Early Recognition and Detection of Biological Events


In 1999, the Centers for Disease Control and Prevention (CDC) established the Laboratory Response Network (LRN). The LRN’s purpose is to run a network of labs that can respond to biological and chemical terrorism. The LRN has grown to greater than 100 LRN laboratories since it was established. It now includes state and local public health, veterinary, military, and international labs.

The LRN Mission

The LRN and its partners will maintain an integrated national and international network of laboratories that are fully equipped to respond quickly to acts of chemical or biological terrorism, emerging infectious diseases, and other public health threats and emergencies.

What Is the LRN?

The LRN is a national network of about 140 labs. The network includes the following types of labs:

- Federal—These include labs at CDC, the US Department of Agriculture, the Food and Drug Administration (FDA), and other facilities run by federal agencies.
- State and local public health—These are labs run by state and local departments of health. In addition to being able to test for Category A biological agents, a few LRN public health labs are able to measure human exposure to toxic chemicals through tests on clinical specimens.
- Military—Labs operated by the Department of Defense, including the Naval Medical Research Center in Bethesda, MD.
- Food testing—The LRN includes FDA and USDA labs, and others that are responsible for ensuring the safety of the food supply.
- Environmental—Includes labs that are capable of testing water and other environmental samples.
- Veterinary—Some LRN labs, such as those run by USDA, are responsible for animal testing. Some diseases can be shared by humans and animals, and animals often provide the first sign of disease outbreak.
- International—The LRN has labs located in Canada, the United Kingdom, and Australia.

The LRN in Action

Anthrax Attacks of 2001. The LRN has been put to the test on several occasions. In 2001, a Florida LRN reference laboratory discovered the presence of *Bacillus anthracis* in a clinical specimen. *Bacillus anthracis* causes anthrax. LRN labs tested 125,000 samples by the time the investigation was completed. This amounted to more than 1 million separate tests.

BioWatch

BioWatch is a program using air samplers to test for threat agents. The samplers are located in undisclosed cities and monitor the air 24 hours a day, 7 days a week. LRN BioWatch labs test filters from these samplers. Tests include polymerase chain reaction (PCR). PCR can quickly detect the presence of an agent’s unique DNA.

Severe Acute Respiratory Syndrome

CDC labs identified the unique DNA sequence of the virus that causes SARS. The LRN developed tests and
The LRN Structure for Bioterrorism

LRN labs are designated as either national, reference, or sentinel. Designation depends on the types of tests a laboratory can perform and how it handles infectious agents to protect workers and the public.

**National labs** have unique resources to handle highly infectious agents and the ability to identify specific agent strains.

**Reference labs**, sometimes referred to as “confirmation reference,” can perform tests to detect and confirm the presence of a threat agent. These labs ensure a timely local response in the event of a terrorist incident. Rather than having to rely on confirmation from labs at CDC, reference labs are capable of producing conclusive results. This allows local authorities to respond quickly to emergencies.

**Sentinel labs** represent the thousands of hospital-based labs that are on the front lines. Sentinel labs have direct contact with patients. In an unannounced or covert terrorist attack, patients provide specimens during routine patient care. Sentinel labs could be the first facility to spot a suspicious specimen. A sentinel laboratory’s responsibility is to refer a suspicious sample to the right reference lab.

**LRN Structure for Chemical Terrorism**

Currently, 62 state, territorial, and metropolitan public health laboratories are members of the chemical component of the network. A designation of Level 1, 2, or 3 defines network participation, and each level builds upon the preceding level. (Please note that the level designations were changed in early 2005 so that laboratories previously designated “Level 1” are now “Level 3,” and laboratories previously designated “Level 3” are now “Level 1.”)

**Level 3 Laboratories.** Each chemical network member participates in Level 3 activities. Level 3 laboratories are responsible for:

- Working with hospitals in their jurisdiction;
- Knowing how to properly collect and ship clinical specimen;
- Ensuring that specimens, which can be used as evidence in a criminal investigation, are handled properly and chain-of-custody procedures are followed;
- Being familiar with chemical agents and their health effects;
- Training on anticipated clinical sample flow and shipping regulations; and
- Working to develop a coordinated response plan for their respective state and jurisdiction.

**Level 2 Laboratories.** Thirty-seven labs also participate in Level 2 activities. At this level, laboratory personnel are trained to detect exposure to a limited number of toxic chemical agents in human blood or urine. Analysis of cyanide and toxic metals in human samples are examples of Level 2 laboratory activities.

**Level 1 Laboratories.** Ten laboratories participate in Level 1 activities. At this level, personnel are trained to detect exposure to an expanded number of chemicals in human blood or urine, including all Level 2 laboratory analyses, plus analyses for mustard agents, nerve agents, and other toxic chemicals.

**How Do Public Health Labs Become LRN Members?**

State lab directors determine whether public health labs in their states should be included in the network. Membership is not automatic. Prospective reference labs must have the equipment, trained personnel, properly designed facilities, and must demonstrate testing accuracy. State lab directors determine the criteria for inviting sentinel labs to join the LRN.
Key Messages

- Emerging infectious diseases are a constant challenge to the public health system and may be the cause of a disease outbreak disaster resulting in high morbidity and mortality.
- Globally, infectious disease is still a major cause of morbidity and mortality. Ninety percent of all infectious disease deaths are caused by only six diseases, of which half are emerging or re-emerging infectious diseases (tuberculosis, malaria, and HIV).
- The creation of an emerging infectious disease requires the convergence of complex factors that can be genetic and biological, physical, ecological, social, political, or behavioral in nature.

Learning Objectives

When this chapter is completed, readers will be able to

1. Define the concept of emerging infectious diseases and their classification.
2. Understand factors contributing to emerging infections.
3. Identify diseases of importance.
4. Discuss future directions in the fight against emerging infectious diseases.
Emerging Infectious Disease

Jennifer A. Byrnes

CHAPTER OVERVIEW

Emerging infectious diseases (EIDs) are a continual challenge to the public health system; as one disease is mitigated or eradicated, another emerges to take its place. EIDs are those that are newly evolved, such as SARS, or have increased in their geographic range, such as West Nile virus (Morse, 1995). Until the advent of AIDS in the 1980s, public health had focused a majority of its efforts and resources on the prevention and mitigation of chronic diseases in the belief that infectious diseases were no longer a significant threat to the public’s health. The grave impact of EIDs indeed was a shock to an underfunded and underutilized public health system.

BRIEF HISTORY

In the late 1960s, testifying before Congress, U.S. Surgeon General William T. Stewart claimed victory in the war against infectious diseases. Stewart, along with other members of the medical and scientific communities, believed that there had been a transition in which infectious disease had waned and chronic disease had become the dominant cause of morbidity and mortality in the modern age (Fauci, 2001).

We can look forward with confidence to a considerable degree of freedom from infectious diseases at a time not too far in the future. Indeed... it seems reasonable to anticipate that within some measurable time... all the major infections will have disappeared.


The concept of the transition from infectious to chronic disease became known as the epidemiological shift and was promulgated by Omran in 1971. The shift had three stages; the first stage, the age of pestilence and famine, is characterized by high mortality rates and an inability to sustain population growth. The age of receding pandemics, the second stage, shows a decline in the mortality rate as epidemics become less frequent. The final stage, known as the age of degenerative and man-made diseases, wherein there is a continual decline in
mortality with gradual increases in life expectancy, characterizes the modern Western world. In this final stage, Omran predicted that heart disease and cancer would become the greatest causes of morbidity and mortality; although, the threat of infectious diseases was still very real (Omran, 2005).

The Burden of Infectious Disease

According to the World Health Organization, infectious disease still accounts for approximately 26% of deaths globally (15 million) and is the leading cause of death in people younger than 50. Each year approximately 3 million children die from malaria and diarrheal disease alone. Ninety percent of all infectious disease deaths are caused by only six diseases (World Health Organization, 1999):

- Diarrheal disease
- HIV/AIDS
- Malaria
- Measles
- Pneumonia
- Tuberculosis

These figures do not take into account the millions of deaths secondary to infectious diseases such as liver failure from Hepatitis C or streptococcal rheumatic heart disease (World Health Organization, 1999). Areas that have not reached the third stage of the epidemiological shift such as developing nations, those with extreme poverty, poor living conditions, and malnutrition, carry the largest burden of disease because of a lack of access to vaccines, antibiotics, and quality health care (World Health Organization, 2004).

Factors Contributing to EIDs

The genesis of an EID requires the convergence of complex factors that can be genetic and biologic, physical, ecological, social, political, or behavioral in nature (Institute of Medicine of the National Academies, 2003). Please refer to Table 23.1—Factors in Emergence.

<table>
<thead>
<tr>
<th>Factors in Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbial adaptation and change</td>
</tr>
<tr>
<td>Human susceptibility to infection</td>
</tr>
<tr>
<td>Climate and weather</td>
</tr>
<tr>
<td>Changing ecosystems</td>
</tr>
<tr>
<td>Human demographics and behavior</td>
</tr>
<tr>
<td>Economic development and land use</td>
</tr>
<tr>
<td>International travel and commerce</td>
</tr>
<tr>
<td>Technology and industry</td>
</tr>
<tr>
<td>Breakdown of public health measures</td>
</tr>
<tr>
<td>Poverty and social inequality</td>
</tr>
<tr>
<td>War and famine</td>
</tr>
<tr>
<td>Lack of political will</td>
</tr>
<tr>
<td>Intent to harm</td>
</tr>
</tbody>
</table>


Climate and Weather

Mother Nature also wields exceptional influence in EIDs, especially El Niño, the periods of strong and prolonged warm weather that influence the climate. El Niño is associated with increased rates of death and disease resulting from weather-related disasters such as floods and droughts. According to the World Health Organization, the risk of a natural disaster is highest in the years during and after the appearance of El Niño. Increases in vectorborne diseases such as malaria, dengue, and Rift Valley Fever can be attributed to El Niño because of the standing pools of water created by increased rainfall or the dried up rivers or streams in drought areas that become a rich breeding ground for mosquitos in wet weather (World Health Organization, 2000).

The Changing Environment

Like the weather, even subtle changes in the Earth’s ecosystems can cause alterations in disease transmission patterns. Approximately 75% of emerging pathogens are zoonotic, or communicated by animals to humans. As communities intrude on ecosystems, pathogens are exposed to new environments, increasing human exposure to animal reservoirs and arthropod vectors. Land development, deforestation, dam building, changes in farming techniques, and the consumption of natural resources all influence ecosystems as well (Institute of Medicine of the National Academies, 2003).
Urbanization is typically associated with such disruptions. Population migration from a rural to an urban environment can have serious health consequences because of a general lack of infrastructure, poor sanitation, and crowded living conditions. Additionally, these populations may also lack access to health care (Institute of Medicine of the National Academies, 2003).

**Risk Behaviors**

As we saw with HIV, individual behavior, particularly high-risk behaviors such as unprotected sex and illicit drug use, has the ability to spawn epidemics. According to the World Health Organization, there are approximately 340 million cases of sexually transmitted infections a year worldwide (World Health Organization, 2003a). These preventable diseases can result in illness, infertility, and disability, as well as death. It is imperative for infectious disease prevention programs and interventions to take these complex social–behavioral components into consideration (Institute of Medicine of the National Academies, 2003).

**International Travel and Commerce**

Today, individuals can travel to every corner of the globe quickly and easily. Travelers can bring new diseases to an area, or tourists can be exposed to exotic pathogens in different countries. As we saw with SARS, a woman returning to Toronto from Hong Kong spurred an outbreak of 257 people in Canada (Centers for Disease Control and Prevention [CDC], 2003b; Institute of Medicine of the National Academies, 2003). The impact of SARS was far-reaching in Canada. In addition to the 41 deaths (a 17% case fatality rate); Toronto’s tourism industry lost several million dollars because of a travel advisory that limited travel to Toronto (CBC News, 2003; World Health Organization, 2003b).

As with travel, international commerce has had a profound effect on health. In recent years, the globalization of the food supply and the development of extensive food distribution networks have increased the risk of foodborne disease outbreaks. In particular, outbreaks associated with fresh produce have caused concern. In 1998, eight restaurant-associated outbreaks of shigellosis caused by a common strain of Shigella sonnei occurred in the United States and Canada. The source, contaminated parsley, was traced to a 1,600-acre farm in Mexico (Naimi et al., 2003).

Cause for concern is not limited to food products. In 2003, for the first time in the United States, 71 cases of monkeypox were reported from Wisconsin (39), Indiana (16), Illinois (12), Missouri (2), Kansas (1), and Ohio (1) after exposure to pet prairie dogs imported from Ghana. The prairie dogs were infected by a giant Gambian rat from Ghana that was in close proximity during transport (CDC, 2003a,e; Institute of Medicine of the National Academies, 2003).

**Disease Classification**

EIDs are classified in three ways (Morens, Folkers, & Fauci, 2004):

- **Emerging**—infections that have newly appeared in a population such as SARS or avian influenza.
- **Re-emerging or re-surgeing**—infections that existed previously but are increasing in incidence or geographic range, such as the spread of West Nile virus and monkeypox to North America.
- **Deliberately emerging**—natural or bioengineered agents used in an act of bioterrorism including anthrax or an agent that could be genetically modified to result in a greater impact.

Emerging and reemerging infectious diseases are classified as Category C biological agents by the Centers for Disease Control and Prevention because of their potential for a high rate of contagion, ability to cause widespread morbidity and mortality, and society’s lack of immunity toward them (CDC, 2004a). These diseases pose a significant public health threat because they can also be easily disseminated in a terrorist event. For more information on bioterror agents, please refer to chapters 19, 21, and 22.

**DISEASES OF IMPORTANCE**

The CDC classifies more than 50 diseases as emerging, ranging from HIV/AIDS to Ebola Hemorrhagic Fever (refer to Table 23.2 for a complete list of EIDs). In this chapter six diseases will be focused on that have been identified by the National Institute of Allergy and Infectious Diseases (NIAID) as diseases of importance because of their high contagiousness, high mortality rate, increased incidence, lack of human immunity or drug resistance to them, or their potential for serious economic impact (Fauci, 2006).

**Avian Influenza (Bird Flu)**

Avian influenza, caused by the H5N1 virus, a subtype of influenza A, is a highly contagious avian disease that circulates among birds worldwide. The disease can be transmitted from birds to people via direct contact with infected birds, through an intermediate host, such as a pig, and through contaminated surfaces. The disease is also being carried by asymptomatic migratory water birds, primarily ducks, which are infecting other species, primarily swans and poultry (Tonet,
Emerging Infectious Diseases

- Drug-Resistant Infections
- Bovine Spongiform Encephalopathy
- Campylobacteriosis
- Chlamydia Disease
- Cholera
- Coccioidiomycosis
- Cryptococcosis
- Cryptosporidiosis
- Cyclosporiasis
- Cysticercosis
- Diphtheria
- Ebola Hemorrhagic Fever
- Ehrlichia Coxiellosis
- Group B Streptococcal Infection
- Hantavirus Pulmonary Syndrome
- Hepatitis C
- Hendra Virus Infection
- HIV/AIDS
- Influenza
- Leptospirosis
- Lyme Disease
- Malaria
- Marburg Hemorrhagic Fever
- Meningitis
- Measles
- Monkeypox
- Norovirus Infection
- Nipah Virus Infection
- Methicillin Resistant Staphylococcus Aureus (MRSA)
- Naph Virus Infection
- Nasonovia Infection
- Pertussis
- Plague
- Polio
- Pontiac Fever
- Rabies
- Rift Valley Fever
- Rotavirus Infection
- Salmonellosis
- SARS
- Shigellosis
- Smallpox
- Syphilis
- Tuberculosis
- Tularaemia
- Varicella Zoster (Zoster)
- Venezuelan Equine Encephalitis Virus
- Yellow Fever
- Zika Virus Infection


2005). Human-to-human transmission is extremely rare, and evidence supports that sustained human-to-human transmission of H5N1 has not yet occurred (see Table 23.3—Clinical Profile of Avian Influenza). Because these viruses do not commonly infect humans, there is little or no immune protection against them in the human population (World Health Organization, 2006a). HIV is considered the wildcard of avian influenza.

At present only one H5N1 patient has been reported to also be infected with HIV. HIV/AIDS patients may be more susceptible to adverse complications and antiviral resistance and also can shed the H5N1 virus longer (for several months). Co-infection may have serious implications for individuals and may amplify the spread of H5N1 causing a significant increase in the numbers of people infected with the avian flu virus (Toner, 2006).

Since December 2003, H5N1 infections in poultry or wild birds have spread the virus throughout Asia and into Siberia, the Middle East, North and West Africa, the Mediterranean, Central Europe, India, and northern and western Europe (CDC, 2006a). To monitor H5N1 in animals see the Web site of the World Organization for Animal Health at: http://www.who.int/crisp/avian/influenza/a_H5N1influenza/A_VIAN%20INFLUENZA/A_H5N1_viral.htm.

In 2004, sporadic human cases of H5N1 were reported in Vietnam and Thailand. Since that time, human cases have been identified throughout East Asia and the Pacific (Cambodia, China, Indonesia, Thailand, Vietnam), Europe and Eurasia (Turkey), and the Near East (Iraq) (CDC, 2006a). For more information on the spread of H5N1, please refer to Figure 23.1—Avian influenza hot spots map. An updated cumulative number of confirmed human cases of avian influenza A (H5N1) by country reported to the World Health Organization can be found at: http://www.who.int/csr/disease/avian_influenza/country/cases_table_2006_02_20/en/index.html.

The CDC released guidelines in 2006 for testing individuals with suspected avian influenza. Testing is suggested for patients with the following findings:

- Documented fever greater than 38 ºC.
- Required hospitalization.
- Radiographically confirmed pneumonia for which an alternate diagnosis has not been established.
- Travel within the past 10 days to a country with documented H5N1 infections in humans or birds.
- At least one of the following exposures during travel:
  - Direct contact with sick or dead poultry.
  - Direct contact with surfaces contaminated by poultry feces.
  - Consumption of raw or incompletely cooked poultry or poultry products.
  - Direct contact with sick or dead wild birds suspected or confirmed to have H5N1.
  - Close contact (within 3 feet) of a person who was hospitalized or died from a severe unexplained respiratory illness or with confirmed or suspected H5N1.

Those who work with the live H5N1 virus in a laboratory setting would also be appropriate for testing.
### Clinical Profile of Avian Influenza

<table>
<thead>
<tr>
<th>TRANSMISSION/ISOLATION</th>
<th>CLINICAL PRESENTATION</th>
<th>DIAGNOSIS</th>
<th>THERAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Transmission between persons is rare.</td>
<td>■ Influenza-like symptoms</td>
<td>■ Viral culture</td>
<td>■ Oseltamivir and Zanamivir are both thought to be effective in treatment and prevention.</td>
</tr>
<tr>
<td>■ Isolate patients in a negative pressure room.</td>
<td>■ Fever</td>
<td>■ Immunofluorescence antibody (IFA)</td>
<td>■ Mortality Rate: 50%.</td>
</tr>
<tr>
<td>■ Avian influenza is a federally mandated quarantinable disease.</td>
<td>■ Cough</td>
<td>■ Serologic studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Sore throat</td>
<td>■ PCR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Myalgia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ The following may be seen: pneumonia severe respiratory disorder, viral pneumonia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Atypical presentations: nausea/vomiting diarrhea acute respiratory failure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Transmission between persons is rare.
- Isolate patients in a negative pressure room.
- Avian influenza is a federally mandated quarantinable disease.

- Influenza-like symptoms
- Fever
- Cough
- Sore throat
- Myalgia
- The following may be seen: pneumonia severe respiratory disorder, viral pneumonia
- Atypical presentations: nausea/vomiting diarrhea acute respiratory failure

- Viral culture
- Immunofluorescence antibody (IFA)
- Serologic studies
- PCR

- Oseltamivir and Zanamivir are both thought to be effective in treatment and prevention.
- Mortality Rate: 50%.

Consultation with local and state health departments, patients with mild or atypical symptoms but with the above exposures can be considered on a case-by-case basis as well as patients with severe respiratory disease whose epidemiological information is uncertain or suspicious.

Therapies for typical human influenza viruses should work in treating avian influenza infection in humans; however, influenza viruses can become resistant to drugs such as amantadine and rimantadine, decreasing their effectiveness. Currently no vaccine is available to protect humans against the H5N1 virus that causes avian influenza.

---

**Figure 23.1** Avian influenza hot spots map. USGS National Wildlife Center.
avian flu, although vaccine development efforts began in April 2005 at NIAID. Researchers are also working on a vaccine against H9N2, another bird flu virus subtype (CDC, 2005a, 2006b).

In addition to the threats to human and animal health that H5N1 presents, there exists the possibility of an antigenic shift, an abrupt, major change in the virus resulting in a new subtype with human-to-human transmission. An antigenic shift of this nature may result in a pandemic flu. A pandemic is a global disease outbreak; a flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity and for which there is no vaccine (CDC, 2005b). The disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time (Department of Health and Human Services, 2006b).

The last great flu pandemic occurred in 1918 and was responsible for more than half a million deaths (see Figure 23.2—1918 pandemic flu). Death rates, as well as other factors, differ significantly between seasonal and pandemic flu (please refer to Table 23.4—How Does Seasonal Flu Differ From Pandemic Flu? and Table 23.5—Pandemics Death Toll Since 1900). Both the 1957–1958 and 1968–1969 pandemics were caused by viruses containing a combination of genes from a human influenza virus and an avian influenza virus. It is thought that the 1918–1919 pandemic virus was of avian origin (CDC, 2006c).

Effective preparedness planning for a pandemic flu necessitates predicting the impact on the health care system. One tool in planning is the CDC software FluSurge 2.0. FluSurge is a spreadsheet-based model that provides hospital administrators and public health officials with estimates of the surge in demand for hospital-based services during the next influenza pandemic. FluSurge estimates the number of hospitalizations and deaths of an influenza pandemic (whose length and virulence are determined by the user) and compares the number of persons hospitalized, the number of persons requiring intensive care, and the number of persons requiring ventilator support during a pandemic with existing hospital capacity.

Both the Department of Health and Human Services (DHHS) and the California Department of Health Services (CDHS) utilized FluSurge in an attempt to predict the impact of a pandemic flu, although the predictions they arrived at were very different. CDHS predicted that a pandemic of only moderate severity would require many more critical care beds and ventilators than what the DHHS predicted for a severe pandemic in its Pandemic Influenza Plan (DHHS, 2005, 2006a). In the DHHS report, the assumptions are based on the 1968 influenza pandemic in the United States. CDHS altered the assumptions the calculations were based on, resulting in significant differences in planning implications. CDHS found that severe pandemic planning assump-
23.4 How Does Seasonal Flu Differ From Pandemic Flu?

<table>
<thead>
<tr>
<th>SEASONAL FLU</th>
<th>PANDEMIC FLU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbreaks follow predictable seasonal patterns; occurs annually, usually in winter, in temperate climates.</td>
<td>Occurs rarely (three times in 20th century; last time in 1968).</td>
</tr>
<tr>
<td>Usually some immunity built up from previous exposure.</td>
<td>No previous exposure; little or no pre-existing immunity.</td>
</tr>
<tr>
<td>Healthy adults usually not at risk for serious complications; the very young, the elderly, and those with certain underlying health conditions at increased risk for serious complications.</td>
<td>Healthy people may be at increased risk for serious complications.</td>
</tr>
<tr>
<td>Health systems can usually meet public and patient needs.</td>
<td>Health systems may be overwhelmed.</td>
</tr>
<tr>
<td>Vaccine developed based on known flu strains and available for annual flu season.</td>
<td>Vaccine probably would not be available in the early stages of a pandemic.</td>
</tr>
<tr>
<td>Adequate supplies of antivirals are usually available.</td>
<td>Effective antivirals may be in limited supply.</td>
</tr>
<tr>
<td>Average U.S. deaths approximately 36,000/yr.</td>
<td>Number of deaths could be quite high (e.g., U.S. 1918 death toll approximately 500,000).</td>
</tr>
<tr>
<td>Symptoms: fever, cough, runny nose, muscle pain. Deaths often caused by complications, such as pneumonia.</td>
<td>Symptoms may be more severe and complications more frequent.</td>
</tr>
<tr>
<td>Generally causes modest impact on society (e.g., some school closings, encouragement of people who are sick to stay home)</td>
<td>May cause major impact on society (e.g., widespread restrictions on travel, closings of schools and businesses, cancellation of large public gatherings).</td>
</tr>
<tr>
<td>Manageable impact on domestic and world economy</td>
<td>Potential for severe impact on domestic and world economy.</td>
</tr>
</tbody>
</table>

SARS-associated coronavirus (SARS-CoV; refer to Table 23.6—Clinical Profile of SARS and Figures 23.3 and 23.4—SARS case definition). SARS was first reported in Asia in February 2003, and over a short period of time, the illness spread to more than two dozen countries in North America, South America, Europe, and Asia before being contained (please refer to Figure 23.5—SARS chain of transmission). According to the World Health Organization, a total of 8,098 people worldwide became sick with SARS and 774 died (World Health Organization, 2003b). In the United States, eight people had laboratory evidence of SARS-CoV infection, and all of these people had traveled to parts of the world with SARS (please refer to Figure 23.6—CDC clinical guidance). SARS proved to be most fatal in children, the elderly, and those with underlying chronic diseases (CDC, 2003b,c). In 2003 SARS was added to the list of federally quarantinable diseases.

Two recent studies found evidence for airborne transmission (small droplet aerosol) of SARS in hospital settings. Many experts believed large droplet transmission was the primary route of spread in planes and in the Amoy Gardens, where the epidemic originated in Hong Kong. Large droplets do not travel more than three to six feet and transmission can be prevented with a simple mask. Alternatively, aerosols can stay suspended for longer periods, travel long distances, and require the use of N-95 (or higher) masks, HEPA filters, and negative pressure rooms. The first study, conducted in Toronto, demonstrated airborne dissemination, but transmission was not proven because of a lack of secondary cases. The second study was conducted in Hong Kong and showed temporal–spatial analysis of the large nosocomial outbreak at a hospital, suggesting true airborne transmission (Toner, 2005).

### 23.5 Pandemics Death Toll Since 1900

<table>
<thead>
<tr>
<th>Year</th>
<th>U.S. Deaths</th>
<th>Worldwide Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918–1919</td>
<td>500,000+</td>
<td>40,000,000+</td>
</tr>
<tr>
<td>1957–1958</td>
<td>70,000+</td>
<td>1–2 million</td>
</tr>
<tr>
<td>1968–1969</td>
<td>34,000+</td>
<td>700,000+</td>
</tr>
</tbody>
</table>

West Nile Fever

West Nile fever is caused by infection with the flavivirus *West Nile virus* (WNV). The mosquito is the vector of transmission, specifically the *Culex*, *Aedes*, and
Clinical Profile of SARS

<table>
<thead>
<tr>
<th>TRANSMISSION/ISOLATION</th>
<th>CLINICAL PRESENTATION</th>
<th>DIAGNOSIS</th>
<th>THERAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Close contact is required.</td>
<td>■ Prodrome may include: Fever Myalgia Headache Diarrhea ■ Respiratory phase may include: Fever Dyspnea Cough Pneumonia Hypoxia Acute respiratory distress syndrome (ARDS) features</td>
<td>■ Chest radiograph ■ Pulse oximetry ■ Complete blood count with differential ■ Blood cultures ■ Sputum Gram stain and culture ■ Testing for viral respiratory pathogens, notably influenza A and B and respiratory syncytial virus ■ Legionella and pneumococcal urinary antigen testing ■ RT-PCR testing</td>
<td>■ No known therapy exists. ■ Treat as community-acquired pneumonia. ■ Therapy is largely supportive. ■ Mortality rate: &lt;10%.</td>
</tr>
</tbody>
</table>

Mansonia mosquitoes as well as some ticks, with birds as intermediate hosts (see Table 23.7—Clinical Profile of West Nile Fever). Historically, WNV was endemic to Africa, West Asia, and the Middle East. Scientists from the CDC believe the virus migrated to the eastern United States in the summer of 1999 or possibly earlier. The continued expansion of the virus in the United States indicates that it is permanently established in the Western Hemisphere (refer to Figure 23.7—2005 West Nile virus activity in the United States.). In the temperate zones, cases occur primarily in the late summer or early fall, whereas in the southern climates the virus can be transmitted year round (CDC, 2005e). Birds, mosquitoes, and equines serve as sentinel animals that could alert health officials to the occurrence of human disease.

Although it is still not known when or how WNV was introduced into North America, international travel of infected persons to New York, importation of infected birds or mosquitoes, or migration of infected birds are all possibilities. In addition, the Culex species of mosquito (refer to Figure 23.8—The Culex mosquito) has the ability to survive through the winter, or to overwinter, in the adult stage. The survival of the virus along with the mosquitoes was documented by the widespread transmission during the summer of 2000 (CDC, 2003d, 2004b).

There is no vaccine for WNV but the first clinical trial of a chimeric vaccine, which contains genes from two different viruses, both WNV and yellow fever, is underway. Emphasis has been placed on prevention efforts that focus on vector source reduction, that is the alteration or elimination of mosquito larval habitat breeding grounds, such as the following:

- Improved sanitation—Disposing of trash. Even an item as small as a bottle cap can serve as a mosquito breeding area.
- Water management—Introducing larvae-eating fish to breeding areas.
- Insecticides—Directing them against either the immature or adult stage of the mosquito life cycle.
- Public education—Explaining the importance of mosquito proofing homes, for example, eliminating standing water (even a small amount in a flower pot) from the vicinity (CDC, 2003d).

Malaria

Malaria is a flu-like parasitic disease, transmitted by mosquitoes, that is responsible for approximately 2.7 million deaths yearly, mostly infants and children (see Table 23.8—Clinical Profile of Malaria). Malaria thrives in the tropical areas of Asia, Africa, and South and Central America and remains one of the major killers of humans, threatening the lives of more than one-third of the world’s population (United Nations, 2005). See Figure 23.9—Malaria cases by country.

Malaria is caused by a one-celled parasite from the genus Plasmodium. Four species of Plasmodium infect humans, each appearing somewhat different under the microscope and producing somewhat different clinical presentations. Two or more species can live in the same area and can infect a single individual at the same time (National Institute of Allergy and Infectious Diseases, 2002). The four species are as follows:
Plasmodium falciparum—produces the most severe, life-threatening complications and has the highest mortality rates. This species is generally found in Africa.

Plasmodium vivax—is the most geographically widespread and the cause of the most malaria cases in the United States. This species produces less severe symptoms. Relapse is possible as well as the potential for chronic disease.

Plasmodium malariae—produces typical malaria symptoms but can persist in the blood for very long periods (decades) while remaining asymptomatic. It can infect others via blood transfusions or mosquito bites.

Plasmodium ovale—is a rare species. It can cause relapse and is generally seen in West Africa.

Rates of malaria continue to increase over the years; between 1970 and 1997 there was a 40% increase in malaria rates in sub-Saharan Africa alone. In the mid-1950s, the World Health Organization launched a massive campaign to eliminate malaria from the globe. The initiative was initially successful and combined insecticide use and drug treatment; malaria was conquered completely in some areas and sharply curbed in others. However, nature eventually intervened. *Anopheles* mosquitoes, the carriers of malaria, became resistant to DDT and other insecticides used in their elimination.
In addition, the *Plasmodium* parasite became resistant to chloroquine, the mainstay of drug therapy (National Institute of Allergy and Infectious Diseases, 2002).

The rise of malaria rates is also attributed to agricultural changes and human interventions such as increased land development and urbanization that create new places for mosquito larvae to develop. Also, modern transportation allows travel between malaria-endemic and nonendemic regions. Despite the draining and drying of swamps to get rid of larval breeding sites, water-filled irrigation ditches provide another optimal breeding ground for mosquitoes. The use of the same pesticides on crops as those used on...
mosquitoes has resulted in an increase in insecticide-resistant mosquitoes (National Institute of Allergy and Infectious Diseases, 2002).

At present there is no vaccine for malaria. A recent trial of a vaccine was conducted in Mozambique and was found to prevent infection in 30% of the test population and prevented severe disease in 60% of those infected (Alonso et al., 2004). New drug therapies are also being researched targeting the forms of Plasmodium that are resistant to current medications.

Although malaria has been virtually eradicated in the United States, it continues to affect many Americans every year. In 2000, 1,400 cases of malaria were reported to the CDC. These cases were typically acquired during trips to malaria-endemic areas of the world (traveler’s malaria), although, during the past 10 years, local cases have been reported in California, Florida, Texas, Michigan, New Jersey, and New York (National Institute of Allergy and Infectious Diseases, 2002).

**Marburg Hemorrhagic Fever**

Marburg Hemorrhagic Fever, a close relative of Ebola, is a very rare zoonotic disease of the filovirus family (see Figure 23.10—“Shepherd’s Crook” shape of the Marburg virus; and Table 23.9—Clinical Profile of Marburg Hemorrhagic Fever). Marburg was first identified in 1967 in Germany and the former Yugoslavia when 37 laboratory workers fell ill after exposure to monkeys imported from Uganda. All subsequent cases occurred in Africa where Marburg virus is indigenous. Incidence has been sporadic ever since with cases appearing in 1975, 1989, and in 1998 when an outbreak occurred in the Democratic.
Most recently, the largest ever outbreak of Marburg began in March 2005 in the rural region of Uige in Angola. The disease spread particularly among people exposed to the virus during home care or at funerals, or through contact with bodily fluids of those who died from the disease. The dangerous use of home-based injections was also identified as a major cause of the outbreak’s spread. By April 2005 the outbreak claimed 150 lives, including 12 health care workers. The outbreak had a 92% death rate, much higher than previous reports, suggesting that milder cases of the disease may have gone undetected. The outbreak was declared over in November 2005 by the Angola Ministry of Health (Toner, 2005).
### 23.7 Clinical Profile of West Nile Fever

<table>
<thead>
<tr>
<th>TRANSMISSION/ISOLATION</th>
<th>CLINICAL PRESENTATION</th>
<th>DIAGNOSIS</th>
<th>THERAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Transmission occurs via mosquito vector.</td>
<td>■ Most cases are asymptomatic</td>
<td>■ IgM Antibody-Capture, Enzyme-Linked Immunosorbent Assay (MAC-ELISA)</td>
<td>■ Therapy is mainly supportive.</td>
</tr>
<tr>
<td>■ No person-to-person transmission.</td>
<td>■ Fever</td>
<td>■ Plaque-Reduction Neutralization Test (PRNT)</td>
<td>■ Mortality Rate:</td>
</tr>
<tr>
<td>■ Isolation is not necessary.</td>
<td>■ Headache</td>
<td>■ PCR</td>
<td>Without encephalitis: 3–15%</td>
</tr>
<tr>
<td></td>
<td>■ Fatigue</td>
<td></td>
<td>With encephalitis: 40%</td>
</tr>
<tr>
<td></td>
<td>■ Myalgia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Truncal morbilliform rash (occasionally)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Signs of encephalitis include confusion, neck stiffness, cranial nerve palsy, and generalized weakness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Very little is known about how Marburg is transmitted to humans from the animal host. Previous victims have been in contact with nonhuman primates or their fluids or tissue. The disease spreads easily among humans within close contact, especially in the hospital setting, and health care workers are at high risk for contracting the virus. Bodily fluids, contaminated equipment, blood, or tissues may all be sources of disease. At present there is no vaccine for Marburg, nor is there treatment beyond supportive care. Because of the close contact necessary for transmission, an epidemic of Marburg is unlikely unless it is used as a bioterror agent (CDC, 2005c; Fauci, 2006).

### Tuberculosis

Tuberculosis (TB) is caused by *mycobacterium tuberculosis* and typically manifests as a respiratory infection but can also attack the kidneys, spine, brain, and skin (refer to Table 23.10—Clinical Profile of Tuberculosis). TB is spread via aerosolized particles transmitted by those who have active TB (those with latent TB cannot infect others). Left untreated, each person with active TB disease will infect on average between 10 and 15 people each year. If not treated properly, TB can be fatal. Those with latent TB can also be treated to prevent development of the disease (CDC, 2005d; World Health Organization, 2005).
Clinical Profile of Malaria

**TRANSMISSION/ISOLATION**
- Transmission occurs via mosquito vector.
- No person-to-person transmission.
- Isolation is not necessary.

**CLINICAL PRESENTATION**
- Fever
- Flu-like illness
- Shaking/chills
- Headache
- Myalgia
- Nausea/vomiting
- Diarrhea
- Anemia and jaundice from loss of red blood cells
- Infection with *Plasmodium falciparum* may cause kidney failure, seizures, mental confusion, coma, and death if not treated promptly

**DIAGNOSIS**
- Gold standard is examination of blood smear using Giemsa stain
- PCR
- Antigen detection

**THERAPY**
- Do not treat until there is laboratory confirmation of malaria.
- Determine the *Plasmodium* species.
- Oral antimalarials for uncomplicated cases.
- Treat severe cases aggressively with parenteral antimalarials.

Mortality Rate is difficult to determine because of lack of reporting.

---

At one point TB was the leading cause of death in the United States. Incidence began to drop in the 1940s when medications were developed to combat it. In the 1970s and 1980s the public health system shifted its focus away from infectious diseases, and, as a result, the incidence began to increase again until 1992. Since 1992 there has again been a steady decline, but TB remains a problem; in 2003 more than 14,000 cases were reported in the United States (CDC, 2005d). In other parts of the world, TB has been a consistent problem with one-third of the world’s population infected. It is the second greatest contributor among infectious diseases to adult mortality resulting in 2 million deaths per year (World Health Organization, 2005).

Adding to the global burden, TB has also become drug resistant. Strains that are resistant to a single drug have been documented in numerous countries, as well as the even more dangerous strains resistant to multiple drugs (300,000 cases each year). Drug resistance is caused by inconsistent or partial treatment, when patients do not take their medicines as prescribed, inappropriate treatment regimens, or unreliable drug supplies. Multidrug-resistant TB (MDR-TB) is defined as bacilli resistant to at least isoniazid and rifampicin, the two most powerful anti-TB drugs. Rates of MDR-TB are high in some countries, especially in the former Soviet Union, and threaten TB control efforts worldwide. Given globalization and its associated migration and tourism, all countries are potential targets for outbreaks of MDR-TB (World Health Organization, 2006b).

From a public health perspective, poorly supervised or incomplete treatment of TB is worse than no treatment at all. People may remain infectious if they fail to comply with treatment regimens or are given an inappropriate regimen. They also may develop resistance to medications and will pass on this same drug-resistant strain to those they infect. In general, drug-resistant TB is treatable but requires extensive chemotherapy (up to 2 years) that is often cost prohibitive and is more toxic (World Health Organization, 2005).

The HIV virus has also contributed to the extensive problem of TB. They have formed a lethal partnership, each speeding up the progress of the other. Among those who are HIV positive, TB is a leading cause of death accounting for about 13% of AIDS deaths globally. In Africa alone, HIV has been the single most important determinant of TB incidence over the past 10 years (World Health Organization, 2005).

**FUTURE DIRECTIONS**

**Education and Training**

The United States is lacking a skilled and prepared workforce to combat microbial threats. According to the National Association of City and County Health Officers, public health nursing was one of the most needed occupations in 2000. A recent Institute of Medicine report calls for improved training of all health care...
professionals to ensure prompt and effective responses to natural or deliberate infectious disease. CDC, DOD, and NIH should develop new and expand upon current intramural and extramural programs that train health professionals in applied epidemiology and field-based research and training in the United States and abroad. Research and training should combine field and laboratory approaches to infectious disease prevention and control. Federal agencies should develop these programs in close collaboration with academic centers or other potential training sites. Domestic training programs should include an educational, hands-on experience at state and local public health departments to expose future and current health professionals to new career options, such as public health. (Institute of Medicine, 2003)

The Columbia University School of Nursing, Center for Health Policy has core competencies for all public health workers pertaining to bioterrorism and emergency preparedness to support training efforts. The competencies are based on the essential services of public health, “to promote physical and mental health and prevent disease, injury, and disability,” and serve as an emergency preparedness foundation for both individual and institutional development (Columbia University School of Nursing, 2002).

Columbia University has also established specific guidelines for public health communicable disease staff. These guidelines pertain to occupations in which employees (a) collect, investigate, describe, and analyze
23.9 Clinical Profile of Marburg Hemorrhagic Fever

<table>
<thead>
<tr>
<th>TRANSMISSION/ISOLATION</th>
<th>CLINICAL PRESENTATION</th>
<th>DIAGNOSIS</th>
<th>THERAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human-to-human transmission is possible through bodily fluids, including those of the deceased.</td>
<td>Fever</td>
<td>ELISA</td>
<td>Mortality Rate: 25–90%, depending on strain</td>
</tr>
<tr>
<td>Natural reservoir of the disease remains uncertain.</td>
<td>Cough</td>
<td>PCR</td>
<td></td>
</tr>
<tr>
<td>Isolate in a negative pressure room.</td>
<td>Headache</td>
<td>Igg capture ELISA if patient has recovered</td>
<td></td>
</tr>
<tr>
<td>Use an N-95 or HEPA mask.</td>
<td>Conjunctivitis</td>
<td>Viral culture during the acute phase</td>
<td></td>
</tr>
<tr>
<td>Petechial rash (primarily truncal)</td>
<td>Shock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemorrhaging</td>
<td>Liver failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multisystem dysfunction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The distribution and determinants of disease, disability, and other health outcomes and develop the means for their prevention and control and (b) investigate, describe, and analyze the efficacy of programs and interventions, advising local health departments and the health care community on outbreak investigations, immunization data, disease identification, reporting, and prevention. This includes individuals specifically trained as epidemiologists and those trained in other disciplines (e.g., medicine, nursing, environmental health, veterinary medicine) working as epidemiologists under job titles such as nurse epidemiologist. For more information, please refer to Appendix III: Bioterrorism & Emergency Readiness: Competencies for all Public Health Workers.

The Institute of Medicine also recommends offering on-the-job training opportunities such as the CDC’s Epidemiological Intelligence Service (EIS) to promote real-world information and skills acquisition. The EIS is a 2-year postgraduate program based at the CDC or at a local or state health department that trains nurses and other health care providers in epidemiology and social and behavioral sciences to equip them to serve on the front lines of public health conducting surveillance and driving policy (Institute of Medicine of the National Academies, 2003).

Private Sector Partnerships—Project Bioshield

Dr. Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases, has called for a new

23.10 Clinical Profile of Tuberculosis

<table>
<thead>
<tr>
<th>TRANSMISSION/ISOLATION</th>
<th>CLINICAL PRESENTATION</th>
<th>DIAGNOSIS</th>
<th>THERAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human-to-human transmission of aerosolized droplets via coughing, sneezing, or talking.</td>
<td>Fever</td>
<td>Mantoux tuberculin skin test</td>
<td>All positive cultures should undergo drug susceptibility testing.</td>
</tr>
<tr>
<td>Isolate in a negative pressure room.</td>
<td>Malaise</td>
<td>QuantiFERON®-TB Gold test</td>
<td>Antibiotic therapy lasts 6–12 months.</td>
</tr>
<tr>
<td>Tuberculosis is a federally mandated quarantinable disease.</td>
<td>Weight loss</td>
<td>Demonstration of M. tuberculosis in sputum smear or culture</td>
<td>Guidelines have been developed jointly by the CDC, the American Thoracic Society, and the Infectious Disease Society of America.</td>
</tr>
<tr>
<td></td>
<td>Night sweats</td>
<td>Chest X-ray</td>
<td>Mortality Rate of newly identified cases: 7%. Drug-resistance strains may be higher. Mortality rate of congenital TB is 50%.</td>
</tr>
<tr>
<td></td>
<td>Cough</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chest pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hemoptysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Symptoms of TB disease in other parts of the body depend on the area affected (brain, kidneys, or spine)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
paradigm in combatting EIDs. Whereas research and academic institutions focus on basic research, the development of vaccines and therapeutics has long been dominated by the pharmaceutical industry. With historically low profit margins or hypothetical needs that may never materialize, the industry is hesitant to heavily invest in developing new products. As a result, Project BioShield, a $5.6 billion bill signed in 2004, partners the research community with pharmaceutical companies and provides incentives to develop much needed vaccines and therapeutics. Project BioShield guarantees the government will purchase public health-related products at a fair price even if the products are never used (Fauci, 2006).

CONCLUSIONS

Creatures invisible to the naked eye will continue to outsmart and outwit humans with the complexities of modern living presenting numerous opportunities for them to prove their strength and determination. The public health system must be equally vigilant. Nurses, the largest sector of the health care profession, are poised to take the lead in the fight against these invisible enemies. Improved and increased training is imperative. It is not only important to be able to recognize a newly emerging disease but to also identify the situations that may promote an emerging disease in order to better anticipate their evolution and impact. A holistic approach that considers the biologic, environmental, societal, and behavioral underpinnings of EIDs is our best defense against this perpetual challenge.

REFERENCES


STUDY QUESTIONS

1. How can emerging infectious diseases be classified? What is their bioterrorism category and why? Select 10 diseases from the CDC list of emerging diseases and research them at www.cdc.gov to determine if they are newly emerging, re-emerging, or deliberately emerging.

2. In the last 5 years, what changes have occurred in your local environment that may contribute to an emerging infectious disease?

3. Individual behaviors play a significant role in disease transmission. What risk behaviors can you identify in addition to unsafe sex and drug use that could aid transmission?

4. What competencies can each nurse achieve to be better prepared to address emerging infectious diseases?

5. Why are emerging infectious diseases a perpetual challenge?
CASE STUDY


Richard E. Waldhorn, M.D.

How Will Hospitals Accommodate a Surge of Critical Care Patients?

How should hospitals increase their capacity to provide mechanical ventilation for a surge of patients with acute respiratory failure during a mass casualty event or influenza pandemic? Rubinson and colleagues address this issue in a recently published article (Rubinson, Branson, Pesik, & Talmor, 2006). Their report is based on an evaluation and assessment of a wide range of positive pressure ventilation (PPV) equipment, with the goal of determining the suitability of each device for mass casualty care. The article provides information useful for determining which types of PPV equipment would be the best choice for hospitals in need of a serviceable alternative to full feature ventilators, which will be in short supply and are too expensive for hospitals to stockpile.

Existing Reserves of Ventilators Are Not Adequate

In a severe pandemic, the need for mechanical ventilators may far exceed hospital and Strategic National Stockpile (SNS) reserves. Using the CDC’s FluSurge modeling software to predict the effects of DHHS planning assumptions for a severe pandemic, it can be predicted that in a typical city, with a pandemic of moderate duration and attack rate (8 weeks and 25% respectively), at pandemic peak (Week 5), flu patients would require 191% of all non-intensive care unit (ICU) beds, 461% of all available ICU beds, and 198% of all available mechanical ventilators (Toner, 2005, December 1). Even with greatly increased reserves, the SNS will not be able to provide supplies of ventilators adequate to meet the needs of hospitals in a pandemic. Moreover, they will not be able to rent equipment, and it is not practical for hospitals to purchase, maintain, and store expensive full feature mechanical ventilators just to have them on hand in case they are needed.

Alternative PPV Equipment Can Be Used to Augment Reserves

Alternative PPV equipment, designed and used for short-term PPV in non-ICU locations, but suitable for definitive mechanical ventilation during mass casualty events, should be considered. This equipment is available, less expensive, and more easily stockpiled than full feature mechanical ventilators. Alternative PPV equipment must be easy for non-critical care staff, with limited training and experience, to operate, as it is likely that they will be called on to help manage patients with respiratory failure in a mass casualty setting. Because it may also have to be used outside of an ICU, alternative PPV equipment must have appropriate alarm capabilities, battery power, and the ability to function with either high or low pressure oxygen sources.

Portable ventilators with internal compressors and oxygen blenders will be the most oxygen sparing and will meet most of the criteria for the ideal mass casualty PPV device. A stockpile of PPV equipment alone will not be adequate or sufficient. Shortages of critical care staff will be a limiting factor in any emergency response, which means that cross training of non-critical care staff must be central to any effort to expand hospital surge capacity.

REFERENCES


Source: Clinicians’ Biosecurity Network Report, May 18, 2006
Mumps is an acute viral illness that is spread via respiratory and oral secretions. According to the CDC, the clinical definition of mumps is an illness with acute onset of unilateral or bilateral tender, self-limiting swelling of the parotid or other salivary gland, lasting 2 or more days, and without other apparent cause. A confirmed case of mumps is one that is laboratory confirmed or meets the clinical case definition and is linked epidemiologically to a confirmed or probable case. (CDC, 2006d)

Rarely, mumps can have severe complications such as encephalitis, meningitis, orchitis, oophoritis, mastitis, spontaneous abortion, and deafness that is typically permanent (CDC, 2006e).

In the United States, mumps has been on the decline since the introduction of the mumps vaccine in 1967 and again in 1977 when it was recommended for routine use. In 1989 the two-dose MMR (measles, mumps, and rubella) vaccine schedule was recommended for measles control and mumps cases continued to drop. By 2001, there were less than 300 cases annually, a 99% decline in reported cases compared to 1968 (CDC, 2006d).

In early 2006 there were reports of mumps in 11 states (2,597 cases through May 2006). Of those states, eight reported ongoing transmission (Illinois, Iowa, Kansas, Missouri, Nebraska, Pennsylvania, South Dakota, Wisconsin) whereas the remaining states (Colorado, Minnesota, Mississippi) reported cases associated with air travel from an outbreak state; 11 cases with suspected transmission during air travel were identified. As of May 2006, 575 persons were potentially exposed on 33 flights operated by 8 different airlines.

In December 2005 the first cases of mumps were reported from a college campus in Iowa; the source of the epidemic is unknown. The spread of the disease is multifactorial and includes the close contact of dormitory living and the fact that only 25 states and the District of Columbia require a two-dose MMR vaccine for college admission. The inexperience of young physicians who have most likely never seen mumps and the fact that mumps may not be considered in vaccinated individuals were also cited as factors. In addition, the MMR vaccine is not 100% effective, and susceptible persons who were not successfully immunized might be sufficient to sustain transmission.

To prevent mumps, the Advisory Committee on Immunization Practices (ACIP) recommends a two-dose MMR vaccination series for all children, with the first dose administered at ages 12 to 15 months and the second dose at ages 4 to 6 years. Two doses of MMR vaccine are recommended for school and college entry unless the student has other evidence of immunity. During an outbreak and depending on the epidemiology of the outbreak (e.g., the age groups and/or institutions involved), a second dose of vaccine should be considered for adults and for children ages 1 to 4 years who have received one dose. The second dose should be administered as early as 28 days after the first dose, the minimum recommended interval between two MMR vaccine doses. In addition, during an outbreak, health care facilities should strongly consider recommending two doses of MMR vaccine to unvaccinated workers born before 1957 who do not have other evidence of mumps immunity (CDC, 2006d).
Key Messages

- Advance planning at the state and local levels is critical for efficient and effective operation of immunization and treatment clinics.
- Standardized procedures must be in place for mass immunization and prophylactic treatment clinics to be effective.
- Detailed planning is critical. Useful formats are described in this chapter to conduct this planning process.
- New pathogens can be identified and treatment regimes can change at any time. Therefore, it is more important for practitioners to focus on how to use tools to access the most up-to-date recommendations than on specific current prevention and treatment protocols. These tools are Internet-based and generally available free of charge to practitioners.
- Practitioner training specific to immunization and prophylactic treatment regimes is available via the Internet as well.

Learning Objectives

When this chapter is completed, readers will be able to

1. Develop an understanding of the resource tools available to health care practitioners, providing access to current recommendations regarding immunization against and prophylactic treatment for human exposure to epidemic and pandemic pathogens as well as bioweapons.
2. Develop an understanding of the administrative aspects of designing mass immunization and prophylactic treatment clinics.
3. Understand the administrative aspects of implementing mass immunization and prophylactic treatment clinics.
4. Conduct a community planning exercise for mass immunization clinics.
Design and Implementation of Mass Immunization and Prophylactic Treatment Clinics
Kathryn McCabe Votava

To react to an outbreak of an infectious disease, local hospitals and health departments need to set up and operate mass dispensing and vaccination clinics. These clinics are highly dependent on nurses for their success. Carefully planning these clinics before an event occurs is a difficult and important job. Two key considerations are the capacity of each clinic (the number of patients served per hour) and the time (in minutes) spent by patients in the clinic. Operationalizing the clinic and achieving maximum population coverage (vaccines or treatments) are also predominantly in the nursing domain. The major objective of this chapter is to provide nurses with the knowledge to design and conduct mass immunization and prophylactic treatment clinics for persons who have been exposed to or are at high risk for having been exposed to these pathogens. Advanced planning for a coordinated public health response to a mass exposure of these pathogens is critical in order to obtain the most desirable outcome of limiting the effects of that event on the public.

Warning periods will be relatively short and populations affected may be quite large. This chapter covers the design and implementation of major immunization and prophylactic treatment clinics. All functional aspects of running these types of clinics will be covered, including state and local planning, estimating vaccine or medication needs, clinic site selection, and staffing patterns. Also included is a detailed description of supplies and equipment needed. Sample organizational and documentation formats are provided. The chapter discusses the tools that are commonly and easily accessible to health care practitioners that provide the most up-to-date information about immunization and prophylactic treatment for human exposure to epidemic and pandemic pathogens as well as to biological weapons.
INTRODUCTION

This chapter is designed to familiarize nurses and other health care practitioners with the most current recommendations regarding immunization and prophylactic treatment for many biological agents to which humans may be exposed. Exposure to these agents may be a result of a naturally occurring emerging infectious disease outbreak or a deliberate terrorist attack. The basic principles introduced will apply to the use of bioweapons as well as to the myriad other agents that might be encountered in disaster management and relief situations.

A major objective of this chapter is to equip the reader with a working knowledge of the tools that are commonly and readily available to practitioners that provide the most up-to-date information about immunization and prophylactic treatment for human exposure to epidemic or pandemic pathogens and biological weapons. Given that new agents can be identified and that treatment recommendations can change at any time, it is more important for the practitioner to focus on the tools to access current recommendations than on the specific recommendations themselves. The resources and tools discussed in this chapter are developed by established sources of this type of information, most notably the Centers for Disease Control and Prevention (CDC; http://www.cdc.gov). The tools presented in this chapter are Internet based and available free of charge to the health care practitioner.

Focus will be on providing the learner with an understanding of the administrative aspects involved in designing and conducting mass immunization and treatment clinics for persons who have been exposed to or are at high risk to have been exposed to these pathogens. Key elements such as obtaining vaccines and medications, identifying locations and security, staffing patterns, and administration processes, as well as clinical practice recommendations will be discussed. A case example of a mass immunization clinic will be presented.

HEALTH SYSTEMS OVERVIEW

Advance planning for a coordinated public health response to an epidemic or pandemic pathogen or a bioweapon event is critical in order to obtain the most desirable outcome of limiting the effects of that exposure on the public. Warning periods will be relatively short and populations affected may be quite large. Transmission rates may be high. Public panic may ensue. These factors necessitate a rapid response from health care providers to organize, distribute, and administer the required vaccines and other medications and treatments in a timely fashion (Kaplan, Craf & Wein, 2002). Mechanisms must be developed and put in place to allocate and distribute those vaccines, medications, and treatments to those in greatest need during a mass exposure situation. Whether the offending agent is smallpox, tularemia or plague, SARS, West Nile virus, or avian influenza, nurses must be prepared to rapidly respond to a major public health emergency. The following is an overview of some of the major health system resources that are available to practitioners and health planners to use as tools when designing and implementing mass immunization and prophylactic treatment clinics.

CURRENT IMMUNIZATION AND MEDICATION RECOMMENDATIONS

The CDC maintains a publicly available Web site that is the gold standard for accurate, up-to-date information available via the Internet. The site address is http://www.bt.cdc.gov/agent/agentlist.asp. This site provides a very comprehensive index of all areas related to immunization, medication, and prophylactic treatment for bioweapon exposure as well as prophylaxis for high-risk populations and situations. Another CDC-sponsored Web page provides up-to-date information on recent outbreaks at http://www.bt.cdc.gov/recentincidents.asp. These sites are updated on an ongoing basis to ensure that health care practitioners have access to the most current recommendations. Information is available related to national, state, and local level strategies and plans. The CDC includes information specific to health care facilities as well as legal and planning issues. The information is formatted for easy download via PDF files. The sites also include links to related resources.

PUBLIC HEALTH TRAINING NETWORK

The Public Health Training Network (PHTN) is developed and maintained by the CDC in conjunction with members of the academic community. Historically, the CDC has been a central source of practice-based, job-relevant, high priority training for public health professionals in state and local health departments since its beginning in 1946. For many years, this training was primarily delivered in the classroom or laboratory. Fundamental changes in the American health care system increased both the number of persons who needed training and the number of content and skill areas they needed training in, and in recent years, the CDC found itself unable to meet the increased demand using traditional methods.

The Public Health Training Network was established in 1993 to provide a more effective system for education of the public health workforce. PHTN utilizes
a variety of instructional media to ensure that health care providers have the greatest access to needed programming and that PHTN has the greatest audience saturation.

PHTN is a distance learning system available on the World Wide Web that uses a variety of instructional media ranging from print-based to videotape and multimedia to meet the training needs of the public health workforce nationwide. The options for delivery include satellite, Web, CD-ROM, videotape/DVD, audio bridge, on-site courses and conferences, and print. Using this strategy, the CDC provides ongoing availability of a collection of quality programming addressing critical public health issues. International partners are working with the PHTN to move toward realization of its long-term vision of a global network that will serve the training and learning needs of public health practitioners worldwide.

The PHTN maintains a publicly available no-fee Web site at http://www.phppo.cdc.gov/PHTN/default.asp/ and is available to health care practitioners in the United States and around the world, 24 hours a day, 365 days per year. The PHTN Web site includes links to upcoming satellite broadcasts and Web casts of its training programs. Reports relevant to health care practitioners are also posted and available for viewing or downloading.

The PHTN has increased its efforts with respect to training needs associated with all disaster management topics, including providing up-to-the-minute access through the “Hot Topics” section to content related to immunization and prophylactic treatment for many biological weapons to which humans may be exposed. This site provides very useful training and information that can be accessed by practitioners at a schedule that is convenient for them.

PANDEMIC FLU INFORMATION PORTAL

The threat of a pandemic or epidemic outbreak of disease has been ever increasing in recent times. Pathogens such as avian flu have continued to present serious concerns to public health in the United States and around the world. The U.S. Government has developed a one-stop access portal for avian and pandemic flu information located at http://www.pandemicflu.gov/. This site is managed by the Department of Health and Human Services.

There are state-specific pages located at http://www.pandemicflu.gov/plan/tab2.html/. These state and local planning pages contain information about the state pandemic plan, formal agreements, and other pandemic planning information. They also contain historic information about the 1918 pandemic flu and its impact on the state, as well as links to each state’s Web site for pandemic response and planning information.

GLOBAL OUTBREAK ALERT AND RESPONSE NETWORK

Given that public health responses to mass exposure to epidemics, pandemics, and biological weapons are truly an international issue, the World Health Organization (WHO) coordinates the Global Outbreak Alert and Response Network (GOARN; World Health Organization, 2007). The GOARN is a technical collaboration of more than 120 international institutions and networks that pool human and technical resources for the rapid identification, confirmation, and response to outbreaks of transnational importance. The GOARN provides an operational framework to link this expertise and skill to keep the international community constantly alert to the threat of outbreaks and ready to respond. More information is available at http://www.who.int/csr/alertresponse/en/.

THE STRATEGIC NATIONAL STOCKPILE

The CDC has developed a program called the Strategic National Stockpile (SNS) that contains large quantities of medicine and medical supplies to protect the American public if there is a public health emergency severe enough to cause local supplies to run out. This program is activated when federal and local authorities agree that the SNS is needed. At that point, medicines will be delivered to any state in the United States within 12 hours. Each state has plans to receive and distribute SNS medicine and medical supplies to local communities as quickly as possible. The Internet address for the SNS program is http://www.bt.cdc.gov/stockpile/.

The SNS Program works with governmental and nongovernmental partners to upgrade the nation’s public health capacity to respond to a national emergency. Critical to the success of this initiative is ensuring that capacity is developed at federal, state, and local levels to receive, stage, and dispense SNS assets.

The SNS is a national repository of antibiotics, chemical antidotes, antitoxins, life-support medications, IV administration, airway maintenance supplies, and medical/surgical items. The SNS is designed to supplement and resupply state and local public health agencies in the event of a national emergency anywhere and at any time within the United States or its territories.

The SNS is organized for flexible response. The first line of support lies within the immediate response 12-hour Push Packages. These are caches of pharmaceuticals, antidotes, and medical supplies designed to...
provide rapid delivery of a broad spectrum of assets for an ill-defined threat in the early hours of an event. These Push Packages are positioned in strategically located, secure warehouses ready for immediate deployment to a designated site within 12 hours of the federal decision to deploy SNS assets. If the incident requires additional pharmaceuticals and/or medical supplies, follow-on vendor managed inventory (VMI) supplies will be shipped to arrive within 24 to 36 hours. If the agent is well defined, VMI can be tailored to provide pharmaceuticals, supplies, and/or products specific to the suspected or confirmed agent(s). In this case, the VMI could act as the first option for immediate response from the SNS Program.

Determining and Maintaining SNS Assets

To determine and review the composition of the SNS Program assets, the Department of Health and Human Services (DHHS) and the CDC consider many factors, such as current biological and/or chemical threats, the availability of medical materiel, and the ease of dissemination of pharmaceuticals. One of the most significant factors in determining SNS composition, however, is the medical vulnerability of the U.S. civilian population.

The SNS Program ensures that the medical materiel stock is rotated and kept within potency shelf-life limits. This involves quarterly quality assurance/quality control checks on all 12-hour Push Packages, annual 100% inventory of all 12-hour Push Package items, and inspections of environmental conditions, security, and overall package maintenance.

During a national public health emergency, state, local, and private stocks of medical materiel will be depleted quickly. State and local first responders and health officials can use the SNS to bolster their response to a national emergency, with a 12-hour Push Package, VMI, or a combination of both, depending on the situation. It is important to note that the SNS is not a first response tool.

SNS Rapid Coordination and Transport

The SNS Program is committed to having 12-hour Push Packages delivered anywhere in the United States or its territories within 12 hours of a federal decision to deploy. The 12-hour Push Packages have been configured to be immediately loaded onto either trucks or commercial cargo aircraft for the most rapid transportation. Concurrent to SNS transport, the SNS Program will deploy its Technical Advisory Response Unit (TARU). The TARU staff will coordinate with state and local officials so that the SNS assets can be efficiently received and distributed upon arrival at the site.

DHHS will transfer authority for the SNS materiel to the state and local authorities once it arrives at the designated receiving and storage site. State and local authorities will then begin the breakdown of the 12-hour Push Package for distribution. SNS TARU members will remain on site in order to assist and advise state and local officials in putting the SNS assets to prompt and effective use.

The decision to deploy SNS assets may be based on evidence showing the overt release of an agent that might adversely affect public health. It is more likely, however, that subtle indicators, such as unusual morbidity and/or mortality identified through the nation’s disease outbreak surveillance and epidemiology network, will alert health officials to the possibility (and confirmation) of a biological or chemical incident or a national emergency. To receive SNS assets, the affected state’s governor’s office will directly request the deployment of the SNS assets from CDC or DHHS. DHHS, CDC, and other federal officials will evaluate the situation and determine a prompt course of action.

SNS Training and Education

The SNS Program is part of a nationwide preparedness training and education program for state and local health care providers, first responders, and governments (to include federal officials, governors’ offices, state and local health departments, and emergency management agencies). This training not only explains the SNS Program’s mission and operations, it alerts state and local emergency response officials to the important issues they must plan for in order to receive, secure, and distribute SNS assets.

The CDC and SNS Program staff are currently working with DHHS, Regional Emergency Response Coordinators at all of the U.S. Public Health Service regional offices, state and local health departments, state emergency management offices, the Metropolitan Medical Response System cities, the Department of Veterans’ Affairs, and the Department of Defense to provide the necessary training and outreach regarding the SNS program.

MASS IMMUNIZATION AND PROPHYLACTIC TREATMENT CLINICS

The following section describes various aspects involved in planning and conducting mass immunization and prophylactic treatment for your local area clinics. Factors such as state and local planning, estimating vaccine and medication needs, clinic site selection, staffing patterns, and detailed description of supplies and equipment needs are discussed. Principles for this section have been drawn from the Small Pox Vaccination Clinic.

**STATEWIDE ORGANIZATIONAL RESPONSIBILITIES**

In preparation for a mass immunization and prophylactic treatment clinic, health departments around the country at the state and local levels have a variety of responsibilities (Blank, Moskin, & Zucker, 2003). The following is a listing of those responsibilities that relate to preparedness functions:

- Develop a comprehensive plan to prepare for and respond to an epidemic, pandemic, or biological weapon event.
- Coordinate planning activities with state government offices and other local agencies.
- Identify clinic sites and vaccine/prophylactic medication storage sites in advance.
- Create a command structure with clear delineation of assignments and responsibilities.
- Assign primary contact(s) for communication.
- Assess partnerships with local organizations that may be involved: Emergency Medical Service (EMS), private health care providers, nursing homes and chronic care facilities, human services providers, schools, universities, university health centers, businesses, media, hospitals, and voluntary organizations.
- Ensure that resources, in addition to the vaccine and prophylactic medication, will be readily available to the local level before an attack occurs.
- Obtain authorization or standing orders for administration of vaccine and other medications that will be used in these mass immunization and prophylactic treatment clinics.
- Obtain content approval for informational materials.

In response to an epidemic, pandemic, or biological weapon event, the state and local health departments will do the following:

- Request necessary materials and conduct these prophylaxis or mass vaccination clinics according to the predesigned plans.
- Activate a plan to run clinics for high-risk individuals, as well as the general public, as the circumstances dictate.
- Ensure timely and equitable distribution of vaccine and prophylactic medication within regions.
- Communicate with local media partners.

- Distribute informational memorandums to physicians, hospitals, long-term care facilities, schools, universities, and major employers.
- Send reports of inventory and doses administered to the designated authorities.
- Evaluate effectiveness of the clinics, in addition to the overall response.

**ADVANCE PLANNING**

Command structures for establishing the scope of a response to an epidemic, pandemic, or biological weapon event in advance of the occurrence of that event must be established. Contact lists need to be distributed identifying which technical staff members are responsible for surveillance and control measures during an outbreak or suspected outbreak. Standardized procedures for who should be informed must be created to ensure a coordinated response. Data from epidemiological investigations by state and local health officials, in collaboration with CDC epidemiologists will delineate the size and vector of the pathogen outbreak. The amount of vaccine or prophylactic medication available, and the possibility that additional new and epidemiologically related cases will be identified in subsequent days will influence the response.

In addition to a contact list for technical staff, the following lists need to be created prior to an epidemic, pandemic, or biological weapon event:

- High-risk individuals
- Regional and local health department personnel
- Clinic personnel and volunteers
- Clinic location contacts
- Clinic support services such as emergency services, law enforcement, sanitation, water
- Local hospitals
- Local clinical laboratories
- Local pharmacies
- Translators and language interpreters

A plan for prioritizing selected groups to receive vaccine or prophylactic medication needs to be in place for every level of response. The potential number of recipients is based on the identified target population, including such factors as those individuals at high risk, geographic boundaries, and so forth.

Personnel deemed to be critical to ensure a sustained response to an epidemic, pandemic, or biological weapon event are considered high risk as well. High-risk workers include the following:

- Health care workers and public health personnel involved in the distribution of vaccine or prophylactic medication.
464 Part IV Disasters Caused by Chemical, Biological, and Radiological Agents

24.1 Vaccine or Prophylactic Medication Estimates for High-Risk Populations Data Collection Format

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Immediate Family</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Clinics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Health Personnel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Law Enforcement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Department</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecommunication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Transportation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Businesses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Personnel involved with direct medical or public health evaluation, care, or transportation of confirmed, probable, or suspected patients.
- Laboratory personnel collecting or processing clinical specimens from confirmed, probable, or suspected patients.
- Persons responsible for community safety and security (e.g., police and firefighters).
- Groups likely to come into contact with infectious materials (e.g., laundry workers and medical waste handlers).
- Highly skilled persons who provide essential community services (e.g., nuclear power plant, telecommunications, and electrical grid operators).

Local hospitals, clinics, public utilities, and other key agencies and businesses need to establish lists of high-risk employees. Information about immediate family size should also be collected as these families may need to be treated also. Vaccine or prophylactic medication estimates, including high-risk persons and their immediate family members, for key agencies and businesses need to be given to a planning authority. Table 24.1 is a format for use in that data collection process. Table 24.2 is a critical clinic staff contact information format.

Sites are selected as clinics based on the estimates provided by key agencies and businesses. Estimate capacity and vaccine/prophylactic medications required by proposed clinic site vary based on the type of event and the functional capacity of the people coming to that clinic. A nurse can immunize one patient every 1 to 3 minutes depending on those variables. That rule of thumb holds given adequate administrative and secretarial support to handle documentation and overall patient flow in the clinic. The following formula can be used to calculate clinic capacity:

\[
\text{Capacity (clients/hour)} = \frac{\text{Number of Nurses} \times 20 \text{ to } 60 \text{ clients per hour}}{1 \text{ to } 3 \text{ minutes per patient}}
\]
24.2 Critical Clinic Staff Contact Information List

<table>
<thead>
<tr>
<th>Type of Clinic Personnel</th>
<th>Name</th>
<th>Telephone #1</th>
<th>Telephone #2</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician/Nurse Practitioner in-charge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security Coordinator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volunteer Coordinator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other contacts (sanitation, EMS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments (special needs or requirements for site):

Capacity may vary depending on the physical layout of each clinic, the speed of screeners and immunizers, functional status of the recipients, and other factors. During an actual response to a bioterror event, the vaccine/prophylactic medication estimates might be scaled back based on the epidemiologic investigation. It may not be necessary to vaccinate and/or treat all high-risk persons. Initial estimates reflect a worst-case, communitywide scenario. Local planning authorities may want to create high-risk lists for smaller, more manageable geographic areas within their jurisdiction. Table 24.3 is a helpful centralized list of all clinics in an area.

General Population Assessment

During an actual event the high-risk category would also include persons exposed to the initial release (in the event of a bioterrorist attack) or exposure (in the event of an emerging infectious disease). Face-to-face contacts of cases, including household members or other close contacts may be considered high risk depending on the scope of response, as determined by technical staff investigating the outbreak. All residents may be at risk depending on the biological agent (or potentially, chemical agent) used. For this scenario, general population estimates should be used to determine vaccine/prophylactic medication requirements by the proposed clinic site. These estimates should be recorded in advance for each clinic site (see Tables 24.2 and 24.3). These estimates may differ throughout the year if an area has large transient populations (e.g., university students, seasonal workers). Because some of these fluctuations are predictable, they should be considered in the plan’s estimates.

Agencies should plan for a high percentage of persons to attend clinics because of the “fear factor” (those from outlying or bordering areas will possibly
Clinic Site Selection and Design

Determine nonhospital locations where vaccine and/or prophylactic medications could be administered for case contacts and large numbers of the general public. Visit proposed sites before making final selections. For each site selected prepare the following:

- Written plan for physical layout.
- Clinic information sheet (see Table 24.2).
- Clinic site selection criteria sheet (see Table 24.4).

Schools are often the preferred location for any clinic larger than can be held in the local health department. Schools have parking lots, long corridors, large classrooms, cafeterias, private offices, and other immediately available resources such as tables, chairs, and restrooms, and offer an ideal physical structure that can meet most clinics’ needs. Enclosed sports arenas and other facilities at universities should be considered. Also, local employers may offer sites to vaccinate staff and family members.

In the event of a major pandemic involving an agent as infectious as smallpox, employing the drive-through windows of fast food restaurants might be a potential solution to large-scale community immunization while minimizing exposure to disease.

Training is an important feature for the efficient and effective operation of immunization and prophylactic treatment clinics. Training includes all aspects of conducting the clinics. Table 24.5 is a checklist of the modules to include in that training and the designated staff who need to receive that training.

Immunization and Prophylaxis Clinic Setup

The following sections outline the setup and flow of a clinic to administer immunizations and prophylactic treatment.

Prescreening

Highly trained volunteers or clinical staffs observe clients as they arrive at the clinic to screen for obvious signs of illness. Standard precautions (protective gear, etc.) should be followed in accordance with EMS and HAZMAT guidelines. Those with illness and symptoms are directed immediately to the Sick Station.

Initial Screening

Establish eligibility to receive vaccine/prophylactic medication. Review address, identification, referrals, or any information needed to determine eligibility.
### Clinic Site Selection and Design Criteria Worksheet

<table>
<thead>
<tr>
<th>Potential Clinic Name:</th>
<th>Street Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>City State Zip</td>
</tr>
</tbody>
</table>

- Protected from weather; adequate climate control (heating and air conditioning): ____________

- Adequate space for large crowds, intake, briefing, screening, vaccine or prophylaxis administration, and medical emergencies. There needs to be space enough to contain and control long lines, preferably inside. The site needs to be large enough to handle the target population with room to spare: ____________

- Adequate power sources for equipment: ____________

- Hygiene facilities for workers: ____________

- Hygiene facilities for public: ____________

- Location that is familiar and accessible to the public: ____________

- Adequate parking: ____________

- Public transportation: ____________

- Clean utility storage for large amounts of supplies: ____________

- Dirty utility storage for biohazardous waste: ____________

- Refrigeration for vaccine/prophylactic storage: ____________

- Adequate restrooms: ____________

- Space for portable restrooms if necessary: ____________

- Accommodations available for special needs (e.g., wheelchairs): ____________

- Handicapped accessibility: ____________
Special needs populations:

Communication:
- Telephone
- Fax
- Internet capacity

<table>
<thead>
<tr>
<th>Accessible Internet</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Email</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Video conferencing</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Security

Accessibility of law enforcement personnel:

Triage Station
This is the first point of entry for clients who need administration of vaccine/prophylactic medication. Separate and direct clients to the appropriate station according to the following:

- Those who are pregnant go to the Pregnant Station.
- Those who are well (males and females) go to the Interpretation Station.
- Those with documentation of previous prophylaxis/vaccination are referred out of the receiving line to the Problem Station.
- Those receiving vaccine/prophylactic medication receive Information Statements.

Interpretation Station
All clients (males and females) who are well should receive vaccine/prophylactic medication and be referred to this station for the following:

- Conduct counseling and review of the most current Information Statements. Two-way verbal communication is essential to obtain informed consent especially with non-English speaking individuals.
- Ask females about pregnancy status or suspected pregnancy. If a positive response is received about pregnancy status, refer client to the Pregnant Station.
- Discuss precautions and contraindications prior to administration, according to the latest CDC recommendations.
- Refer clients to the next Registration and Sign-in Station.

Registration and Sign-In Station
Clients verify personal information at this station by the following method:

- Verify personal information and record date on Information Statement.
- This list may be used for consent of prophylaxis/vaccination if clinic policies have this requirement.
- After obtaining signature and verifying information from client, refer to the Prophylaxis/Vaccination Station.
24.5 Immunization and Prophylactic Treatment Clinic Training Module

### Topics

<table>
<thead>
<tr>
<th>Training Module</th>
<th>Targeted Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic management</td>
<td>Nurse Clinic Manager, Physician or Nurse Practitioners in Charge, Pharmacy Manager</td>
</tr>
<tr>
<td>Scope of response/ control measures</td>
<td>Epidemiologists, Nurses, Physicians</td>
</tr>
<tr>
<td>Inventory and control</td>
<td>Supply Managers, Centralized Admin. Personnel, Immunizer Assistants</td>
</tr>
<tr>
<td>Screening, registration</td>
<td>Medical Screeners, Registration Staff, Forms Collectors</td>
</tr>
<tr>
<td>HIPAA compliance</td>
<td>All personnel</td>
</tr>
<tr>
<td>Recordkeeping</td>
<td>All personnel</td>
</tr>
<tr>
<td>Security</td>
<td>All personnel</td>
</tr>
<tr>
<td>Emergency procedures</td>
<td>All personnel</td>
</tr>
<tr>
<td>Vaccine/prophylactic medication management</td>
<td>Supply Managers, Nurses, Physicians, Pharmacists</td>
</tr>
<tr>
<td>Vaccine/prophylactic medication administration</td>
<td>Nurses, Physicians, Pharmacists, Immunizer Assistants</td>
</tr>
<tr>
<td>Vaccine safety</td>
<td>Nurses, Physicians, Pharmacists, Immunizer Assistants, Medical Screeners</td>
</tr>
</tbody>
</table>

### Prophylaxis/Vaccination Station

Clients receive prophylaxis/vaccination at this station. The clinician takes the following actions:

- Supply manager or pharmacy manager maintains centralized inventory of vaccine/prophylactic medication.
- Provide documentation of vaccine/prophylactic medication.
- Give instructions regarding importance of completing medication or returning for additional doses of vaccine. Inform patients of tracking/recall procedures.
- Make available Standing Orders and an Emergency Kit for possible reactions to vaccine/first dose of medication.

### Pregnant Station

Women who are known or suspected to be pregnant should be referred to this station for the following:

- Determine name of prenatal provider. Provide necessary counseling.

### Sick Station

Clients who have a history or symptoms of illness (e.g., rash or obvious signs of illness) should be referred to the Sick Station for an evaluation that includes the following:

- Arrange for clients with rash or illness to exit building and be transported to nearest care facility, with the least exposure to other clients.
- Fill out case investigation form.

### Avoiding Backlog

There are a number of computer-generated discrete event simulation models available to evaluate different mass vaccination clinic designs (Aaby, Herrman, Jordan, Treadwell, & Wood, 2005; Sanjay & McLean 2004). These models allow hospitals and health departments to plan operations that reduce the number of patients in the clinic, which avoids unnecessary congestion, crowding, and confusion. In particular, the models show how batching at the education station, or any specific station, degrades clinic performance. Plans that provide educational resources before patients arrive to the clinic need to be investigated further. All efforts must be made to keep clinics fully operational and all individuals moving through in a timely manner.

### Clinic Operation

#### Resources/Supplies

Create a supply list (see Table 24.6) for the entire jurisdiction. Maintain centralized inventory of items that are difficult to obtain. Identify appropriate storage facilities. Ensure that personnel and protocols are in place for quality assurance: monitoring and maintaining appropriate storage temperatures; checking lot numbers and expiration dates. Develop guidelines for vaccine/prophylactic medication distribution...
and redistribution within the region/county or to surrounding counties. Establish contacts and procedures for obtaining all other necessary supplies within 24 hours of an emergency. When appropriate, share clinic site plans and anticipated needs with contractors in advance (e.g., for delivery of refrigerators, portable restrooms, tables, chairs, etc.).

Establish inventory control systems. Use a form similar to the one in Table 24.6 to distribute supplies to clinics. Establish a primary point of contact for clinic supply managers. Develop procedures to check each request for supplies carefully based on available information about the scope of response, clinic capacity, and existing on-site inventory. The supply manager at each clinic is responsible for maintaining inventory at each clinic. These managers need to be trained in advance on procedures for ordering supplies and maintaining inventory. The correct procedures for handling medications and vaccines need to be emphasized.

Develop security procedures for storage facilities and transportation systems. Determine criteria for entry into centralized storage depots for vaccines, prophylactic medications, and other supplies. Work with law enforcement to develop a transportation plan to service clinics in the event of a crisis.

Personnel and Logistics

Plan for adequate staff in advance. Make sure individuals understand their roles and responsibilities at all levels: health authority, regional office, and clinic. Many individuals will require advance training, including administrative staff assigned to answer hotlines, process paper work from clinics, and carry out normal public health functions. Table 24.7 includes details related to personnel and logistics necessary for clinic operations.

Administrative Personnel

Depending on scope and size of the response, significant administrative resources may be needed to process doses administered forms, vaccination records (including data entry), and information requests from the medical community and the general public. Policies must be in place for awarding compensatory time and/or paying overtime. New priorities for duties and responsibilities must be established and communicated to frontline staff as quickly as possible.

Clinic Job Descriptions

Many different jobs are involved in providing immunization and prophylactic treatment clinics in mass community campaigns. The following is a brief description of these jobs.

Nurse Clinic Manager
Assigns/directs all those administering vaccines and prophylactic medication; assists on-duty staff at all stations (e.g., vaccine/prophylactic medication, sick, and screening) as needed.

Nurse Practitioner or Physician in Charge
Final authority on all medical questions and media contact.

Pharmacy Manager
Oversees repackaging of all medications and all other pharmacy-related activities. In charge of vaccine/prophylactic preparation station.

Supply Manager
Ensures adequate vaccine/prophylactic medications and supplies are taken to the clinic site. Maintains all supplies in a temporary warehouse on site and maintains vaccine cold-chain. Issues supplies/vaccines to supply distributors as required. Sees that all unused supplies and vaccines are transported back to point of origin and properly stored.

Security Coordinator
Oversees personnel assigned to security activities at the clinic site; assists the clinic manager in making duty assignments of security personnel; determines the appropriate number of necessary security staff according to clinic size and location; maintains a list of authorized clinic staff and their phone numbers; assigns and coordinates use of cell phones and pagers; establishes staff check-in and check-out procedures; ensures all staff wear ID badges; maintains communication with local law enforcement and EMS officials.

Volunteer Coordinator
Oversees volunteer activity at the clinic site. Coordinates recruitment and training of volunteers. Provides job descriptions and defines roles/responsibilities. Maintains volunteer roster and activates volunteer network when needed. Maintains accurate records of volunteer hours.

Medical Gatekeeper
Assists security in assessing clients as they first arrive at the clinic site. Should be a highly trained volunteer or
## Advance Planning Supply List for Regional/Local Health Department

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMOUNT ON HAND</th>
<th>AMOUNT TO ACQUIRE</th>
<th>TOTAL AMOUNT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informed consent forms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccine or Drug Information Statements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biological waste containers (i.e., 12-gallon size)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syringes with needles:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• size ____________________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• size ____________________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterilized bifurcated needles for smallpox clinics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latex gloves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latex-free gloves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetone pladgets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spot band-aids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectangle band-aids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectal thermometers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral thermometers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermometer probe covers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table pads and clean paper to cover table for work site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antibacterial hand washing solutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloth towels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper towels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gauze</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesive tape</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleach solution and spray bottle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetaminophen elixir individual doses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetaminophen drops individual doses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetaminophen children’s chewable (80 mg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetaminophen adult tablets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigeration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage for vaccine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage for transport/handling of vaccine</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Part IV Disasters Caused by Chemical, Biological, and Radiological Agents

### 24.6 Continued

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMOUNT ON HAND</th>
<th>AMOUNT TO ACQUIRE</th>
<th>TOTAL AMOUNT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pill-counting machines and/or trays (if needed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pill bottles and lids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spatulas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box cutters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand truck</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small two-tiered cart for moving supplies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Janitorial supplies (mop, bucket, broom, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reusable ice packs (3–5 per station)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow “Caution” tape or other barriers to define waiting lines and areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing orders for emergencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampules of epinephrine 1:1000 SQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampules of diphenhydramine (Benadryl) 50 mg IM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3cc syringes with 11/2” 25-gauge needles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1/2” in needles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculin syringes with 5/8 in needle, for epinephrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9% Sodium Chloride</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5% Dextrose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV Starter Kits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spirit of ammonia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol swabs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tongue depressors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatric pocket mask with one-way valve</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult pocket mask with one-way valve</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Chapter 24 Mass Immunization and Prophylactic Treatment Clinics

#### 24.6 Continued

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMOUNT ON HAND</th>
<th>AMOUNT TO ACQUIRE</th>
<th>TOTAL AMOUNT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambu Bag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatric airways</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult airways</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tourniquets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flashlights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra batteries Size:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portable power sources for backup—portable generators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio (preferably at least one hand crank radio or radio with fresh batteries)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gurneys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stethoscopes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult regular Blood Pressure Cuff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult large Blood Pressure Cuff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatric Blood Pressure Cuff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blankets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pillows</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing orders for prophylaxis/vaccination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional contact list (multiple copies)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signage: English</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other languages (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>External</em>—entrances and exits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Internal</em>—Clearly marked areas, lines, stations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Biohazard</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>AMOUNT ON HAND</td>
<td>AMOUNT TO ACQUIRE</td>
<td>TOTAL AMOUNT REQUIRED</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>----------------</td>
<td>-------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>“TDH contraindications posters, other posters specific for vaccine or prophylactic medication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public information materials in:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other languages (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screening questionnaires</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other languages (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic vaccination administration record</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reminders/recall/vaccine “take away” cards for clients—specific for vaccine or prophylactic medication being administered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccine Adverse Event Report (VAERS) forms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calendars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound barriers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clipboards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra pens</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Envelopes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber bands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tape</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-it notes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date stamps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper clips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staplers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staples</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scissors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
24.6 Continued

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMOUNT ON HAND</th>
<th>AMOUNT TO ACQUIRE</th>
<th>TOTAL AMOUNT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell phones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra line telephones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two-way radios</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pagers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boxes/ice chests for storage and transport</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>File boxes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Containers for drinking water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking cups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portable restrooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snacks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toys, stickers, children’s books, small TV with VCR and children’s tapes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garbage containers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trash bags</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Clinician who screens for obvious signs of illness. Obtain information about possible contacts from ill persons (e.g., family members, possible contact with pregnant women, address, work place, and other pertinent information). Directs sick persons to Sick Station or arranges transportation to primary care site.

**Greeters**

Greet and conduct initial orientation of potential vaccine/prophylactic medication recipients on their arrival; provide basic information (verbally or with a video presentation); distribute informational material and forms (and pens) to be filled out. Send ill persons and persons with recent case contact to Sick Station.

**Registration Staff**

Review each vaccine recipient’s forms for completeness and accuracy; assist clients with completing documents. Send ill persons and persons with recent case contact to Sick Station.

**Medical Screeners**

Assess clients for contraindications to treatment/vaccination; when necessary perform physical examination.
## Personnel and Logistic Advance Planning Activity Checklist

<table>
<thead>
<tr>
<th>ACTIVITY STATUS</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Create contact lists for clinic personnel:</td>
</tr>
<tr>
<td></td>
<td>- Medical (physicians, nurses, NPs, EMTs, PAs, pharmacists, social workers)</td>
</tr>
<tr>
<td></td>
<td>- Logistical (clerks, record keepers, materials and supply management, messengers/couriers, people movers)</td>
</tr>
<tr>
<td></td>
<td>- Communication including interpreters</td>
</tr>
<tr>
<td></td>
<td>- Security (police, military, traffic control)</td>
</tr>
<tr>
<td></td>
<td>- Volunteers</td>
</tr>
<tr>
<td></td>
<td>Designate personnel with authority to direct operations: medical, logistics, communications, and security. Create command structure with clear delineation of assignments and responsibility. Create organizational chart delineating command structure.</td>
</tr>
<tr>
<td></td>
<td>Review current partnerships with organizations (e.g., Emergency Management, Private Health Care, Skilled Nursing/Long-Term Care, Human Services, Schools, Business and Industry, Media, Voluntary Organizations, Hospitals, Home Health).</td>
</tr>
<tr>
<td></td>
<td>Write clinic job descriptions with qualifications.</td>
</tr>
<tr>
<td></td>
<td>Produce setup diagrams for clinics, showing location of personnel by job title.</td>
</tr>
<tr>
<td></td>
<td>Identify contact personnel within your department who will assume responsibility for communication with vaccine administration partners (e.g., local health departments).</td>
</tr>
<tr>
<td></td>
<td>Amend policies and procedures to ensure that all non-health department personnel administering vaccine/prophylactic medication, such as volunteers, are working under the auspices of the regional office and/or the local health department.</td>
</tr>
<tr>
<td></td>
<td>Establish policies and financial support to ensure personnel will be reasonably compensated for working overtime.</td>
</tr>
<tr>
<td></td>
<td>Establish backup plan for provision of routine public health services in the event of personnel reduction.</td>
</tr>
<tr>
<td></td>
<td>Ensure availability of translators for all levels of clinic (e.g., security, screeners, nurses, emergency).</td>
</tr>
<tr>
<td></td>
<td>Conduct advance training sessions (e.g., smallpox vaccination, VAERS, precautionary measures and guidelines).</td>
</tr>
<tr>
<td></td>
<td>Develop security procedures for vaccine distribution and storage. Review procedures for vaccine/prophylactic medication transport.</td>
</tr>
<tr>
<td></td>
<td>Develop security plans for crowd control, traffic control, clinic personnel, materials/supplies/equipment at each clinic site.</td>
</tr>
<tr>
<td></td>
<td>Develop plan to transport workers, supplies/materials/equipment to clinic.</td>
</tr>
<tr>
<td></td>
<td>Develop procedures for transferring infected or potentially infected clients to a definitive care site if necessary.</td>
</tr>
<tr>
<td></td>
<td>Review public transportation system and other issues related to clinic access.</td>
</tr>
<tr>
<td></td>
<td>Establish procedures for the distribution of medications to people that cannot come to the mass medication dispensing centers (a family member may be able to obtain medication for children at home or for an invalid family member).</td>
</tr>
<tr>
<td></td>
<td>Establish procedures for segregating sick people from exposed but asymptomatic people at clinics.</td>
</tr>
<tr>
<td></td>
<td>Develop quality assurance plan.</td>
</tr>
<tr>
<td></td>
<td>Develop procedures and strategies for tracking, follow-up, and recall if second clinic visit required (e.g., recognition of expected vaccine reactions/take).</td>
</tr>
<tr>
<td></td>
<td>Develop procedures for shutting down clinic.</td>
</tr>
</tbody>
</table>
of patients who state they have conditions that may constitute contraindications; and answer medical questions. Should be a physician, nurse, or paraprofessional.

Immunizers

Medically screen, vaccinate, and complete documentation. Oversee the vaccination process; sign the clinic record; observe vaccine recipients for immediate reaction or complications. Must be a nurse, EMS personnel, or physician.

Immunizer Assistants

Assist the immunizer with all aspects of pre- and post-vaccination activities. Ensure that the vaccination station maintains adequate supplies; assist vaccine recipients in preparing the vaccination site (roll up sleeve, remove arm from shirt/blouse); clean vaccination site, if necessary, apply dressing to the vaccination site, instruct clients about care and changing of the dressing.

Forms Collectors

Verify that forms are correctly completed; collect all necessary forms from recipients before they depart.

Supply Distributor(s)

Obtains supplies from supply manager to keep vaccination stations adequately supplied. Also, transports pre-drawn syringes from the “mixing station” to the immunizers as needed (if this method is used in the clinic).

Crowd Controllers

Personnel should be stationed every few yards along waiting line to distribute forms, answer questions, monitor clinic flow, and check for ill persons.

Security

Ensure an orderly flow of traffic and parking at the clinic site; assist in maintaining orderly movement of vaccine/prophylactic medication recipients through the clinic; provide necessary control if persons become unruly; assist supply officer in maintaining security of prophylaxis/vaccine and other clinic supplies.

EMS

Local EMS should be on site or in very close proximity during clinics to respond to medical emergencies.

Recovery Area Staff

Available to client who is faint or having a reaction to a vaccine, assesses client condition and provides care as needed.

Volunteers at Various Stations

Volunteers can be the backbone of many essential functions at mass immunization and treatment clinics. The following is a listing of functions that volunteers can perform in these types of clinics.

Triage Station. Help separate people to be vaccinated by directing them to the holding area for the appropriate station:

- Pregnant
- Child-bearing age
- Sick
- Well, susceptible

Interpretation Station

- Provide verbal information about vaccine/prophylactic medication.
- Read Drug Information Sheets to those unable to read.
- Determine possible contraindications or previous allergic reactions to vaccine/prophylactic medication components.

Registration and Sign-In Station

- Document name of person.
- Have individuals sign in on clinic roster.
- Direct to appropriate vaccination station.

Vaccination Station

- Translate for staff.
- Assist in completing prophylaxis/vaccination records.
- Encourage individuals to keep records on their person at all times.
- Inform individuals about vaccine “take” and any additional doses needed of medicine/vaccine.

Pregnant Station. Provide translation as needed.

Sick Station. Provide translation as needed.

Clinic Setup

Clinics should have clearly marked entrance and exit points with adequate waiting space for groups of people seeking prophylaxis/vaccination. Security staff should
be posted at both locations to maintain order. It is vital that sick individuals be identified quickly and removed from the clinic site to avoid exposing large numbers of people. At least one trained volunteer or clinician should be dedicated to observing clients for signs of illness as they arrive at the clinic.

Traffic flow within the clinic should be controlled and should follow a logical path from the clinic entry to the exit. The best approach to crowd control is to never let people sit down. Keep the line(s) moving at all times. A linear path of traffic flow from entry to exit on opposite sides of the facility is optimal. However, it may be necessary to set up serpentine lines, similar to those used by amusement parks, using rope or some other temporary barrier. Appropriate accommodations must be made for all high-risk, high-vulnerability populations (see chapter 16 for further discussion).

Ideally, greeter-educators and registration staff should be located in a separate room from the vaccine administration station. It is likely that the registration and screening functions will be the most time-consuming clinic activities. Sufficient staff should be assigned to move a person through these areas quickly and to keep a steady flow of people to the vaccination/dispensing area. Figure 24.1 is an example of a sign-in form that can be used in these clinics.

Trained employees should monitor the vaccine supply to ensure that the vaccine is not left unrefrigerated for extended periods of time and to ensure that excess amounts of vaccine are not drawn up ahead of time and then possibly left over, and wasted, at the end of the clinic.

It is advisable to have one person monitor all supplies. Each station should be set up with adequate supplies at the beginning of the clinic and then replenished as needed. Having one person in charge of supplies helps to avoid wastage and keeps people from helping themselves to supplies and opening multiple boxes/packages of the same item.

Table 24.8 includes a summary of the recommended response steps for conducting mass immunization and prophylactic treatment clinics for the public. This checklist is a helpful tool for managers and planners to ensure that all aspects of clinic operation have been addressed in the planning phase. This list is also useful during an actual operation of mass clinics as a double check that all aspects of operation are in place.

**SUMMARY**

Any major outbreak of an infectious disease will necessitate local hospitals and health departments establishing and operating mass dispensing and vaccination clinics. These clinics will be highly dependent on nurses
Chapter 24  Mass Immunization and Prophylactic Treatment Clinics

24.8  Mass Immunization and Medication Treatment Clinic Response Checklist

- Investigate outbreak and determine scope of response.
- Select sites and times for high-risk clinics.
- Select sites and times for general population clinics.
- Use contact lists to activate clinic personnel.
- Fill out clinic supply lists (see Table 24.6) based on population estimates at each clinic site.
- Order vaccine/prophylactic medication and necessary supplies (see Table 24.6).
- Arrange delivery of supplies to clinics.
- Activate security plan to protect supply depots and deliveries of clinic supplies.
- Inform media partners of scope of response: date, time, location of clinics.
- Advise the public to wear appropriate clothing (e.g., vaccination via injection).
- Publicize a reassuring message that all possible measures are being taken to prevent further spread. State clearly what the criteria are for who will/will not be accepted for prophylaxis or vaccination.
- Conduct clinics for high-risk population.
- Conduct clinics for general population.
- Consolidate daily tally sheets onto single doses-administered form and submit on regular intervals to appropriate regulatory agency (e.g., State Bureau of Immunization).
- Monitor inventory levels and reorder supplies as necessary.
- Conduct random checks of clients to ensure treatment effectiveness.
- Arrange revaccination clinics if necessary.
- Evaluate effectiveness of clinics and overall response.
- Update policies and procedures based on experience and feedback from participants.

for their success. Careful planning regarding all of the functional aspects of these clinics and the training of personnel before an event occurs is extremely important.

COMMUNITY PLANNING EXERCISE FOR MASS IMMUNIZATION CLINIC

This exercise is designed to complement the information in this chapter. In this scenario you are the nurse manager of your local community health center who is working on a disaster relief planning team to develop your community plan for mass immunization and prophylactic treatment clinics. The focus of your community planning is centered on mass smallpox immunization. In preparation for your first planning meeting, perform the following Internet activities and write an executive summary of your findings from these Internet activities to present at the meeting.

\[\text{Locate and review the Public Health Emergency Preparedness and Response section of the CDC Web site (http://www.bt.cdc.gov).}\]

\[\text{Locate the smallpox section of this Web site [http://www.bt.cdc.gov/agent/smallpox/index.asp].}\]

\[\text{Locate and review the smallpox question and answer section of this Web site [http://www.bt.cdc.gov/agent/smallpox/vaccination/vaccination-program-qa.asp].}\]

\[\text{Locate and review the PHTN site (http://www.phppo.cdc.gov/phtn/default.asp).}\]

\[\text{Locate and review the listing of previous smallpox training Web casts (http://www.bt.cdc.gov/agent/smallpox/training/).}\]

\[\text{Locate and review the listing of upcoming smallpox Web casts (http://www.phppo.cdc.gov/PHTN/calendar.asp).}\]

\[\text{Locate and review the Strategic National Stockpile Web site (http://www.bt.cdc.gov/stockpile/).}\]

\[\text{Locate and review the synopsis of the Strategic National Stockpile program (http://www.bt.cdc.gov/stockpile/#synopsis).}\]

REFERENCES

Part IV  Disasters Caused by Chemical, Biological, and Radiological Agents

Key Messages

- Chemical disasters may result from accidental exposure, industrial accidents, or an intentional terrorist act.
- Chemical disasters create fear and panic and will cause widespread social disruption.
- A chemical disaster will create a surge of patients seeking care and has the potential to overwhelm the health care system.
- The ability to accurately identify chemical exposures in the field varies by geographic location and not all possible chemical exposures will be detected.
- Chemical contamination may be recognized by odors emanating from victims; reports from the scene; or victims fainting, seizing, and complaining of watering eyes and a dripping nose.
- Chemical disasters may result in multiple ill individuals with similar complaints seeking care at the same time.
- A rapid decision must be made to protect the hospital from secondary contamination.
- Storage of appropriate inventories of chemical antidotes, or quick access to such stores, is critical to the successful treatment of many chemical weapon victims.
- Nurses need to be able to recognize and treat exposures to the chemical agents of concern.

Critical Information

- Notify local emergency responders by calling 911.
- Call Poison Center 1-800-222-1222.
- Centers for Disease Control Emergency Response Hotline: (770) 488-7100.
- Do not wait for test results to begin immediate treatment.
- Wear proper protective equipment when handling hazardous materials and when treating exposed patients.
- Protect the emergency department from secondary contamination.

Learning Objectives

When this chapter is completed, readers will be able to

1. Identify the risk of exposure to chemical agents.
2. Describe the five major types of chemical agents used in chemical warfare.
3. Discuss the historical use of chemical weapons.
4. Recognize the typical features of each category of chemical agents.
5. Describe the need to conduct a focused health history to assess potential exposure to a chemical agent.
6. Describe the immediate psychological response of the individual, family, child, and community following a chemical incident.
7. Discuss the Centers for Disease Control and Prevention Guidelines for the initial management of patients with acute toxic exposures.
8. Identify the key components of the cyanide antidote kit.
Exposure to hazardous chemical agents can occur in the home, workplace, and in the community and may arise accidentally or through the intentional acts of terrorists. A variety of toxic chemicals may be used as chemical warfare agents. These include nerve agents, vesicants, tissue (blood) agents, pulmonary agents, and riot control agents. Symptom onset may be immediate and occur in the field as is seen with nerve agent poisoning, or may be delayed for many hours as is seen after phosgene exposures. Treatment needs to be individualized depending on the class of chemical agents. Rapid administration of specific antidotes is critical to treat symptomatic cyanide or nerve agent poisoning. Other chemical exposures such as most choking or blistering agents do not have specific antidotes. Treatment in the latter cases is limited to decontamination and supportive care.

A major event involving the use of chemical weapons would potentially result in chaos and panic, widespread social disruption, and significant morbidity and mortality. Nurses need to have an awareness of the challenges that would be encountered in caring for victims of a chemical attack, and where to locate guidelines for patient care and event management.

INTRODUCTION

A hazardous material is any substance that is potentially toxic to the environment or to living cells. This includes not only chemicals but also biologic and radiologic agents. Hazardous materials are used in the production of almost every product touched by man. The toxic, explosive, and flammable properties of some chemicals make them potential weapons in the hands of terrorists (Institute of Medicine, 2002). Many such chemicals (see Table 25.1) are commonly produced, transported, and used in large quantities in the United States. The potential for exposure is significant, and exposure to these agents can cause serious injury and
25.1 Chemical Agents of Concern

**Blister Agents/Vesicants**
- Mustards
  - Distilled mustard (HD)
  - Mustard gas (H) (sulfur mustard)
  - Mustard/lewisite (HL)
- Nitrogen mustard (HN-1, HN-2, HN-3)
- Saxitoxin mustard
- Sulfur mustard (H) (mustard gas)
- Phosgene oxime (CX)

**Blood Agents**
- Arsine (SA)
- Carbon Monoxide
- Cyanide
- Cyanogen chloride (CK)
- Hydrogen cyanide (AC)
- Potassium cyanide (KCN)
- Sodium cyanide (NaCN)
- Sodium monofluoroacetate (compound 1080)

**Choking/Lung/Pulmonary Agents**
- Ammonia
- Bromine (CA)
- Chlorine (CL)
- Hydrogen chloride
- Methyl bromide
- Methyl isocyanate
- Osmium tetroxide
- Diphosgene (DP)
- Phosgene (CG)
- Phosphine
- Phosphorus, elemental, white or yellow
- Sulfuryl fluoride

**Nerve Agents**
- G agents
  - Sarin (GB)
  - Soman (GD)
  - Tabun (GA)
- V agents
  - VX

The first challenge encountered in the event of a terrorist attack involving the use of chemical warfare agents (CWA) is detection of the chemical in the environment. Because of their physical properties, the use of chemical agents in a domestic terrorist incident may not be associated with a high explosive event. Delivery of chemical agents may occur by spraying, delivery in missiles or artillery shells, or by aerial bombing. Dispersal of a vapor hazard in a confined space may be particularly attractive to the terrorist.

In June 1994 and again in May 1995 the Japanese cult group Aum Shinrikyo created much havoc when they released the deadly nerve agent sarin in two Japanese cities. In the first attack in Matsumoto, Japan, sarin vapor was released in a residential area where judges unfriendly to the cult resided. Seven people died as a consequence of this nerve agent exposure, and 500 people were injured. The 1995 attack occurred in the Tokyo subway system. Several coordinated releases of this potentially deadly vapor resulted in more than 5,000 visits to local emergency departments. Fortunately, the vast majority of exposed victims had few if any symptoms and there were only a handful of fatalities (Tucker, 2006; for further discussion, see chapter 19—Biological and Chemical Terrorism: A Unique Threat).

The type of incident that occurred in Tokyo is an excellent example of the type of incident that can be anticipated as the result of a terrorist attack. The attack of sarin gas was minimized, fortunately, because of the inefficient release of the gas. The highest probability of detecting the presence of a CWA occurs in situations where there is a continuous source of vapor. By the time emergency medical responders arrive at the scene, significant dispersion of the agent can likely be expected, making detection difficult (Tucker, 2006). Once casualties of a vapor (gas) incident are removed from the scene of the attack and taken to medical care stations or facilities, the signs and symptoms of the patient may be the only clues to the detection of a chemical agent. Following the removal of victims from the source of the exposure, the threat of spreading the chemical agent to others remains but is relatively low. In the case of the Tokyo sarin gas attack however, 9% of EMS workers and a significant number of hospital staff, including nurses, experienced acute symptoms of nerve toxicity from exposure to casualties in unventilated areas.

Emergency response systems and health care facilities will need to respond to terrorist chemical attacks in a similar manner as an incident involving hazardous materials. The same principles regarding triage, decontamination, and the allocation of resources in death. Rapid detection of the presence of a chemical involved in any hazardous material (HAZMAT) incident is vital to the protection of first responders and emergency medical personnel, as well as to the effective treatment of victims.
response to a hazardous material incident will be needed during a terrorist chemical attack (Burda & Sigg, 2001).

**HAZMAT EMERGENCY RESPONSE**

An emergency response incident that involves the release of any chemicals or toxic materials will typically be referred to as a HAZMAT incident. The response to a HAZMAT incident is somewhat standardized across the country, and specialized HAZMAT teams are called in to address these situations. HAZMAT teams are typically affiliated with the fire services and will possess a majority of the locality’s chemical detection equipment. Emergency medical responders arriving on the scene must first be capable of determining that a HAZMAT incident has occurred. These first responders are the individuals responsible for determining whether the HAZMAT team should be called for assistance. Responders may have different levels of training and preparedness for HAZMAT response (see Table 25.2).

Minimally, all hospital personnel (e.g., nurses, physicians, security, and triage) who have a designated role in a HAZMAT response must be trained to the first responder awareness level (Levitin & Siegelson, 2002). Staff must be comfortable with knowing how to locate and use personal protective equipment and with the decontamination process (see chapter 26, Mass Casualty Decontamination, for further discussion).

**DETECTION OF CHEMICAL AGENTS**

HAZMAT teams are routinely equipped with a variety of chemical detectors and monitoring kits, primarily chemical-specific tests indicating only the presence or absence of a chemical. The ability to detect and measure chemical agents in the field varies considerably by locality and may be severely limited or nonexistent. Some large metropolitan areas have adequate instrumentation, whereas other areas have no chemical detection capabilities at all. In those locations lacking adequate detection technology, and in most emergency departments, the signs and symptoms of the victims may be the only detection method available.

Like modern canaries in a coal mine, the goal of chemical weapons detectors and sensors is to alert to an imminent danger (Kosal, 2003). Significant biotechnology research has been conducted and sponsored by the Department of Defense, as well as by a large number of private biotechnology firms, on the development of portable specialized sensors. These scientists are attempting to develop new, lighter, and more portable detection tools and to refine the sensitivity and specificity of these types of instruments to greatly improve our detection capabilities. Handheld portable alarm detectors and alarm agent monitoring dose meter detectors are now used for control of contaminated and decontaminated areas, chemical disarmament, water contamination control, and medical sorting of casualties. Cutting-edge chemical techniques readily allow for the detection of single molecules; however, the use of these tools is limited to sophisticated research.
Centers for Disease Control and Prevention (CDC) are people exposed to it. The categories/types used by the scientists often categorize hazardous chemicals by the type of chemical or by the effects a chemical would have on their structure and/or physical effect on victims. Scientists vary widely and are categorized by the chemical agent (Kosal).

Chemical agents vary widely and are categorized by the structure and/or physical effect on victims. Scientists often categorize hazardous chemicals by the type of chemical or by the effects a chemical would have on people exposed to it. The categories/types used by the Centers for Disease Control and Prevention (CDC) are as follows (CDC, 2006a):

- Nerve Agents
- Blood Agents
- Choking/Lung/Pulmonary Agents
- Incapacitating Agents
- Long-Acting Anticoagulants
- Metals
- Riot Control Agents/Tear Gas
- Toxic Alcohols
- Vomiting Agents

CWAs are classified into groups: nerve agents, biotoxins (e.g., ricin), vesicants (blistering agents), tissue (blood) agents, pulmonary agents, and riot control agents. An important principle of chemical agents is the rapid onset of symptoms that often occurs within minutes of the initial exposure (Burda & Sigg, 2001). Therefore, in order to minimize casualties, there must be prompt initiation of rescue, decontamination, medical attention, and antidotal therapy. The National Response Center’s Chemical and Biological Hotline (1-800-424-8802) based in Aberdeen, Maryland, serves as an emergency resource to all health care providers for technical assistance (Burda & Sigg).

Rapid diagnosis of patients who have been exposed to a chemical agent is critical to saving lives and preventing further injury. The signs and symptoms of the patient provide the most important information on which to base treatment decisions. Frequently, clinicians cannot rapidly detect the presence of an agent within the body but must look for some by-product of the agent or a particular biochemical reaction in the body (e.g., sludge symptoms suggestive of cholinergic poisoning from nerve agents) that is suggestive that a chemical exposure has taken place. The specific nature of the biochemical reaction and the resultant clinical picture it produces will then lead clinicians to determine a course of therapy.

ANTIDOTES

The hallmark of the successful management of a large-scale chemical attack involving mass casualties is based on a response plan that integrates local, state, and federal systems for the delivery and stockpiling of antidotes for mass casualty events. (The Strategic National Stockpile contains special chemical antidote packages called Chem packs. For more information, see http://www.bt.cdc.gov/stockpile/.) Emphasis must be placed on which agents need to be available locally, how much is needed, and under whose authority they will be delivered and administered (see chapter 24, Design and Implementation of Mass Immunization and Prophylactic Treatment Clinics, for further discussion).

NERVE AGENTS

Nerve agents are among the most potent and deadly of the chemical weapons. They are rapidly lethal, and hazardous by any route of exposure (Reutter, 1999; Tucker, 2006). First discovered accidentally during the 1930s by industrial chemists in Germany conducting pesticide research, the nerve agents Tabun and Sarin were developed into chemical weapons and stockpiled by the Nazi regime. Fortunately, Hitler did not order their use during World War II because German intelligence believed—incorrectly—that the United States and the Soviet Union had developed similar weapons. After the war, the victorious Allies competed among themselves for the secrets of the Nazi nerve agent program. In the early 1950s, British industrial scientists accidentally discovered a second generation of nerve agents that were even more toxic than Sarin and were dubbed V agents because of their venomous (skin-penetrating) properties. During the Cold War, the United States and the Soviet Union pursued a chemical arms race in which they produced and stockpiled various nerve agents in the thousands of tons. These supertoxic poisons have no peaceful uses and when inhaled or absorbed through the skin, are lethal in tiny amounts by disrupting the operation of the nervous system (Tucker, 2006). Nerve agents are liquids at room temperatures with the capability of producing a vapor that may be well absorbed through the skin as well as the lungs and GI tract. It is
possible to disseminate the nerve gases in high enough concentrations that would cause one breath to be incapacitating or deadly. Detecting the presence of nerve agents is extremely difficult as freshly mixed are clear and colorless liquids. Liquid agents are heavier than water and their vapor is heavier than air, allowing them to sink into low terrains and basements (Sidell, Patrick, Dashiell, Alibek, & Layne, 2006; Weinstein & Alibek, 2003).

Nerve agents are classified in two groups: G and V (Reutter, 1999). The G agents include GA (Tabun), GB (Sarin), GD (Soman), and GF. The V agents, which tend to be more pernicious, include VG (Amigon), VS, and VX. These agents are all highly poisonous chemicals that act by binding to the enzyme acetylcholinesterase, thereby blocking its normal function of breaking down the neurotransmitter acetylcholine following its release at neuronal synapses and neuromuscular junctions throughout the peripheral and central nervous systems. As a result of exposure to cholinesterase inhibitors, acetylcholine cannot be broken down, and accumulates at all cholinergic receptors. The result is continued receptor stimulation (Weinstein & Alibek, 2003).

Recognizing Nerve Agents

Persons exposed to high concentrations of organophosphate nerve agents usually develop signs and symptoms within a matter of minutes after exposure. Clinical presentation of patients with gasping, miosis, copious secretions, sweating, and generalized twitching is very suggestive of nerve agent exposure (Weinstein & Alibek, 2003). The cholinergic toxidrome that results is characterized by muscarinic signs and symptoms (DUMBBELSS: Diarrhea, Urination, Miosis, Bradycardia, Bronchorhea, Bronchospasm, Emesis, Lacrimation, Salivation, and Sweating), and nicotinic signs and symptoms (muscle fasciculations, tremor, and weakness). Severe diaphoresis and loss of other body fluids can lead to dehydration, systemic hypovolemia, and shock. Resultant respiratory muscle paralysis is a frequent cause of death. Agitation, seizures, and coma can also occur as a result of central nervous system (CNS) effects (Sidell, 1997).

Nicotinic symptoms may be observed initially, but muscarinic signs can be observed concurrently. Later in the course of poisoning, muscarinic signs predominate. Persistent depolarizing neuromuscular blockade may develop after initial resolution of the cholinergic crisis and can cause sudden respiratory failure and death (Reutter, 1999; Weinstein & Alibek, 2003). Initial patient diagnoses and treatments are likely to be based on observations of signs and symptoms by the paramedic or other health care professionals at the scene (Table 25.3). Rescuers and health care workers must prevent direct contact with victims through proper use of PPE and decontamination procedures.

Duration / Mortality

Recovery may take several months. Permanent damage to the central nervous system is possible after exposure to a high dose. G agents are lethal within 1 to 10 minutes and V agents are generally lethal within 4 to 18 hours, depending on dose and route of entry.

Patient Assessment

Muscle fasciculations and eventual paralysis may occur. Symptoms usually occur within seconds of exposure to a nerve agent but may take several hours when exposure is only transdermal (see Figure 25.1). Effects and time of onset of a nerve agent are dependent on the concentration of the agent and the amount of time exposed, as well as the route of exposure.

Mild inhalational exposure: Rapid onset of miosis, blurry vision, runny nose, chest tightness, dyspnea, and possible wheezing.

Severe inhalational exposure: Sudden coma, seizures, flaccid paralysis with apnea, miosis, diarrhea, and a victim who is “wet” (lacrimation, salivation, urination, sweating, copious upper and lower respiratory secretions).

Figure 25.1 Patient assessment.
Mild dermal exposure: Sweating and muscle fasciculations localized to the area of exposure, nausea, vomiting, diarrhea, and possible miosis.

Severe dermal exposure: Sudden coma, seizures, flaccid paralysis with apnea, miosis, diarrhea, and a victim who is "wet" (lacrimation, salivation, urination, sweating, copious upper and lower respiratory secretions). Onset of symptoms may be delayed by 30 minutes following exposure as the agents transit the skin.

Victims of a terrorist attack will usually have both inhalational and dermal exposures. Hours after treatment/decontamination, the agent, still in transit through the skin, may produce sudden and severe symptoms.

Clinical Diagnostic Tests
Red blood cell and serum cholinesterase.

Patient Management
Do not approach contaminated victims unless wearing proper personal protective equipment. Supportive therapy and assisted ventilation as needed.

Treatment
The agents act rapidly and profoundly, and, therefore, poisoning from nerve agents is a serious medical emergency. Treatment consists of thorough decontamination and, once the path of exposure has been determined, appropriate emergency and supportive measures (see Table 25.4). Patients with respiratory failure and compromised airways require immediate endotracheal intubation and positive pressure ventilation. Suctioning may be needed to remove bronchial secretions. Treatment includes prophylactic anticonvulsants to prevent seizures, oximes to reactivate the inhibited acetylcholinesterase and reverse paralysis, and anticholinergic agents to antagonize the muscarinic effects (Evson, Hinsley, & Rice, 2002). Specific antidotes include atropine and pralidoxime. Atropine, an antimuscarinic agent, may be required in extremely large quantities, and routine hospital stocks can be quickly depleted. Atropine does not treat reverse nicotinic effect such as fasciculations and paralysis. Pralidoxime (2-PAM, Protopam) acts to regenerate the enzyme activity at all affected sites, reverses paralysis, and is potentially curative if provided early enough and in sufficient doses. Patients may be put on atropine drips once initial symptoms stabilize. Seizures are treated with benzodiazepines (Sidell et al., 2006; Weinstein & Alibek, 2003). Nerve agents serve no useful purpose to society and primary prevention through full chemical disarmament should be the goal (Tucker, 2006).

VESICATING/BLISTER AGENTS

Vesicants/blister agents are chemicals that severely blister the eyes, respiratory tract, and skin on contact. Possible substances included in this class are mustard agents, Lewisites/chloroarsine agents, and phosgene oxime (Sidell et al., 2006).

Sulfur mustard has been used as a chemical warfare agent (CWA) in several wars, most recently in the Iran–Iraq conflict (see Photo 25.1). Thioglycol, an immediate precursor to sulfur mustard, has many industrial uses and is commercially available. At room temperature, sulfur mustard is an oily liquid that is only slightly soluble in water. At higher temperatures, it becomes a significant vapor hazard (mustard gas). It can permeate rubber and is readily absorbed through the skin, eyes, respiratory tract, and gastrointestinal tract. Nitrogen and sulfur mustards and Lewisite are cytotoxic alkylating agents. Sulfur mustard reacts within minutes with components of DNA, RNA, and proteins, and interrupts cell function. Mustard is the only one of the vesicants that does not cause immediate pain (Sidell, Urbanetti, Smith, & Hurst, 1997). Clinical signs and symptoms may develop within 2 to 12 hours but typically develop after 12 hours. The fluid-filled bullae that eventually form do NOT contain mustard agent.
(see Photo 25.2). Ocular and pulmonary injuries also may occur, and respiratory involvement is the most common cause of mortality. Mortality ranges from 2% to 3%. Approximately 5 to 7 mL (100 mg/kg) of mustard spread over 25% of the body surface area is potentially lethal (Davis & Aspera, 2001). Lewisite liquid or vapor produces irritation and pain seconds after contact. Phosgene oxime in vapor or liquid form is highly corrosive, and readily penetrates clothing and rubber. Exposure is characterized by immediate, severe pain and skin lesions similar to those caused by exposure to a strong acid (Sidell, 1997).

Recognizing Vesicants

Rapid recognition of vesicating agents in an emergency is a key step to ensure rapid and effective care. Though many blister agents are similar in appearance, they may be differentiated based on their distinctive odor (Table 25.5).

Exposure Types and Onsets

While symptoms generally manifest quite rapidly after exposure to a blister agent, the time course is a function of the route of exposure as well as the type and volume of vesicant involved (see Table 25.6).

Treatment

Blister/vesicant exposure is treated primarily as a thermal burn. Sulfur mustard decontamination is limited to immediate washing of exposed skin with water or soap and water, and flushing the eyes with copious amounts of water. Avoid 0.5% sodium hypochlorite solution or vigorous scrubbing as they may cause deeper tissue penetration. Typical burn therapy is accomplished with antibiotic ointment, sterile dressing, and other supportive
therapy. Patient whose burns cover more than 20% to 25% of body surface area should be admitted to critical care units even though at presentation they may have relatively few signs and symptoms (Davis & Aspera, 2001). Lewisite ocular or dermal exposure can be treated with British Anti-Lewisite (BAL) topical or ophthalmic preparations if available; however, they are not currently manufactured. Injectable BAL may help reduce systemic effects of Lewisite, but it may not prevent dermal damage that has already occurred. Intubation and airway management may be required for patients with airway damage. Prevention of infection with careful cleaning and topical antibiotics and pain relief should be instituted as part of symptomatic and supportive care.

### Duration/Mortality

The severity of the illness is dependent on the amount and route of exposure to the vesicant, the type of vesicant, and the medical condition of the person exposed. Exposure to high concentrations may be fatal.

### Patient Assessment

All of these vesicant agents act by producing direct irritation and have similar clinical presentations (see Figure 25.2).

**Ocular:** Redness and burning of the eyes with lacrimation, blepharospasm, and lid edema.

**Upper airway:** Nasal irritation and discharge, sinus burning, nose bleeds, sore throat, cough, and laryngitis.

**Pulmonary:** Dyspnea, necrosis of large airway mucosa with sloughing, chemical pneumonitis, pulmonary edema, ARDS, respiratory failure.

**Skin:** Irritation and redness with delayed production of wheals, vesicles, or bullae, followed later by areas of necrosis (see Table 25.7).

### Clinical Diagnostic Tests

- **CBC**
- **Glucose**
- **Serum electrolytes and renal function (BUN/creatinine)**
- **Chest X-ray**
- **Pulse oximetry (or arterial blood gas [ABG] measurements)**

### Patient Management

Decontaminate patients before treating.

Supportive therapy.

### Therapy

There is no antidote.

### BLOOD AGENTS

Blood or tissue agents are chemicals that affect the body by being absorbed into and distributed by the blood to the tissues. Substances include arsine, carbon monoxide, cyanide agents, and sodium monofluoroacetate.

Arsine is formed when arsenic comes in contact with an acid. Arsine is a colorless, nonirritating toxic gas with a mild garlic odor (Table 25.8). Although arsine was investigated as a warfare agent during World War II, it was never used on the battlefield. Arsine is most commonly used in the semiconductor and metals refining industries. Inhalation is the primary route of exposure, causing red blood cell lysis and symptoms including weakness, shortness of breath, and possible loss of consciousness, respiratory failure, paralysis, and death. Severely exposed patients are not likely to
25.8 Identifying Tissue (Blood) Agents by Appearance and Odor

<table>
<thead>
<tr>
<th>AGENT</th>
<th>APPEARANCE</th>
<th>ODOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsine</td>
<td>Colorless</td>
<td>Mild garlic or fishy</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>Colorless</td>
<td>Odorless</td>
</tr>
<tr>
<td>Cyanides</td>
<td>Colorless or pale-blue</td>
<td>Bitter almond</td>
</tr>
</tbody>
</table>

survive. If the initial exposure is survived, long-term effects may include kidney damage, neuropathy, and neuropsychological symptoms. Initial treatment includes fresh air, removal of contaminated clothing, washing contaminated skin, and symptomatic and supportive care. There is no specific antidote for treatment of arsine poisoning. Patients may need blood transfusions to replace damaged red blood cells (Walter, 2003; Weinstein & Alibek, 2003).

Recognizing Tissue (Blood) Agents

Cyanide in chemical weapons comes in four forms. These include cyanogen chloride (CK), hydrogen cyanide (AC), potassium cyanide (KCN), and sodium cyanide (NaCN). All forms may be released as a liquid, aerosol, or gas for inhalation; they may also be ingested or absorbed through the eyes and skin (Weinstein & Alibek, 2003). Sources of exposure include fumigants (rodenticides and insecticides), military poison gas, fire by-products, gold and silver ore extrication, mining, electroplating, and steel production. The cyanide anion, NC-, whether delivered in hydrocyanic acid or in a cyanogen such as cyanide chloride, exerts its toxicity primarily by inhibiting mitochondrial cytochrome oxidase, leading to lactic acidosis, hypoxia, syncope, seizures, dysrhythmias, respiratory failure, and death within minutes after inhalation or ingestion of a sizable dose. There are three main laboratory findings indicative of cyanide exposure: (a) an elevated blood cyanide concentration (the most definitive); (b) metabolic acidosis with a high concentration of lactic acid; and (c) oxygen content of the venous blood greater than normal (although this is not specific to cyanide exposure). As with the nerve agents, however, the effects of cyanide exposure have such a rapid onset that treatment must begin long before any laboratory results are available (Baskin & Brewer, 1997).

Patient Assessment

Cyanide poisoning: The latency period for cyanides is 10 to 15 seconds up to several minutes. The signs and symptoms of mild cyanide poisoning are nonspecific and may be difficult to differentiate from other chemical warfare agents. The signs and symptoms of moderate-to-severe cyanide poisoning are profound and may appear similar to those of the nerve agents.

Cyanogen chloride is an irritant and may produce lacrimation and upper airway irritation. When exposed to low concentrations of the other three forms of cyanide, victims will have 10 to 15 seconds of gasping, tachypnea, tachycardia, flushing, sweating, headache, giddiness, and dizziness, followed by nausea, vomiting, agitation, and confusion. At higher concentrations, the victim will have all these initial signs and symptoms, followed by bradycardia, apnea, seizures, shock, coma, and death. In all cases, death is caused by respiratory arrest and can be prevented by CPR. Cyanosis is a rare finding. Pupils may be unresponsive and dilated, but this is not specific to cyanide poisoning.

Arsine/phosphine poisoning: Upon inhalation there may be a burning sensation in the chest followed by chest pain, but there may be no symptoms at all, leaving the victim unaware that he or she has been exposed. Symptoms of shortness of breath and weakness that is due to a sudden severe anemia may occur.

The length of time between exposure and exhibiting symptoms depends on the concentration and duration of exposure. A delay of 2 to 24 hours is typical before the onset of any symptoms.

Initial symptoms of arsine poisoning include nausea, vomiting, headache, malaise, weakness, dizziness, abdominal pain, dyspnea, and, occasionally, red stained conjunctivae (see Figure 25.3). Symptoms progress to include hematuria, jaundice, and possibly renal failure. A slight odor of garlic may bedetectible on the breath. Urine may appear bloody and patients may experience numbness, tingling, burning or pricking, memory loss, and disorientation. Severe anemia, low blood pressure and an elevated serum potassium may be brought about by hemolysis 2 to 24 hours after exposure.

Later, look for enlargement of the liver, yellowing of the skin and whites of the eyes, or a bronze appearance to the skin.

Approximately 2 to 3 weeks after exposure to arsine Mee’s lines (horizontal white lines of the nails) may be observed.

Clinical Diagnostic Tests

CBC
Blood glucose
Electrolyte determinations
Urine for hemoglobinuria
Treatment

Treatment consists of proper circulatory and respiratory support until the antidote can be administered (Weinstein & Alibek, 2003). Contrary to what is popularly believed from movies and television, the effects of cyanide are not always irreversibly fatal, and victims may be successfully resuscitated by proper circulatory and respiratory support until the antidote can be administered. If the initial dose is not sufficient to kill the victim within minutes, treatment includes initial decontamination, administration of 100% oxygen, and utilization of a cyanide antidote kit (see Table 25.9).

The cyanide antidote kit contains amyl nitrate, sodium nitrate, and sodium thiosulfate. Nitrates convert hemoglobin to methemoglobin, which in turn competes for cyanide with the mitochondrial oxidase complex. Amyl nitrate pearls, administered by inhalation, can be utilized as a first aid measure when intravenous (IV) access is impossible or will be delayed. If IV access is available, IV sodium nitrate is preferred, followed by sodium thiosulfate. Sodium thiosulfate reacts with cyanide to form nontoxic thiocyanate, which is then excreted into the urine.

Exposure to carbon monoxide interferes with oxygen transport. As hypoxia progresses, more severe signs and symptoms may occur, including angina, seizures, respiratory depression, coma, and delayed neurological sequelae (DNS). Treatment with either hyperbaric oxygen (HBO) or normobaric oxygen can prevent damage and the development of DNS.

Patient Management

Closely monitor serum electrolytes, calcium, BUN, creatinine, hemoglobin, and hematocrit. For victims of arsine poisoning, avoid high levels of fluid replacement to avoid the onset of congestive heart failure symptoms.

Therapy

Cyanide poisoning. Victims may be successfully resuscitated by proper circulatory and respiratory support while waiting for the antidote to be administered. Every
### 25.10 Identifying Pulmonary Agents by Appearance and Odor

<table>
<thead>
<tr>
<th>Pulmonary Agent</th>
<th>Appearance</th>
<th>Odor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>Colorless</td>
<td>Bleach</td>
</tr>
<tr>
<td>Bromine</td>
<td>Brownish</td>
<td>Bleach</td>
</tr>
<tr>
<td>Chlorine</td>
<td>Yellow-green</td>
<td>Pungent, irritating</td>
</tr>
<tr>
<td>Hydrogen chloride</td>
<td>Colorless, yellowish</td>
<td>Odorless or fruity/floral/sweet</td>
</tr>
<tr>
<td>Methyl bromide</td>
<td>Colorless</td>
<td>Pungent</td>
</tr>
<tr>
<td>Methyl isocyanate</td>
<td>Colorless</td>
<td>Pungent, chlorine-like</td>
</tr>
<tr>
<td>Osmium tetroxide</td>
<td>Colorless, pale yellow</td>
<td>Pleasant odor of newly mown hay or green corn</td>
</tr>
<tr>
<td>Phosgene</td>
<td>Colorless</td>
<td>Garlic</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>Colorless</td>
<td>Odorless</td>
</tr>
<tr>
<td>Sulfuryl fluoride</td>
<td>Colorless</td>
<td></td>
</tr>
</tbody>
</table>

Effort should be made to administer the antidote as soon as possible.

**Arsine/phosphine poisoning:** There is no antidote for Arsine or phosphine poisoning. Do not administer arsenic chelating drugs. Patient may need blood transfusions.

### Pulmonary/Choking Agents

Pulmonary/choking agents are chemicals that cause severe irritation or swelling of the respiratory tract causing pulmonary damage and ultimately impairing oxygen delivery. Substances include ammonia, bromine, chlorine, hydrogen chloride, methyl bromide, methyl isocyanate, osmium tetroxide, phosgene, phosphine, phosphorus (elemental, white or yellow) and sulfuryl fluoride. Most are used in multiple industries, but some are easily found in the home (e.g., bleach, ammonia, chlorine).

**Recognizing Pulmonary Agents**

While the process of identifying pulmonary agents is complicated by their sheer diversity, most may be distinguished on the basis of their characteristic appearance and odor (Table 25.10).

**Exposure Type(s)/Onset**

Exposure by inhalation, ingestion, or skin/eye contact typically leads to immediate onset of symptoms but, in some cases, onset may be delayed by as much as 48 hours. Irritant gases are classified according to their water solubility. Gases that are highly water soluble (ammonia, hydrogen chloride) react with moisture in the mucosal surfaces and cause irritation primarily in the upper airway. Prolonged exposure may result in injury further into the bronchopulmonary system. Gases that are moderately water soluble (chlorine) cause injury to the upper airway to a lesser extent than those that are highly water soluble and also cause damage to the lower airway. Slightly water soluble gases (phosgene) are less irritating to the upper airway and may result in prolonged exposure because victims do not immediately sense that they are being exposed to toxic gases. Injury to the lower airway with noncardiogenic pulmonary edema can be delayed. Therefore, appropriate observation and supportive care are imperative (Weinstein & Alibek, 2003).

Chlorine is a gas with intermediate water solubility, thereby causing injury to both the upper and lower airways. Exposure to chlorine gas results in rapid onset of upper airway and pulmonary symptoms including choking, gasping, stridor, wheezing, shortness of breath, and respiratory compromise. Eye irritation and the development of a chemical conjunctivitis may also occur.

Phosgene is a gas with low water solubility. Exposure to this gas tends to predominantly affect the lower respiratory tree. An initially asymptomatic period for the first few hours after exposure is common. Onset of symptoms may first occur 24 hours after exposure. Typical symptoms include cough and shortness of breath. Pulmonary edema may develop.

**Duration/Mortality**

The duration and risk of mortality depend on the amount of exposure and the patient’s physical characteristics.

**Patient Assessment**

Initial symptoms include eye pain, redness, lacrimation, sore throat, runny nose, coughing, and headache.
After hours to several days, victims may develop nausea, hemoptysis, and the signs and symptoms of pulmonary edema including choking, dyspnea, rales, hemoconcentration, hypotension, and possible cyanosis (see Figure 25.4). Hypoxia and hypotension within 4 hours of exposure carries a poor prognosis.

Rarely, depending on concentration/time, pulmonary edema can occur within 30 minutes to 4 hours for chlorine and between 2 and 6 hours for phosgene. Most fatalities are within the first 24 hours and are due to respiratory failure.

Clinical Diagnostic Tests

- CBC
- Glucose determinations
- Electrolyte determinations
- Chest radiography
- Pulse oximetry (if severe inhalation exposure is suspected)

Patient Management

Supportive therapy.
Monitor blood pH if chlorine poisoning is suspected.

Therapy/Antidote

No antidote.

Treatment

Treatment for exposure to such respiratory agents is mainly supportive. Evaluation of respiratory function and oxygenation is critical. Pulse oximetry should be performed. High flow oxygen is required if hypoxemia is present. Patients with ventilatory failure or severe hypoxemia will need endotracheal intubation and mechanical ventilation (Table 25.11). No specific antidotes are available to reverse the effects of these chemicals. Supportive care may include beta-2 agonists to treat bronchospasm and pain and/or cough medications. Antibiotics and corticosteroids are not generally...

### Pulmonary Agent Treatment by Exposure Type

<table>
<thead>
<tr>
<th>EXPOSURE</th>
<th>TREATMENT</th>
</tr>
</thead>
</table>
| Inhalation | ■ Respiratory symptoms: Administer supplemental oxygen by mask.  
■ Bronchospasms: Treat with aerosolized bronchodilators or cardiac sensitizing agents.  
■ Children with stridor: Administer racemic epinephrine aerosol.  
■ Dose: 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water.  
■ Repeat every 20 minutes as needed, cautioning for myocardial variability.  
■ Observe patients carefully for 6–12 hours for signs of upper-airway obstruction.  
■ Patients who have had a severe exposure may develop noncardiogenic pulmonary edema. |
| Skin | ■ Treat chemical burns like thermal burns.  
■ If a victim has frostbite, treat by rewarming affected areas in a water bath at a temperature of 102 to 108°F (40 to 42°C) for 20–30 minutes and continue until a flush has returned to the affected area. |
| Eyes | ■ Continue irrigation for at least 15 minutes or until the pH of the conjunctival fluid has returned to normal.  
■ Test visual acuity.  
■ Examine the eyes for corneal damage and treat appropriately. |
| Ingestion | ■ Do not induce vomiting.  
■ Do not administer activated charcoal.  
■ Do not perform gastric lavage or attempt neutralization after ingestion.  
■ If not given during decontamination, give 4–8 ounces of water by mouth to dilute stomach contents.  
■ Consider endoscopy to evaluate the extent of gastrointestinal tract injury. |
warranted unless the patient develops a bacterial super-infection or evidence of reactive airway disease.

RIOT CONTROL AGENTS

Riot control agents are chemical compounds that temporarily inhibit a person’s ability to function by causing irritation to the eyes, mouth, throat, lungs, and skin. Sometimes known as tear gas, riot agents are present in both liquid and solid form and can be released in the air as fine droplets or particles. The purpose of their use is to incapacitate the victim. Riot control agents may be employed by police attempting to subdue an unruly crowd.

Several different compounds are considered to be riot control agents. The three major agents are:

- Chloroacetophenone (CN), also known as mace
- Chlorobenzylidenemalononitrile (CS)
- Diphenylaminearsine (DM)

Exposure to riot control agents is by inhalation or by contact with the skin and/or eyes and leads to rapid onset of symptoms.

Recognizing Riot Control Agents

Due to the circumstances of their typical use in the U.S., identification of riot control agents may be simplified by communication with the police or other agency responsible for disseminating the agent. In the absence of additional information, appearance and odor may help reveal the agent’s identity (Table 25.12).

Treatment

No specific treatment is required. Situation improves within 30 minutes after exposure ends (Weinstein & Alibek, 2003).

<table>
<thead>
<tr>
<th>RIOT CONTROL AGENT</th>
<th>APPEARANCE</th>
<th>ODOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN (Chloroacetophenone)</td>
<td>White</td>
<td>Fragrant (e.g., apple blossoms)</td>
</tr>
<tr>
<td>CS (Chlorobenzylidenemalononitrile)</td>
<td>White</td>
<td>Pungent (e.g., pepper)</td>
</tr>
<tr>
<td>DM (Diphenylaminearsine)</td>
<td>Yellow-green</td>
<td>Odorless</td>
</tr>
</tbody>
</table>

Duration/Mortality

Situation will improve 15 to 30 minutes after exposure ends. Death can be immediate when serious chemical burns are present in the throat and lungs.

Patient Assessment

Riot control agents primarily affect the eyes, causing temporary blindness that is due to lacrimation and blepharospasm. They also produce conjunctival redness; cough; chest tightness; sneezing; and mouth, nose, and throat irritation (see Figure 25.5). In raw or abraded skin, lacrimators can cause burning and erythema. Rarely, under conditions of high temperature, high humidity, and high concentration, vesicles may form hours later on exposed skin areas.

EMERGENCY DEPARTMENT PROCEDURES IN CHEMICAL HAZARD EMERGENCIES

Every hospital must prepare to treat victims of HAZMAT accidents before an event occurs. The hospital must provide appropriate HAZMAT training, provide personal protective equipment, and develop and disseminate policies and procedures necessary to quickly and efficiently treat contaminated patients (Levitin & Siegelson, 1996, 2002; Pfaff, 1998). Guidelines for the initial management of patients with acute toxic exposures have been established by the Centers for Disease Control and Prevention. Initial treatment protocols are agent specific and are provided for review (see Table 25.13; CDC, 2006b). At a minimum, nurses should be aware of the guidelines and how to access them quickly at the point of care (see Table 25.14).
Emergency Room Procedure in Chemical Hazard Emergencies

**PREPARATIONS**

1. Try to identify agent.
2. Break out personal protection equipment, decontamination supplies, antidotes, etc.
3. Is chemical hazard certain or very likely? If yes:
   - Don personal protective equipment.
   - Set up hot line.
4. Clear and secure all areas that could become contaminated.
5. Prepare and secure hospital entrances and grounds.
6. Notify local emergency management authorities if needed.
7. If chemical is a military agent and army has not been informed, call them.
8. If an organophosphate is involved, notify hospital pharmacy that large amounts of atropine and 2-PAM may be needed.

**WHEN VICTIM ARRIVES**

(Note: A contaminated patient may present at an emergency room without prior warning.)

9. Does chemical hazard exist?
   - Known release/exposure (including late notification)
   - Liquid on victim’s skin or clothing
   - Symptoms in victim, EMTs, others
   - Odor (H, L, phosgene, chlorine)
   - M-8 paper, if appropriate
   - If yes: Go to 10.
   - If no: Handle victim routinely.

10. Hold victim outside until preparations are completed (don personal protective equipment to assist EMTs as necessary).

11. If patient is grossly contaminated (liquid or skin, positive M-8 paper) OR if there is any suspicion of contamination, decontaminate patient before entry into building.

**SUMMARY**

Toxic chemical exposures offer a variety of unique challenges to nurses, particularly emergency nurses and other first responders. Most HAZMAT accidents are small-scale events that happen at the workplace, involving only one or two patients. However, the current threat of chemical terrorism increases the likelihood that a large-scale event involving many casualties may occur. Many fire departments, Emergency Medical Services, and hospitals are not prepared to deal with these types of events. Furthermore, these agents, when mishandled, can turn a contained incident into a disaster involving the entire hospital and community. During a HAZMAT incident, victims often seek out the nearest hospital regardless of the institution’s capability to handle a chemical event. Nurses and other providers need to be prepared in advance for this type of situation (adequate training and access to personal protective equipment), and be aware of the proper procedures for triage, decontamination, and initial management of an acute toxic exposure.

The large-scale use of chemical weapons has the potential to cause massive social disruption and significant morbidity and mortality. Nurses must support all efforts to advocate for chemical disarmament and the ultimate abolition of the use of nerve agents for any purpose.

**STUDY QUESTIONS**

1. Which chemical agent was used in the Tokyo subway system in 1995? How effective was this agent in causing physical injury?
2. List two antidotes used to treat sarin gas poisoning.
3. Describe the levels of training for hazardous materials exposure management. What should hospital personnel involved in HAZMAT response have as a minimal level of training?
4. True or false: Specific antidotes have been developed to treat poisonings from all the common types of chemical warfare agents.
Chapter 25  Chemical Agents of Concern

25.14 Initial Treatment and Identification of the Chemical Agent

1. Establish airway if necessary.
2. Give artificial respiration if not breathing.
3. Control bleeding if hemorrhaging.
4. Check for symptoms of cholinesterase poisoning?
   - Pinpoint pupils
   - Difficulty breathing (wheezing, gasping, etc.)
   - Local or generalized sweating
   - Fasciculations
   - Copious secretions
   - Nausea, vomiting, diarrhea
   - Convulsions
   - Coma
   YES: Go to NERVE AGENT PROTOCOL
5. Check for history of chlorine poisoning?
   YES: Go to CHLORINE PROTOCOL.
6. Burns that began within minutes of poisoning?
   NO: Go to 8.
7. Thermal burn?
   YES: Go to LEWISITE PROTOCOL.
8. Burns or eye irritation beginning 2 to 12 hours after exposure?
   YES: Go to MUSTARD PROTOCOL.
9. Is phosgene exposure possible?
   - Known exposure to phosgene
   - Known exposure to hot chlorinated hydrocarbons
   - Respiratory discomfort beginning a few hours after exposure
   YES: Go to PHOSGENE PROTOCOL
10. Check other possible chemical exposures:
    - Known exposure
    - Decreased level of consciousness without head trauma
    - Odor on clothes or breath
    - Specific signs or symptoms

PHOSGENE PROTOCOL
1. Restrict fluids, take chest X-ray, test blood gases. Results consistent with phosgene poisoning?
   YES: Go to # 4
2. Dyspnea?
   YES: OXYGEN, positive end-expiratory pressure
3. Observe closely for at least 6 hours.
4. If SEVERE DYSPEA develops, go to 4.
5. If MILD DYSPEA develops after several hours, go to 1.
6. Severe dyspnea develops or X-ray or blood gases consistent with phosgene poisoning:
   - Admit to hospital
   - Give oxygen under positive end-expiratory pressure
   - Restrict fluids
   - Take chest X-ray
   - Test blood gases
   - May send to ICU

MUSTARD PROTOCOL
1. Airway obstruction?
   YES: Tracheostomy
2. If there are large burns:
   - Establish IV line—do not push fluids as for thermal burns.
   - Drain vesicles—unroof large blisters and irrigate area with topical antibiotics.
3. Treat other symptoms appropriately:
   - Antibiotic eye ointment
   - Sterile precautions PRN
   - Morphine PRN (generally not needed in emergency treatment; might be appropriate for in-patient treatment)
25.14 Continued

LEWISITE PROTOCOL
2. Treat affected skin with British Anti-Lewisite (BAL) solution (if available).
3. Treat affected eyes with BAL ophthalmic ointment (if available).
4. Treat pulmonary/severe effects
   □ BAL in oil, 0.5 mL/25 lbs body weight deep IM to max of 4.0 mL. Repeat q 4 h × 3 (at 4, 8, and 12 hours).
   □ Morphine PRN
5. Severe poisoning?
   YES: Shorten interval for BAL injections to q 2 h.

CHLORINE PROTOCOL
1. Dyspnöea?
   □ Try bronchodilators
   □ Admit to hospital
   □ Give oxygen by mask
   □ Take chest X-ray
2. Treat other problems and reevaluate (consider phosgene).
3. Respiratory system OK?
   YES: Go to 5.
4. Is phosgene poisoning possible?
   YES: Go to PHOSGENE PROTOCOL.
5. Give supportive therapy; treat other problems or discharge.

NERVE AGENT PROTOCOL
1. Severe respiratory distress?
   YES:
   □ Intubate and ventilate
   □ ATROPINE
      Adults: 6 mg IM or IV
      Infants/children: 0.05 mg/kg IV
   □ 2-PAM C1
      Adults: 600–1,000 mg IM or slow IV
      Infants/children: 15 mg/kg slow IV
2. Major secondary symptoms?
   NO: Go to 6.
   YES:
   □ ATROPINE
      Adults: 4 mg IM or IV
      Infants/children: 0.02–0.05 mg/kg IV
   □ 2-PAM C1
      Adults: 600–1,000 mg IM or slow IV
      Infants/children: 15 mg/kg
   □ OPEN IV LINE
3. Repeat atropine as needed until secretions decrease and breathing is easier
   Adults: 2 mg IV or IM
   Infants/children: 0.02–0.05 mg/kg IV
4. Repeat 2-PAM C1 as needed
   Adults: 1.0 g IV over 20–30 min
   Repeat q 1 h × 3 PRN
   Infants/children: 15 mg/kg slow IV
5. Convulsions?
   NO: Go to 6.
   YES: DIAZEPAM 10 mg slow IV
   Infants/children: 0.2 mg/kg IV
6. Reevaluate q 3 to 5 min.
   If signs worsen, repeat from 3.

Note: Warn the hospital pharmacy that unusual amounts of atropine and 2-PAM may be needed.

5. True or false: Multiple ill individuals with similar complaints seeking care at the same time is suggestive of the use of chemical weapons.
6. True or false: Nerve agents are well absorbed through the skin.
7. A patient presents to the triage desk in your emergency department following exposure to some sort of gaseous substance in his office building while at work. He is 48 years old, appears anxious and agitated, and has rapid respirations. Describe what should be done in terms of initial patient management.
8. The Joint Commission, which implements standards that must be met for hospitals to receive accreditation, has also established specific HAZMAT guidelines for hospitals. Locate a copy of these guidelines and identify the primary requirements they contain. Find out if your hospital or health care organization meets these guidelines.

INTERNET ACTIVITIES
1. How quickly can you locate the most current recommended protocols for emergency treatment of toxic chemical exposures? Locate the Centers for Disease Control and Prevention Web site for the most current, valid, and reliable information.
2. What is the CDC’s role in the transport and disposal of toxic chemical weapons?
3. Go to the Federation of American Scientists’ Web site on chemical weapons. Locate the Chemical Warfare Agents section and find nerve agents.
Describe what effect nerve agents have on the human body.

4. Locate the Web site for the United States Army Medical Research Institute for Chemical Defense. Locate the Triage of Chemical Casualties chapter. Describe each of the triage categories and how they would be used in a mass chemical exposure event.

5. How would you manage casualties with combined chemical exposures (more than one type of agent)?

6. What unique factors about children make them more susceptible to exposure to chemicals?

7. Visit the Emergency Nurses Association Web site and look for their position statement on hazardous material exposure. How do they define a hazardous material? What does the position statement say and how will this affect your practice?

8. Go to the Terrorism Research Center’s Web site at http://www.terrorism.com/index.php/. What types of resources are available at this site? Evaluate the benefit of these resources for nurses.

9. Go to The Center for Nonproliferation Studies Web site at http://cns.miis.edu/cns/index.htm. The Chemical and Biological Weapons Nonproliferation Program (CBWNP) monitors the global proliferation of chemical and biological weapons (CBW) and develops strategies for halting and reversing their spread. What resources are available? What do they have to say about the use of chemical weapons? Identify readings that might help nurses understand the reality of the threat of chemical warfare.

REFERENCES


Overview
The Agency for Toxic Substances and Disease Registry (ATSDR), based in Atlanta, Georgia, is a federal public health agency of the U.S. Department of Health and Human Services. ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. In 1990, ATSDR established the Hazardous Substances Emergency Events Surveillance (HSEES) system to collect and analyze information about (a) sudden uncontrolled or illegal releases of hazardous substances that require cleanup or neutralization according to federal, state, or local law and (b) threatened releases that result in public health action, such as evacuation. The HSEES system aims to reduce injury and death among first responders, employees, and the general public that result from releases of hazardous substances. It is the only federal database designed specifically to address the public health effects from releases of hazardous substances.

What Is a Hazardous Substance Event?
A HSEES event is any release or threatened release of at least one hazardous substance (excluding releases involving only petroleum products). A substance is considered hazardous if it might reasonably be expected to cause adverse health effects to humans. Events are included in the system if the amount released, or threatened to be released, is required to be cleaned up according to federal, state, or local law. In addition, for threatened releases to be included in HSEES, they must cause an action to protect public health (i.e., evacuation).

Who Provides Information to the HSEES System?
Fifteen state health departments participate in HSEES through cooperative agreements with ATSDR. These states are Colorado, Florida, Iowa, Louisiana, Michigan, Minnesota, Missouri, New Jersey, New York, North Carolina, Oregon, Texas, Utah, Washington, and Wisconsin. Participating states provide information about the release, such as time and place, circumstances, substances involved, persons affected, and public health action taken.

What HSEES System Information Has Shown
- Approximately 9,000 hazardous substances releases occur annually in the 15 states reporting.
- Releases at facilities account for 70%–75% of events, and transportation-associated releases account for 25%–30% of reported events.
- Most releases occur on weekdays between 6 a.m. and 6 p.m.
- Releases tend to increase in spring and summer.
- Equipment failure and human error cause most releases at facilities.
- Human error and equipment failure cause most releases during transport.
- More than 90% of events involve the release or threatened release of only one hazardous substance.
- Releases of hazardous substances most often injure employees, followed by the general public and—less frequently—first responders and school children.
- Respiratory irritation and eye irritation are the most commonly reported symptom or injury.
- Approximately 50% of people who reported developing symptoms or injuries from a HSEES event are treated at a hospital and released.

CASE STUDY

25.2 CDC Chemical Agents Fact Sheet: Sheltering in Place Following a Chemical Release

What “Sheltering in Place” Means

Some kinds of chemical accidents or attacks may make going outdoors dangerous. Leaving the area might take too long or put you in harm’s way. In such a case, it may be safer for you to stay indoors than to go outside.

Sheltering in place means to make a shelter out of the place you are in. It is a way for you to make the building as safe as possible to protect yourself until help arrives. You should not try to shelter in a vehicle unless you have no other choice. Vehicles are not airtight enough to give you adequate protection from chemicals.

Every emergency is different and during any emergency people may have to evacuate or to shelter in place depending on where they live.

How to Prepare to Shelter in Place. Choose a room in your house or apartment for the shelter. The best room to use is one with as few windows and doors as possible. A large room with a water supply is best—something like a master bedroom that is connected to a bathroom. For chemical events, this room should be as high in the structure as possible to avoid vapors (gases) that sink. This guideline is different from the sheltering-in-place technique used in tornadoes and other severe weather and for nuclear or radiological events, when the shelter should be low in the home.

The following items, many of which you may already have, would be good to have in your shelter room:

- First aid kit
- Flashlight, battery-powered radio, and extra batteries for both
- A working telephone
- Food and bottled water. Store 1 gallon of water per person in plastic bottles as well as ready-to-eat foods that will keep without refrigeration in the shelter-in-place room. If you do not have bottled water, or if you run out, you can drink water from a toilet tank (not from a toilet bowl). Do not drink water from the tap.
- Duct tape and scissors.
- Towels and plastic sheeting. You may wish to cut your plastic sheeting to fit your windows and doors before any emergency occurs.

How to Know if You Need to Shelter in Place. Most likely you will only need to shelter in place for a few hours. If there is a code red or severe terror alert, you should pay attention to radio and television broadcasts to know right away whether a shelter-in-place alert is announced for your area. You will hear from the local police, emergency coordinators, or government on the radio and on television emergency broadcast system if you need to shelter in place.

What to Do. Act quickly and follow the instructions of your local emergency coordinators such as law enforcement personnel, fire departments, or local elected leaders. Every situation can be different, so local emergency coordinators might have special instructions for you to follow. In general, do the following:

- Go inside as quickly as possible. Bring any outdoor pets indoors.
- If there is time, shut and lock all outside doors and windows. Locking them may pull the door or window tighter and make a better seal against the chemical. Turn off the air conditioner or heater. Turn off all fans, too. Close the fireplace damper and any other place that air can come in from outside.
- Go in the shelter-in-place room and shut the door.
- Turn on the radio. Keep a telephone close at hand, but don’t use it unless there is a serious emergency.
- Sink and toilet drain traps should have water in them (you can use the sink and toilet as you normally would). If it is necessary to drink water, drink stored water, not water from the tap.
- Tape plastic over any windows in the room. Use duct tape around the windows and doors and make an unbroken seal. Use the tape over any vents into the room and seal any electrical outlets or other openings.
- If you are away from your shelter-in-place location when a chemical event occurs, follow the instructions of emergency coordinators to find the nearest shelter. If your children are at school, they will be sheltered there. Unless you are instructed to do so, do not try to get to the school to bring your children home. Transporting them from the school will put them, and you, at increased risk.
- Listen to the radio for an announcement indicating that it is safe to leave the shelter.
- When you leave the shelter, follow instructions from local emergency coordinators to avoid any
Part IV  Disasters Caused by Chemical, Biological, and Radiological Agents

contaminants outside. After you come out of the shelter, emergency coordinators may have additional instructions on how to make the rest of the building safe again.

More Information About Sheltering in Place

To obtain more information, you can contact one of the following:

- State and local health departments
- Centers for Disease Control and Prevention
  - Public Response Hotline (CDC)
    - 800-CDC-INFO
    - 888-232-6348 (TTY)
  - E-mail: cdcinfo@cdc.gov

Source: Centers for Disease Control. Available at http://www.bt.cdc.gov/planning/shelteringfacts.asp.
Key Messages

- A large-scale chemical release with mass casualties will create a significant burden and may quickly overwhelm the existing health care system.
- Decontamination must be available and provided quickly to patients involved in chemical and other hazardous materials incidents.
- Decontamination must reduce or remove the chemical agent, while protecting the safety of the staff and preventing further contamination of the environment.
- In treating patients with chemical exposures, decontamination is of primary importance provided the patient does not require immediate life-saving interventions.
- Special conditions triage must be employed to appropriately sort patients to avoid further contamination.
- Emergency departments have a unique role in mass casualty decontamination.
- Nurses must use the appropriate level of personal protective equipment in order to keep themselves safe and avoid becoming a victim.
- Nursing skills may have to be adapted while wearing personal protective equipment.

Learning Objectives

When this chapter is completed, readers will be able to

1. Define a HAZMAT event.
2. Distinguish between first responders and first receivers and understand the implications for personal safety.
3. List the five basic types of chemical warfare agents and their properties.
4. Describe the process for special conditions triage during a chemical incident.
5. Describe the four levels of personal protective equipment and when it is appropriate to use them.
6. List the Joint Commission and Occupational Safety and Health Administration (OSHA) requirements for emergency department preparedness for chemical incidents.
7. Describe the procedure for chemical decontamination in the hospital setting.
8. Describe the decontamination process for infants and small children.
Disaster events may create a sudden influx of patients who have been exposed to a chemical, radiation, or other hazard that requires decontamination. Protecting nurses and other health care workers who respond to chemical or hazardous materials (HAZMAT) mass casualty incidents is critical. Patient decontamination is an organized method of removing residual contaminants from the victim’s skin and clothing and should be performed whenever known or suspected contamination has occurred with a hazardous substance through contact with either aerosols, solids, or liquids. The degree of decontamination performed will depend on the situation. Nurses dealing with these types of emergencies may be exposed to hazards, either in the field or in the hospital setting. Ideally, only HAZMAT experts and other highly trained professionals should be responding to victims of chemical exposure at the site of the event. Nurse responders must approach contaminated sites with great caution and be prepared to self-decontaminate. Nurse receivers need to have a solid understanding of how to stay safe while participating in decontamination procedures and patient care at the hospital.

INTRODUCTION

Chemical emergencies may result from industrial explosions, transportation accidents, police actions involving tear gas, or the intentional use of chemicals as agents of war by terrorists. The release of a chemical into the environment creates a HAZMAT incident that poses unique challenges for the health care system and for those individuals who participate in the response. Victims who are chemically contaminated must be decontaminated, preferably before being brought to the hospital or into a clean treatment area. Emergency Medical Services (EMS) has specific procedures for triage and in some communities decontamination of victims is done before transport to a hospital. EMS may transport victims directly to the hospital, however, and it is expected that many ambulatory victims will leave the scene before being triaged and decontaminated (Levitin & Siegelson, 1996). Hospital personnel should assume that individuals presenting to the hospital have not undergone adequate field decontamination until proven otherwise. Therefore, each hospital must have a system in place
to employ special conditions triage and decontaminate these arrivals (Levitin et al., 2003). A first receiver is defined by OSHA as a health care worker at a hospital (away from the contaminated incident site) receiving contaminated victims. In contrast, first responders are people such as firefighters, law enforcement, and HAZMAT teams typically working at the site of the incident. The assumption in defining first receivers is that the hospital is not the primary incident site, but rather removed from the location of the incident (OSHA, 1997, 2004). The potential exists for nurses functioning in the roles of first responder or first receiver to become victims themselves, either from actual exposure to the toxins or from the stressful physiological effects of wearing and working in the personal protective gear.

Emergency departments (EDs) and EMS are responsible for managing chemical disasters, whether they result from industrial accidents or terrorist activities, and continue to be the primary provider of care to contaminated individuals (Levitin & Siegelson, 1996). In recognition of this responsibility, the Joint Commission and OSHA require EDs to prepare for and have a written plan for potential hazardous materials incidents (Joint Commission, 1996; OSHA, 2004). The determination of a workable hazardous materials plan requires careful thought and often professional input from emergency department physicians and nurses, medical toxicologists, hazardous materials teams, and industrial hygiene and safety officers. Understandably, for most hospital staffs, treatment of chemical casualties presents an obscure and frightening situation. Hospitals must attend to ensuring that they have adequate amounts of antidotes available for the treatment of casualties, adequate showers and decontamination tents, the appropriate level and supply of protective gear and equipment for worker safety, and enough staff trained to decontaminate patients. Concern exists that hospitals in major metropolitan areas are severely lacking in preparedness for chemical terrorism (Kemn, Pesik, & Twum-Danso, 2003), despite significant federal funding. Finally, using a patient decontamination plan implemented without specific adaptation to the hospital and without practice can result in undesirable outcomes. The level of preparedness for a chemical mass casualty scenario should be established according to the existing threat and the available resources and the plan should be tested in regular full-scale hospital drills (Cox, 1994; Tur-Kaspa et al., 1999).

TRIAGE OF CONTAMINATED PATIENTS

Special conditions triage for chemical incidents will occur in several places.

Triage in the Field (Sidell, Patrick, & Dashiell, 1998)

- **Hot Zone**: The area immediately adjacent to the location of the incident. Minimal triage and medical care activities take place and are limited to airway and hemorrhage control, administration of antidotes, and identification of expectant cases (dead or nonsalvageable). All staff are in protective gear in this area.
- **Warm Zone**: A distance of at least 300 feet from the outer perimeter of the hot zone, which is upwind and uphill from the contaminated area. Rapid triage takes place to sort victims into critical, urgent, delayed, or, if they have deteriorated, expectant categories. As in the hot zone, only a minimal amount of treatment is rendered to provide essential stabilization. The priority is to commence decontamination. Nonambulatory victims go through litter decontamination, whereas ambulatory patients and any personnel wishing to leave the warm zone go through ambulatory decontamination before entering the cold zone. Those victims with the most severe signs/symptoms of contamination are given priority for decontamination. All staff in this area must wear the appropriate personal protective equipment.
- **Cold Zone**: The area that is adjacent (and uphill and upwind) from the warm zone, into which decontaminated victims enter. As the victims enter this area, a more thorough triage is performed (including evaluation for secondary injuries), and victims are directed to treatment areas based on the severity and nature of illness or injury. Personal protective equipment is maintained in this area in case the wind changes or victims arrive who have been improperly decontaminated (for further discussion, see chapter 9—Disaster Triage).

Triage in the Hospital Setting

- **Warm Zone**: This is an area that is adjacent to the hospital (usually the emergency department) that has a source of water (in cold climates it must be a warm water source) for decontamination, and barriers to control entrance and exit from the area. The triage station is at the entrance to the warm zone decontamination area. All ambulance and walk-in cases must enter the facility after going through this triage station. Cases that are clearly not contaminated enter the emergency department, and those that require decontamination go through the warm zone decontamination area before exiting into the clean zone in the emergency department (or uncontaminated area).
- **Clean Zone**: This is the treatment area inside of the emergency department or hospital where newly
arriving patients and victims are sent after having
been triaged and decontaminated. Any staff or pa-
tients who have entered the warm zone must be de-
contaminated before entering the clean zone. Another
more thorough triage is performed in the clean zone
area.

In the hospital or at the scene of a mass chemical
contamination, nurses may be asked to accurately de-
cide which patients need care, in what order they should
receive care, and in situations of severely con-
strained resources, who should not receive care at all.
This is an extremely difficult scenario for the nurse
and will create personal emotional distress. This type
of disaster triage is best practiced in field exercises and
drills prior to participation in a real event (Veenema,
2003).

**DECONTAMINATION FOR CHEMICAL
WARFARE AGENTS**

Chemical warfare agents (CWAs) are a diverse group
of extremely hazardous materials. There are five major
classes of CWAs (Maniscalco & Christen, 2002):

- Nerve agents: tabun, sarin, soman, GF, and VX
- Vesicants: sulfur mustard and lewisite
- Pulmonary agents: phosgene and chlorine
- Riot control agents (tear gas): mace (CN), pepper
  spray, and CS.

Because of their toxic, explosive, and flammable proper-
ties, chemicals continue to be the weapons of choice for
terrorist attacks. As potential weapons of mass destruc-
tion with the capability of causing a catastrophic med-
ical disaster, CWAs easily may overwhelm any health
care system. Because victims exposed to CWAs are likely
to flee to the nearest hospital, nurses should be famil-
iliar with the various clinical presentations produced by
CWAs (see Table 26.1) and the principles and practices
of appropriate care (see Table 26.2). The onset of symp-
toms may not always be immediate; sometimes they
may be delayed by several hours, as is the case with
certain vesicants and pulmonary agents. Exposure to
these agents can cause serious injury and death (for
further discussion, see chapter 25—Chemical Agents of
Concern). Thus, rapid detection of the chemical is crit-
ical to the protection of first responders and emergency
medical personnel, as well as to the effective treatment
of victims (Brennan, Waeckerle, Sharp, & Lillibridge,
1999).

**PERSONAL PROTECTIVE EQUIPMENT**

The first consideration for decontamination should al-
ways be staff safety. Emergency departments that are
part of an emergency response plan for hazardous ma-
terials incidents must meet OSHA requirements (OSHA,
1995) for both staff training and response to hazardous
materials, because they likely will be presented with
a chemically exposed patient who has not been de-
contaminated at the scene. Under these regulations,
emergency personnel who may decontaminate victims
exposed to a hazardous substance should be trained
at a minimum to the first-responder operational level.
Staff require the appropriate level of personal protec-
tive equipment (PPE), and must know how to properly
use it. PPE is the clothing and respiratory gear designed
specifically to protect the health care provider while he
or she is caring for a contaminated patient. OSHA (1989)

---

**Table 26.1 Chemical Warfare Agents and Descriptions and Examples**

<table>
<thead>
<tr>
<th>AGENT CATEGORY</th>
<th>BRIEF DESCRIPTION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve Agents</td>
<td>The most toxic of the known chemical warfare agents, nerve agents inhibit the body's normal functions.</td>
<td>Sarin</td>
</tr>
<tr>
<td>Vesicants</td>
<td>Chemical agents that cause blisters or sores.</td>
<td>Mustard gas</td>
</tr>
<tr>
<td>Tissue (Blood) Agents</td>
<td>Tissue (blood) agents cause chemical asphyxiation by preventing body tissues from utilizing oxygen.</td>
<td>Cyanide</td>
</tr>
<tr>
<td>Pulmonary Agents</td>
<td>Chemicals that cause severe irritation or swelling of the respiratory tract.</td>
<td>Chlorine</td>
</tr>
<tr>
<td>Riot Control Agents</td>
<td>Chemical compounds that temporarily inhibit a person's ability to function by causing irritation to the eyes, mouth, throat, lungs, and skin (i.e., tear gas).</td>
<td>Chlorobenzyliden-emalonitrile</td>
</tr>
</tbody>
</table>
26.2 Chemical Warfare Agents, Physiological Effects, and Antidotes or First Treatments

<table>
<thead>
<tr>
<th>TYPE OF AGENT</th>
<th>PHYSIOLOGICAL EFFECT</th>
<th>ANTIDOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve agents</td>
<td>Inhibit the activation of acetylcholinesterase (AChE), which results in accumulation of neurotransmitters, and results in overstimulation of exocrine glands, skeletal and smooth muscles, and the central nervous system.</td>
<td>Atropine, Protopam (2-PAMCl), Diazepam (for prolonged convulsions)</td>
</tr>
<tr>
<td>Tissue (Blood) agents (Cyanide)</td>
<td>Binds with cytochrome oxidase at the cellular level, inhibiting aerobic metabolism. Results in tissue hypoxia.</td>
<td>Amyl nitrite (perle), Sodium nitrite, Sodium thiosulfate (Pasadena Cyanide Kit contains both sodium nitrite and sodium thiosulfate).</td>
</tr>
<tr>
<td>Vesicants</td>
<td>Tissue damage from alkylation of DNA or modification of other cellular macromolecules. Results in vesicles and blisters.</td>
<td>Decontamination with soap and water or 5% solution of bleach and water. British-Anti-Lewisite (BAL) for Lewisite.</td>
</tr>
<tr>
<td>Pulmonary agents</td>
<td>Cellular damage to the pulmonary capillaries and alveoli causing leakage of fluids into the alveolus and resulting in pulmonary edema.</td>
<td>No known antidote. Must provide oxygen and absolute rest.</td>
</tr>
<tr>
<td>Riot control agents</td>
<td>Local irritants.</td>
<td>Decontamination with soap and water (which may initially increase burning sensation) or a solution of 6% sodium bicarbonate, 3% sodium carbonate and 1% benzalkonium chloride.</td>
</tr>
</tbody>
</table>

Source: Stokes, Gilbert-Palmer, Skorga, Young, & Persell, 2004

has identified the following four classes of personal protective clothing:

■ Level A provides the highest level of skin, respiratory, eye, and mucus membrane protection. Equipment includes a fully encapsulated water- and vapor-proof suit, boots, gloves, and hardhat, which contains a self-contained breathing apparatus (SCBA). The suit should contain a cooling and communication system.

■ Level B is used when the highest level of respiratory protection is required, but skin and eye protection will suffice with splash resistant gear. The equipment includes SCBA and splash resistant clothing, hood, gloves, hardhat, boots, booties, and two-way communication and cooling system.

■ Level C provides the same skin and eye protection as level B, but uses an air-purifying respirator (rather than a SCBA). Level C gear is to be used only when the chemical contaminant is known and the criteria for use of an air-purifying respirator are met (Dickens, 2002).

■ Level D provides standard work protection from splashes and no respiratory and minimal skin protection is required. The gear includes cover clothing, safety glasses, gloves, and face shield.

The higher the level of PPE, the higher the degree of protection for the health care provider; however, there is a higher level of burden that is due to weight, bulk, and the heat factor. Wearing PPE may present various problems for the nurse depending on the environment, the level of PPE that is required, and the duration that the PPE will be worn. Nurses should be prepared to expect any of the following conditions while wearing PPE:

■ Extreme heat
■ Poor ventilation
■ Lack of peripheral vision because of the goggles or head gear
■ Inhibited sense of touch because of the gloves
■ Claustrophobia
■ Heavy weight
■ Fatigue
■ Difficulty in communications

In the hospital setting, the safety officer will determine the level of PPE to be used. It is important to select the correct level of PPE. The minimum protective equipment required by OSHA regulations for nurses caring for
patients contaminated with an unknown substance include chemical-resistant suits that guard against splash exposures and positive-pressure full-faced respirators (OSHA, 2002a, 2002b). Using this equipment requires specialized training; therefore, nurses must have appropriate training prior to being asked to participate in a response effort (CDC/NIOSH, 2005). Nursing skills may have to be adapted while wearing PPE. Participating in classroom instruction taught by HAZMAT experts and practice exercises involving donning and working in PPE will allow the nurse to become comfortable with the decontamination process.

The following cautions should be used when wearing PPE:

- Ensure proper fit of PPE. If PPE does not fit properly, it will not be effective.
- Do not use respirators in a flammable or explosive atmosphere.
- Keep batteries/battery packs away from heat and flame.
- Know the proper procedure for donning and removing PPE.

It is important to determine if your hospital or agency has enough PPE in the event of a disaster for all its nurses and if any mitigation plans are in place in the event of an equipment shortage. Ensuring that hospitals have adequate resources and training to mount an effective decontamination response in a rapid manner is essential (Levitin et al., 2003). Nurses need to know that there is enough PPE, where it is located, how to put it on, and what their role is during decontamination. It is critically important that nurses know they are safe in order to function effectively during decontamination procedures. This also affects their willingness to come to work. A process to notify decontamination personnel needs to be in place to allow members to assemble and don proper PPE when the hospital is notified of an impending arrival of contaminated patients.

**RESPIRATORS**

In the event of deployment of chemical weapons, emergency care providers will be at serious risk of exposure, and special respirators may be needed for additional protection. There are several types of respirators, each providing a different level of protection.

- Full Facepiece Air Purifying Respirators (APR)
- Full Facepiece Air Purifying Respirators (APR) Retrofit
- Powered Air Purifying Respirators (PAPR)
- Self-Contained Breathing Apparatus (SCBA)

Respirators protect the user in two basic ways. The first is by the removal of contaminants from the air. Respirators of this type include particulate respirators that filter out airborne particles and gas masks that filter out chemicals and gases. Other respirators protect by supplying clean respirable air from another source. Respirators that fall into this category include airline respirators that use compressed air from a remote source and self-contained breathing apparatus (SCBA) that include their own air supply.

The National Institute for Occupational Safety and Health (NIOSH) issues recommendations for respirator use. Industrial type approvals are in accordance with the federal respiratory regulations (24 CFR Part 84). Development of respirator standards is in concert with various partners from government and industry. NIOSH states that respirators should only be used as a last line of defense when engineering control systems are not feasible. Engineering control systems, such as adequate ventilation or scrubbing of contaminants, should be used to avoid the need for respirators.

At the time of printing of this book, the NIOSH along with the U.S. Army Soldier and Biological Chemical Command (SBCCOM), and the National Institute for Standards and Technology (NIST) were continuing their efforts to develop the standards for all classes of PPE respirators for chemical, biological, radiological, and nuclear inhalation exposures. The reader is cautioned that the science in this field is rapidly evolving, and it is essential that nursing professionals refer to reliable, established sources frequently to stay abreast of current changes. Up-to-date information may be obtained from the Centers for Disease Control and Prevention at: http://www.cdc.gov/niosh/npptl/respsdpd.html.

**PATIENT DECONTAMINATION**

Decontamination is the process of removing or neutralizing a hazard from the environment, property, or life form (Farmer, Jiminez, Rubinsoin, & Talmor, 2004). The goals of decontamination are to reduce or remove the hazardous agent while maintaining staff safety, and to prevent further contamination of the environment. For victims, the goal is to prevent further harm and to enhance the potential for a full clinical recovery from the exposure. Decontamination needs to be accomplished as quickly as possible. For most chemical agents, there is a direct relationship between contact time and effect; therefore, physical removal is of the highest priority. Optimal decontamination requires identification and knowledge of the hazardous material, but decontamination can occur without this exact knowledge.
26.3 Decontamination Methods

<table>
<thead>
<tr>
<th>METHOD</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| Physical removal           | ■ Remove clothing—Clothing removal is decontamination—encourage victims to remove clothing at least to their undergarments.  
                            | ■ Flush with water or aqueous solutions.                                    
                            | ■ Absorb contaminating agent with absorbent materials (e.g., rub with flour followed by wet tissues or use military M291 resin kits for spot decontamination of skin only).  
                            | ■ Scrape bulk agent with a wooden stick (e.g., tongue depressor/popsicle stick). |
| Chemical deactivation      | ■ Water/soap wash: Chemical warfare agents have a generally low solubility and slow rate of diffusion in both fresh water and seawater. Therefore, the major effect of water and water combined with soap (especially alkaline soaps) is via a slow breakdown of the compound (i.e., hydrolysis) or through dilution of the agent and the mechanical force of the wash. When other chemical deactivation means are not available, washing with water or soap and water is a good alternative.  
                            | ■ Chemical solutions: In the event of an emergency you may be directed to perform decontamination with other chemical deactivation agents. These vary depending on the chemical warfare agent and may include alkaline solutions of hypochlorite. |
| Hydrolyzing agents         | ■ Alkaline hypochlorite is effective for hydrolyzing VX and G agents.       |

The four basic methods for decontamination are (Hurst, 1997)

- **Physical removal**—Flushing with water or aqueous solutions. This method is highly effective and significantly dilutes or reduces the amount of chemical agent on the skin or mucus membrane. For absorbent materials: Rub with flour followed by wet tissues. This is suggested for emergency situations where water flushing is not available. M291 Resin: Used by the military; wallet-sized packets with resin-impregnated pads used for individual decontamination.
- **Chemical methods**—Water/soap wash: This is the most likely method to be used in the hospital setting. The chemical agent is removed via mechanical force as well as hydrolysis.
- **Oxidation**—Hypochlorite solutions are considered to be universally effective for removing the organophosphates and mustard agents.
- **Hydrolysis**—Hydrolyzing agents: Alkaline hypochlorite is effective for hydrolyzing VX and G agents (for further information, see Table 26.3).

**PATIENT DECONTAMINATION IN THE FIELD**

Ideally, a hazardous materials team at the scene will be able to provide assistance regarding the specifics of the exposure and the potential treatment. A local poison control center also may be able to provide assistance.

The Chemical Manufacturers Association provides 24-hour assistance in the specifics of treating a particular chemical exposure; it can be reached at (800) 424-9300. The Domestic Preparedness Chem/Bio Helpline can be reached at (410) 436-4484. Online information is available at the Centers for Disease Control and Prevention Web site at www.cdc.gov/.

**PATIENT DECONTAMINATION IN THE EMERGENCY DEPARTMENT**

When a patient presents to the ED, the nurse must ascertain that an exposure has taken place. Nurses should suspect chemical exposures for any mass casualty incident in which multiple ill persons with similar clinical complaints (point-source exposure) seek treatment at about the same time or in persons who are exposed to common ventilation systems or unusual patterns of death or illness. The ED may or may not receive notification in advance that a chemical explosion or leak has occurred. In either case, ED health care providers have the following three primary goals in treating a patient who has been exposed to a hazardous material and may be contaminated or who has not undergone adequate decontamination before arrival at the hospital:

1. Isolate the chemical contamination.
2. Appropriately decontaminate and treat the patient(s) while protecting hospital staff, other patients, and visitors.
3. Reestablish normal service as quickly as possible.
Chapter 26  Mass Casualty Decontamination

26.4 Hospital Decontamination Work Zones

<table>
<thead>
<tr>
<th>ZONE</th>
<th>LOCATION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot</td>
<td>Contamination site (prehospital)</td>
<td>Contaminated area where the release occurred. See earlier discussion of on-scene decontamination.</td>
</tr>
<tr>
<td>Warm/Dirty</td>
<td>Adjacent to the hospital, usually near the Emergency Department (remote to the release site)</td>
<td>Hospital decontamination area. This area needs a source of water (cold climates require a warm water source) for decontamination and barriers to control entrance and exit from the area, which must be tightly controlled. Personnel working in this area (first receivers) have potential to be exposed to the contaminant(s) and, therefore, must wear the appropriate level of PPE (level C minimum). At the entrance to the Warm Zone is the initial triage station. All ambulance and walk-in cases must enter the facility after going through this triage station. Victims who are clearly not contaminated skip the Warm Zone and enter the Cold (Clean) Zone directly. All others proceed into the Warm Zone for decontamination.</td>
</tr>
<tr>
<td>Cold/Clean</td>
<td>Hospital treatment area, often the Emergency Department</td>
<td>Uncontaminated hospital treatment area (postdecontamination). Because no agent exposure is expected in this area, in most cases only Standard (Universal) Precautions are needed for health care workers. This area needs to be tightly controlled so that only patients who have been triaged and decontaminated are allowed entry. Any potentially contaminated victims, clothing, PPE, and/or equipment should not be permitted entrance to this zone. Another more thorough triage is performed in the Cold (Clean) Zone before treatment is begun based on the nature and acuity of signs and symptoms.</td>
</tr>
</tbody>
</table>

Health care providers caring for the patient should put on the appropriate PPE prior to coming into contact with contaminated patients. In most instances, this is Level B PPE.

Ideally, decontamination occurs outside the hospital by EMS providers (Johnson, 1997). If this does not occur, prepare a decontamination area for the patient. If possible, the ideal location is outdoors (see Table 26.4). If indoor decontamination is necessary, a decontamination room is the next ideal location. Indoor decontamination should occur only in cases in which a controlled indoor environment may be maintained safely.

Control volatilization of the chemical to prevent displacement of ambient room oxygen, prevent combustion, and to prevent levels of the chemical from reaching air concentrations deemed immediately dangerous to life or health for that specific hazard. In order to monitor this hazard effectively, the hospital requires testing equipment capable of identifying the chemical, its ambient air concentration, and ambient room oxygen concentrations. If such a room is not available, try to isolate the patient in a single large room after removing nonessential and nondisposable equipment. Ideally, this room should be away from other patient care areas. Maintain ventilation to the area in which the patient is located, but be wary of further contaminating the hospital with recycled ventilation.

Establish a secure zone with yellow tape and permit only appropriately protected individuals to enter as needed. Include in the secure zone any area the patient may have contaminated while entering the ED.

On arrival of the patient, determine whether the patient requires any immediate life-saving interventions. If these are required, stabilize the patient before or during decontamination.

DECONTAMINATION PROCEDURES

The basic preparation steps in patient decontamination include the following:

- Get information. Identify the agent (if possible).
- Determine the level of PPE required.
- Mobilize security personnel and trained triage and decontamination staff.
- Control access to the decontamination site as well as to the hospital.
- Prepare decontamination area (warm zone should be outside of the facility).
Decontamination Supplies and Equipment

**Table 26.5** Baseline Items Needed for Decontamination

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Containment equipment</td>
<td>Safe environment for decontamination</td>
</tr>
<tr>
<td>Pool or tank</td>
<td>Clean area for washing and cooling</td>
</tr>
<tr>
<td>Tarp</td>
<td>Protection from contamination</td>
</tr>
<tr>
<td>6-mil construction plastic</td>
<td>Strong material for covering surfaces</td>
</tr>
<tr>
<td>Fiberglass backboards</td>
<td>Support for patients during decontamination</td>
</tr>
<tr>
<td>Supports for ambulatory patients</td>
<td>Assist patients during decontamination</td>
</tr>
<tr>
<td>Sawhorses to support backboards</td>
<td>Additional support for backboards</td>
</tr>
<tr>
<td>Water supply</td>
<td>Necessary for washing and rinsing</td>
</tr>
<tr>
<td>Scissors for clothing removal</td>
<td>Remove clothing during decontamination</td>
</tr>
<tr>
<td>Mild detergent (dishwashing liquid)</td>
<td>A gentle detergent for cleaning clothing</td>
</tr>
<tr>
<td>5-gallon buckets</td>
<td>Large containers for holding liquids</td>
</tr>
<tr>
<td>Sponges and soft brushes</td>
<td>Soft materials for cleaning clothing</td>
</tr>
<tr>
<td>Towels and blankets/sheets</td>
<td>Additional materials for cleaning clothing</td>
</tr>
<tr>
<td>Triage tags</td>
<td>Mark patients during decontamination</td>
</tr>
<tr>
<td>Disposable clothes and shoes for ambulatory patients</td>
<td>Provide clean clothes for patients</td>
</tr>
<tr>
<td>Large plastic bags for contaminated clothing</td>
<td>Protect contaminated clothing from further contamination</td>
</tr>
<tr>
<td>Waterproof pens to mark bags</td>
<td>Label bags and mark patients</td>
</tr>
<tr>
<td>Clear, zip-front body suits or large water repellant blankets</td>
<td>Minimize contamination transport personnel and ambulances</td>
</tr>
<tr>
<td>Duct Tape (4-inch)</td>
<td>Seal connections and prevent contamination</td>
</tr>
<tr>
<td>Gathere decontamination supplies and equipment (see Table 26.5).</td>
<td>Decontamination supplies and equipment materials.</td>
</tr>
<tr>
<td>Downwind of clean area, not located near facility air intake.</td>
<td>Air intake protection.</td>
</tr>
<tr>
<td>Area for decontamination triage: those with most severe signs or symptoms are triaged first.</td>
<td>Triage patients with more severe conditions first.</td>
</tr>
<tr>
<td>Receptacles for contaminated clothing, valuables, and contaminated supplies.</td>
<td>Hold contaminated items.</td>
</tr>
<tr>
<td>Source of water (warm in cold climate areas), soap, and towels.</td>
<td>Water supply for decontamination.</td>
</tr>
<tr>
<td>Tape to demarcate dirty and clean side</td>
<td>Mark areas for decontamination and cleaning</td>
</tr>
<tr>
<td>Screens for privacy or segregation by gender (if possible).</td>
<td>Privacy and segregation.</td>
</tr>
<tr>
<td>Collection system for runoff water.</td>
<td>Collect runoff water for proper disposal.</td>
</tr>
<tr>
<td>Chemical agent monitor supplies (CAM).</td>
<td>Monitor agents for contamination.</td>
</tr>
</tbody>
</table>

**Victim Decontamination**

- **Having the patient perform as much of the decontamination as possible is preferable to decrease the amount of cross-contamination.**
- **Remove all clothing** (this will remove 80–90% of the contaminants).
- **Place all clothing and valuables in a bag**. Place these individual bags in a larger collection container, taking care to not touch the outside of the container.
- **Wet skin and wash down with soap and water**. Attention needs to be given to hair, face, hands, and other areas that were exposed and not covered by clothing. Avoid vigorous scrubbing to prevent skin breakdown. Wash for 5 to 10 minutes and rinse.
- **Decontaminate open wounds by irrigation with saline or water for an additional 5 to 10 minutes.**
- **Try to avoid contaminating unexposed skin on the patient.** Use surgical drapes if necessary.
- **Flush exposed areas with soap and water for 10 to 15 minutes with gentle sponging.**
- **Irrigate exposed eyes with saline for 10 to 15 minutes, except in alkali exposures, which require 30 to 60 minutes of irrigation.**
- **Clean under fingernails with a scrub brush.**
- **Check for presence of agent using CAM or M-8 paper, and if positive decontaminate again.**
- **Relocate to clean area, don dry clothing.**
- **Ideally, collect runoff water in steel drums if possible.**
- **IV setups and solutions can be left in during decontamination, but should be replaced as soon as possible with new, clean set-ups.**
- **Endotracheal tubes can remain in place during decontamination, but should be replaced as soon as possible with a new, clean tube.**

For more detailed information, see Tables 26.6 and 26.7.

During the decontamination procedure, the victims must be monitored for signs of decompensation, and staff must be monitored for signs of exhaustion. Antidotes may need to be administered during decontamination procedures, and previous ambulatory individuals may have to have their decontamination on a gurney (see Table 26.8).

**Pediatric Considerations**

Children presenting to the emergency department needing decontamination require special consideration. When dealing with children in a disaster situation, nurses must not only work to identify, triage, and
decontaminate a potentially large number of children, they also must take special precautions to ensure that the emotional and psychological trauma experienced by the children is minimized (Mueller, 2006). Children lack the cognitive ability to make clear and rational decisions and are likely to refuse to follow directions. Children are unpredictable and are unable to fully understand the event as it is occurring. They will become distressed when separated from their parents and health care providers dressed in PPE will appear threatening to young victims. Adolescents may be reluctant to undress for decontamination. Infants and small children will need to be held throughout the decontamination process and will be extremely fearful. Special considerations should include the following:

- Allow children and parents (or other adults known to them) to remain together.
- Constantly reassure and offer compassion to a child if the child is separated from his or her parent(s)—children will be fearful.
- Attempt to reunite children with their parents if they were separated during the course of the disaster.
- Take time to inform and reassure older children of the current situation.
- Prevent children from developing hypothermia.
- Use a water temperature of 100°F.
- Wash/shower for 5 minutes.
- Use great caution—wet infants are slippery.

The Children’s Hospital of Boston, in conjunction with Dr. Michael Shannon, Chief, Division of Emergency Medicine, has developed an instructional video entitled “The Decontamination of Children” to teach individuals who will need to care for children contaminated with chemicals. This valuable teaching and learning resource can be obtained by contacting: AHRQ Publications Clearinghouse; (800) 358-9295; ahrqpubs@ahrq.gov/. For further discussion, see chapter 15—Unique Needs of Children During Disasters and Other Public Health Emergencies.

### EVACUATION OF THE EMERGENCY DEPARTMENT

Decontamination helps protect nurses and other health care providers and maintains the viability of the ED as a treatment center. Mismanagement of the process
Individual Nonambulatory Patient Decontamination

Procedures for Nonambulatory Decontamination

- Apply C-collar immediately if a cervical spine injury is suspected.
- Place plastic sheet on cart, cover with sheet, place victim on sheet.
- Remove all clothing and place in plastic bag and label the bag.
- Place valuables in small plastic bag and label properly.
- Brush or wipe off particulate matter.
- Rinse patient gently using hand-held sprayer; begin with face and airway, then open wounds (cover patient’s mouth and pinch nose when washing face).
- Ensure axilla, genitalia, and the back are rinsed.
- Use non-rebreather mask or bag-valve-mask to protect airway.
- Wash from head to toe using tepid, not hot, water and soap five (5) minutes when agent is non-persistent and eight (8) minutes when a persistent or unknown agent.
- Wash and rinse creases such as ears, eyes, axilla, groin; rinse for about 1 minute; roll patient to side if needed.
- Wash around IV site(s) and IV setup. Replace IV once out of decontamination.
- Thoroughly dry patient and cover with a blanket.
- Soap, brushes, sponges and other equipment used for decontamination should be placed in a trashcan and not carried into the Support Zone (on-scene) or the Cold (Clean) Zone (hospital setting).
- Open wounds should be covered with dressings after decontamination is complete.
- Transfer patient to clean backboard and exit into Cold Zone for rapid assessment, triage, and assignment to a treatment area.

SUPPORTIVE MEDICAL AND NURSING CARE

Saving lives always depends on ensuring the ABCs: adequate airway, breathing, and circulation. The care of patients who have experienced chemical contamination is nursing intensive. These patients may require 1-to-1 staffing ratios, an impossibility during a mass casualty event. Greater contamination or exposure more likely results in victims who require early intubation and ventilation (having an adequate supply of ventilators and respiratory therapists available in the ED is an important component of planning.) Conversely, adequate ventilation may be impossible because of the intense muscarinic effects of certain nerve gas exposures (copious airway secretions, bronchoconstriction). In this situation, administer atropine before initiating other measures. In some patients, large quantities of atropine may be required, rapidly depleting hospital supplies. Administering succinylcholine to assist intubation is relatively contraindicated because nerve agents prolong the drug’s paralytic effects.

SEIZURES

Victims of certain chemical exposures will experience seizure activity. Patients must be protected from harm. Benzodiazepines are the mainstays in seizure treatment. Liberal doses are required, titrate to effect. Termination of seizure activity may reflect onset of flaccid paralysis from the nerve agent rather than adequacy of anticonvulsant therapy. A bedside electroencephalograph (EEG) may be required to assess ongoing seizure activity.

STATE OF THE SCIENCE

The past 5 years have seen a visible shift in disaster preparedness efforts toward mass casualty incidents involving chemicals. Emergency responders, health care workers, emergency managers, and public health officials are being tasked to improve their readiness by acquiring equipment, providing training, and implementing policy, especially in the area of mass casualty decontamination. Accomplishing each of these tasks requires good scientific data, and rational prioritization of individuals’ needs in the decontamination process (Tables 26.9 and 26.10). Management of the incident scene

may result in illness in health care providers and contamination of the ED, and severe ED contamination may necessitate departmental closure, which is potentially catastrophic in a mass casualty incident. Evacuation of the ED rarely is indicated, however, it remains a possibility. In most situations, isolation of the contamination is all that is required.

Nurses should contact the Chief Nurse Executive or hospital administrator-on-call and consider evacuation of the ED in the following situations:

- Toxic material spills in the ED.
- Nearby hazardous materials are threatening the hospital.
- A patient is contaminated with a volatile toxic or flammable chemical and is decontaminated insufficiently prior to entering the ED.

If symptoms start to occur outside of the isolation area or the situation requires urgent decision making without time to identify the contaminant, consider evacuation. Odor does not predict toxicity reliably.
26.9 Ambulatory Patient Decontamination Prioritization

<table>
<thead>
<tr>
<th>DECONTAMINATION PRIORITY</th>
<th>AMBULATORY PATIENT CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First priority:</td>
<td>■ Closest to point of release.</td>
</tr>
<tr>
<td>Direct to Warm Zone for immediate decontamination</td>
<td>■ Report of exposure to an aerosol/mist or known liquid agent contamination.</td>
</tr>
<tr>
<td>Second priority</td>
<td>■ Not as close to point of release.</td>
</tr>
<tr>
<td></td>
<td>■ May or may not have known liquid agent contamination but are clinically symptomatic (moderate to minimal signs/symptoms).</td>
</tr>
<tr>
<td>Third priority</td>
<td>■ Suffering from conventional injuries (e.g., open wounds).</td>
</tr>
<tr>
<td>Lowest priority:</td>
<td>■ Far from point of release.</td>
</tr>
<tr>
<td>Direct to ambulatory assembly area in the Warm Zone for further review</td>
<td>■ No known/suspected exposure to liquid, aerosol, or vapor.</td>
</tr>
<tr>
<td></td>
<td>■ Minimal or no signs/symptoms.</td>
</tr>
</tbody>
</table>

26.10 Nonambulatory Patient Decontamination Prioritization and Relation to START Triage System

<table>
<thead>
<tr>
<th>START CATEGORY</th>
<th>DECON PRIORITY</th>
<th>START MEDICAL CRITERIA</th>
<th>CONTAMINATION CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED (Critical)</td>
<td>1</td>
<td>Respiration present only after repositioning airway. RPM:</td>
<td>■ Closest to point of release.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Respiration:</td>
<td>■ Serious signs and symptoms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Respiratory rate &gt; 30</td>
<td>■ Known liquid agent contamination or severe exposure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Perfusion:</td>
<td>■ Capillary refill &gt; 2 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Mental Status:</td>
<td>■ Unable to obey commands</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ Closest to point of release.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ Moderate to minimal signs/symptoms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ Known/suspected liquid agent contamination or known aerosol contamination Second priority.</td>
</tr>
<tr>
<td>YELLOW (Urgent)</td>
<td>2</td>
<td>Injuries treatable or controllable on-scene for a limited time. RPM:</td>
<td>■ Closest to point of release.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Respiration:</td>
<td>■ Moderate to minimal signs/symptoms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Respiratory rate &lt; 30</td>
<td>■ Known/suspected liquid agent contamination or known aerosol contamination Second priority.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Perfusion:</td>
<td>■ Capillary refill &lt; 2 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Mental Status:</td>
<td>■ Able to obey commands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ Minimal signs/symptoms.</td>
</tr>
<tr>
<td>GREEN (Delayed)</td>
<td>3</td>
<td>Ambulatory.</td>
<td>■ Severe signs/symptoms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injuries do not require immediate treatment.</td>
<td>■ Grossly contaminated with liquid nerve agent.</td>
</tr>
<tr>
<td>BLACK (Expectant: Dead or non-salvageable)</td>
<td>4</td>
<td>Respiratory arrest, even after attempt to reposition the airway.</td>
<td>■ Unresponsive to Atropine injections.</td>
</tr>
</tbody>
</table>

and the approach to victim care varies throughout the world and is based more on dogma than scientific information (Levitin et al., 2003). Future research initiatives should attempt to identify best practices in mass casualty decontamination.

SUMMARY
Hazardous chemical incidents create unique challenges for nurses. A large-scale chemical release with mass casualties will create a significant burden and may quickly
516 Part IV Disasters Caused by Chemical, Biological, and Radiological Agents

overwhelm the existing health care system. Special conditions triage must be employed to appropriately sort victims of the exposure. Decontamination must be available and provided quickly to patients involved in chemical and other hazardous materials incidents. Decontamination must reduce or remove the chemical agent while protecting the safety of the staff and preventing further contamination of the environment. Hospitals in the United States must be prepared to handle large numbers of casualties requiring triage and decontamination. Above all, safety is of the utmost priority during disaster response. Proper equipment, clearly written policies and procedures, and staff training are required to ensure a safe environment for the staff as well as the patients during disaster triage and decontamination. All nurses should be (at a minimum) aware of the basics regarding mass triage techniques and decontamination procedures.

STUDY QUESTIONS

1. During triage for mass casualty chemical incidents, what are the differences in the triage activities in the hot, warm, and cold zones?
2. What are the five major classes of chemical warfare agents? Can you describe their basic physiological effects?
3. Describe the primary goals of decontamination.
4. A 32-year-old worker at a large photochemical plant presents to the Emergency Department following a hot, warm, and cold zones?
5. Why is staff safety such an important factor for the disaster manager during response to a chemical incident?
6. You are the triage nurse in the emergency department on a hot and windy Saturday afternoon. Two women present to the ED with complaints of cough, runny eyes, headache, and report smelling a foul odor. Ten minutes later, three more people arrive with the same complaint. Five minutes later, eight more patients present to the ED with a similar story. Identify how you would manage this situation.
7. What level of personal protective equipment is needed by the nurse caring for a victim of a chemical contamination of an unknown agent?

REFERENCES


CASE STUDY

26.1 Chemical Decontamination System at the Center for Emergency Medical Services, North Shore–Long Island Jewish Health System (NSLIJHS)

Brian O’Neill, EMT-P, System Director and James Romagnoli, Deputy Director, Emergency Services

NSLIJHS is an 18-hospital integrated health network that spans the Long Island and New York City system. The NSLIJHS decided to link all of its facilities into one disaster response network. Through the collaboration of all partners in the network, a standard disaster plan template was developed, and each facility uses the same table of contents, but may have different methods for operations for some facilities. In addition, disaster response job action sheets have been designed for each functional disaster response role and are consistent across the system. This facilitates sharing of staff during times of disaster response, as the functional roles are the same, regardless of the facility. The NSLIJHS utilizes what they have termed their Network Emergency Incident Command Structure (NEICS) for all disaster responses. There is one centralized Emergency Operations Center (EOC) that provides communication services and resource inventory analysis and dispatch across the network. Resources include personnel, supplies, and equipment. All HAZMAT incidents automatically trigger activation of the NEICS.

Recognizing the threat posed by chemical incidents, the NSLIJHS decided that key staff in each facility would receive chemical HAZMAT response training. All security, engineering, environmental, safety officer, and emergency department staff underwent initial HAZMAT training and receive an annual update. This training is extensive and includes recognition, notification, containment, facility setup, and decontamination procedures, including the proper use of personal protective equipment (PPE). In the NSLIJHS network, the emergency department nursing staff is empowered to recognize and activate the NEICS. The first employee in the emergency department to suspect a chemical or HAZMAT patient immediately sequesters the patient, and then contacts the charge nurse via pager or radio. She or he immediately evaluates the situation and makes a judgment regarding the presence of a HAZMAT incident. If the suspicion is positive, the NEICS is activated and the decontamination plan is implemented.

Strategically located throughout the NSLIJHS are large inflatable decontamination tents. The plan includes a mechanism for delivery of strategic supplies and equipment to any facility within the system, utilizing its emergency response fleet and specially trained personnel. Each decontamination tent has the following features: climate control, apparatus to connect to a source of warm water, wastewater collection bladders, curtain tracks to create internal spaces for gurney and ambulatory decontamination areas, as well as male and female sections. A defined perimeter is set up to demarcate the dirty versus clean zones. All personnel don level B personnel protective equipment gear with the appropriate respirator with air filter canister. A grease board is set up to facilitate communication between the staff. As victims arrive, an entry triage officer, utilizing a look-see question method, determines whether decontamination is required, and if yes, determines ambulatory versus gurney method. Those who do not require decontamination do not enter the dirty area, but rather, are directed to the emergency department, whereas those requiring decontamination are directed to the entrance of the tent. If required, life-saving airway or hemorrhage control is initiated before decontamination (all other treatment is delayed until after decontamination). At the entrance to the tent, all victims have their clothing removed, which is then bagged, labeled, and placed in collection receptacles. Security personnel in PPE collect and place all valuables in labeled zippered bags, and this material is placed in a separate container. The name and functional role of each responder wearing PPE is written on tape and affixed to the back and front of each PPE suit. (This facilitates identification of staff and makes it easier to get an employee’s attention, as each is in the same type of garb and difficult to identify.) Safety Officers monitor each employee for the length of time in PPE and signs or symptoms of heat exhaustion or chemical contamination. Each employee has a Mark I antidote kit taped to his or her arm, for rapid accessibility and use if required.

In the NSLIJHS protocol, victim decontamination is accomplished with soap and water (for 10 minutes), whereas fomite (i.e., contaminated clothing) decontamination is performed with a 1:10 dilution of bleach and water. Ambulatory victims decontaminate themselves.
whereas those who are too ill are placed on a gurney and decontaminated by staff in PPE. After decontamination, victims are transferred to the clean transfer zone, provided with new clothing, receive a more thorough triage for medical/surgical/psychological problems, and are directed to the appropriate area in the emergency department for evaluation and treatment.

The NSLIJHS illustrates a system that considers disaster preparedness to be important, places employee safety as a top priority, and has used the advantages of economies of scale to provide access to high-tech resources for its entire network. The NSLIJHS frequently tests its HAZMAT response system and has used it successfully for decontamination of victims of industrial accidents. Nursing clearly plays a key role in this model system.

Although not all hospitals are parts of large networks, facilities in adjacent communities should give thought to developing a similar cooperative system to achieve the same economies of scale and assurance of resources where and when required for effective, safe hazardous material decontamination.
Key Messages

- Radiation is a part of our natural environment.
- In large doses, radiation can cause a number of syndromes, including death.
- In small doses, radiation is more likely to cause cancer later in life.
- Radioactively contaminated patients (such as following a terrorist attack) pose relatively little risk to health care staff.
- Contamination control measures when working with contaminated patients will help limit the spread of radioactive contamination to medical facilities.

Learning Objectives

When this chapter is completed, readers will be able to

1. Distinguish between radiation and radioactive contamination.
2. Describe the three basic types of radiation.
3. Recognize common types of radiological incidents and emergencies.
4. Describe the clinical signs of radiation exposure.
5. Understand the importance of treating significant medical problems in patients with radioactive contamination.
6. Explain basic radiological control methods.
Radiological Incidents and Emergencies
Andrew Karam

CHAPTER OVERVIEW

Medical and nursing personnel may be called on to care for patients who have been exposed to high levels of radiation or who have been contaminated with radioactive materials. Some of these patients may be gravely ill with radiation sickness or may have radiation burns, whereas others may have no radiological medical problems other than minor skin contamination. It is essential that nurses and other medical and nursing personnel be able to recognize radiation injury and provide appropriate treatment. It is also essential that medical and nursing personnel understand that patients who are merely contaminated may be treated without risk of radiation injury to the medical staff, although contamination control measures may be prudent if the medical condition permits.

Radiation and radioactivity are used throughout society, and it is possible that, at some point, medical staff will have to deal with patients who are contaminated with radioactivity or who have been exposed to possibly damaging levels of radiation. At the same time, there is a decided lack of knowledge among medical staff about the effects of radiation, how to recognize radiation injury, or how to treat patients involved in radiological incidents. This lack of knowledge has resulted in medical staff delaying or denying treatment to mildly contaminated patients, recommending therapeutic abortions that are not medically necessary, failing to recognize radiation injury, and more.

A radiological incident may be as dramatic as a terrorist attack or as mundane as mild skin contamination from a minor spill. Radiological incidents have resulted in death from radiation sickness, but the vast majority of cases simply require decontamination and monitoring. With a very few, specific exceptions, patients involved in radiological incidents pose absolutely no risk to medical staff, who must treat the patient’s medical conditions without regard to radiological risks. This chapter will address these and other issues.
RADIATION BASICS

The word radiation usually refers to ionizing radiation—radiation with enough energy to create ion pairs in matter. Ultraviolet light can do this, as can X-rays, gamma rays, and other kinds of radiation. Visible light is also radiation, but it is not energetic enough to cause ionizations, so it cannot normally cause problems. By comparison, ionizing radiation can damage our DNA, causing health effects in sufficiently high doses.

It is important to distinguish between radiation and radioactive contamination. Radiation is energy emitted by atoms that are unstable. Radiation travels through space to some extent—some kinds of radiation can only travel a few millimeters, whereas other types can travel many meters. Radioactive contamination is the presence of radiation-emitting substances (radioactive materials or RAM) in a place where it is not desired. A patient may be contaminated with radioactive materials, but that patient will not be inherently radioactive and can be decontaminated. Radioactive materials, by comparison, are inherently radioactive—it is a physical property of that material in the same manner as mass or size—and they remain radioactive until they decay to stability.

Types of Radiation

There are three basic kinds of radiation that medical staff can expect to see: alpha, beta, and gamma radiation. These have distinct properties that are summarized in the following:

Alpha Radiation

Emitted by heavy atoms, such as uranium, radium, radon, and plutonium (to name a few), alpha particles are helium nuclei, making them the most massive kind of radiation. Alpha radiation can cause a great deal of damage to the living cells it encounters, but has such a short range in tissue (only a few microns) that external alpha radiation cannot penetrate the dead cells of the epidermis to irradiate the living cells beneath. If inhaled, swallowed, or introduced into open wounds, however, alpha radiation can be very damaging. In nature, alpha radiation is found in rocks and soils as part of the minerals, in air as radon gas, and dissolved in water as radium, uranium, or radon. Alpha emitters are also found in nuclear power plants, nuclear weapons, some luminous paints (radium may be used for this), smoke detectors, and some consumer products. Objects and patients exposed to alpha radiation may become contaminated, but they do not become radioactive.

Beta Radiation

Beta particles are electrons and are both lighter than alpha particles and possess a lower electrical charge. This means that they are not nearly as damaging, although they will penetrate up to a centimeter into tissue. Beta particles will give radiation dose only to the skin, unless they are ingested or inhaled, or enter the body through open cuts or wounds. In nature, beta radiation is found as part of natural potassium, in rocks and soils, and in the atmosphere as naturally produced carbon 14 and tritium. Beta-emitting radioactive materials are used in research, some luminous paints, and for both diagnostic and therapeutic medical purposes. Objects and patients exposed to beta radiation may become contaminated, but they do not become radioactive.

Gamma Radiation

Gamma rays are energetic photons, similar to X-rays. Gamma radiation is much less damaging than alpha radiation and is about as damaging as beta radiation. Unlike alpha and beta radiation, gamma radiation will penetrate the whole body (as X-rays will), so it will deliver radiation doses to internal organs as well as to the skin. In nature, gamma radiation is ubiquitous and is found in outer space and on the surface of the Earth. Gamma radioactivity is found in rocks and soils, as well as in naturally radioactive isotopes of potassium found in foods and our own bodies. Gamma radiation is used for many research, industrial, and medical purposes. Objects and patients exposed to gamma radiation may become contaminated, but they do not become radioactive.

Units of Radiation Dose

Radiation can cause two main kinds of damage to our bodies. The energy deposited in cells by radiation can directly damage the cells, breaking chemical bonds and interfering with a cell’s ability to function properly or even killing the cell. If enough cells are incapacitated or killed in a short period of time, we will become sick or can die from this exposure. Exposure to relatively high doses of radiation in a short period of time (acute exposure) acts in this manner. The damage caused by acute radiation exposure is most strongly affected by the amount of energy that is absorbed by a cell. The unit that is used to measure the amount of energy deposition is the gray (Gy)—a unit of radiation absorbed dose that is equal to the deposition of 1 Joule of energy in 1 kilogram of material. The U.S. unit for absorbed dose is the rad, which results from the deposition of 100 ergs of energy per gram of absorber.

Radiation can also damage the DNA in a cell, ultimately leading to cancer years or decades later.
Exposure to relatively low doses of radiation over a long period of time (chronic exposure) acts in this manner: Some kinds of radiation, such as alpha radiation, cause higher levels of DNA damage than other kinds of radiation, so they are more effective at causing cancer. Such kinds of radiation have a high quality factor (also called relative biological effectiveness) because they cause more DNA damage and a higher risk of developing cancer, than do other radiations that deposit the same amount of energy in the body. In essence, the effective risk from exposure to these types of radiation is higher than we would guess if we only measured the amount of energy deposited in the body. The unit sievert (Sv) is used to measure the amount of biological damage (and the cancer risk) from exposure to radiation. The U.S. unit for effective dose is the rem.

Acute radiation exposure, which can cause radiation sickness, radiation burns, and so forth, is caused by the energy deposited in the body, and so we are looking for effects that will occur within hours, days, or weeks of the exposure. As cancer takes many years or decades to develop, quantifying the long-term effects of DNA damage resulting from an acute exposure is not as important. In the case of acute radiation exposure, then, we measure only the amount of energy deposited in the body, so we use units of Gy or rad.

When we are concerned about the long-term effects of radiation exposure, it is important to understand how much DNA damage is caused by the radiation, so the quality of the radiation must also be considered. Because of this, we measure radiation dose in units of Sv (or rem) when we are considering, for example, the risk that someone will develop cancer as a result of their radiation exposure. This is why regulations and radiation dosimeter reports use units of Sv or rem; they are concerned with protecting us against the risk of developing cancer several decades later in our lives.

In this chapter, we will follow this convention of using units of Gy and rad when we are concerned about the short-term risk of skin burns, radiation sickness, or fatal radiation injury that results from acute radiation exposure and using units of Sv and rem when we discuss the risk of developing cancer many years or decades after the radiation exposure, or when we are discussing compliance with radiation safety regulations.

Background Radiation Exposure

We are all exposed to radiation on a daily basis from both natural and man-made sources. Background radiation levels vary widely depending on altitude, local geology, and latitude, but average background radiation dose in the United States and Canada is about 360 mrem (mrem) annually. Of this, nearly 300 mrem is due to natural radiation and the remainder is from artificial sources (see Table 27.1).

There are trace amounts of radioactivity in rocks and soils, in our bodies, and in the air we breathe; and charged particles from the sun and our galaxy bombard our planet continually. This background radiation exposure is unavoidable, but our biochemistry is able to repair the resulting DNA damage. Each year, we are exposed to about 200 mrem from radon inhalation, 28 mrem from uranium, thorium, and potassium in rocks and soils, and 27 mrem from cosmic radiation. To this, we can add another 40 mrem annually from the 0.01% of potassium in our bodies that is naturally radioactive for a total of about 395 mrem/yr from natural radiation. In some places, such as Ramsar, Iran and Kerala, India, residents are exposed to radiation levels nearly 100 times as high, without apparent ill effects. (Radiation levels are higher because of variations in local geology and geochemistry.)

Man-made sources of radiation account for about 65 mrem/yr for U.S. residents. Exposure to medical radiation yields an average dose of 53 mrem/yr, although this varies considerably depending on a person’s actual medical history. Consumer products expose us to about 10 mrem/yr, and all other sources of man-made radiation contribute another 2 mrem/yr to our average radiation exposure. Artificial sources of radiation account for about 16% of total radiation exposure. Some of these consumer products are smoke detectors, certain types of ceramic materials, some static eliminators, and welding electrodes.

In all, we receive about 360 mrem/yr from background sources of radiation; a dose that varies considerably in both directions depending on local geology, elevation, and other factors. It is worth noting that, even in areas with exceptionally high levels of natural radiation, inhabitants do not appear to suffer from any ill effects. This suggests that occupational exposure to moderately elevated radiation levels is not harmful.

Health Effects of Radiation Exposure

Both patients and medical staff are understandably concerned about the health effects of exposure to radiation and radioactive contamination. There are two distinct types of radiation exposure, acute and chronic, and two primary exposure modes, radiation and radioactive contamination. Each exposure type and mode is slightly different and must be treated differently by medical staff (see Table 27.2). In addition, there are concerns about the reproductive effects of radiation exposure. In this section, these concerns will be discussed.
Acute Exposure to High Doses of Radiation

Exposing the whole body to very high levels of radiation in a short period of time can be harmful or fatal to the patient. Exposing parts of the whole body to very high radiation levels can also cause harm, but is usually not life threatening. Acute radiation injury has been noted in the survivors of the Japanese atomic bombings, among surviving Chernobyl workers, in the wake of nuclear criticality accidents, and among people who have found lost radioactive sources with high levels of activity. Acute radiation injury to limited parts of the body has also been noted in patients receiving excessive fluoroscopy, mineralogists misusing X-ray diffraction equipment, industrial employees using linear accelerators, and radiation oncology patients.

Sunburn is a mild form of acute exposure to radiation, but it serves as a starting point to acute radiation injury. At a skin dose of a few hundred rem, the patient will exhibit erythema and, at higher doses, blistering and peeling (dry and moist desquamation). Depending on the characteristics of the exposure, one side of the body may be more affected—typically the side facing the radiation source. Very high radiation doses to parts of the body will produce these same symptoms to limited parts of the body. The accompanying photos show the effects of radiation burns to the back (from a radiology procedure) and to the hands (from an industrial linear accelerator). Some patients may exhibit symptoms of both limited and whole-body radiation exposure. These are typically those who have come across abandoned radioactive sources and carry them home (see Case Study 27.1). Other effects of acute whole-body radiation exposure can include depilation, nausea, and a variety of radiation syndromes that are described in the following text. Some instances of radiation injury are illustrated in the accompanying photographs (see Photos 27.1–27.11).

Prodromal Syndrome

In some cases, radiation effects may appear within a few hours of radiation exposure and will persist for up to a few days. In general, higher doses result in earlier and more severe symptoms. At lower levels of exposure, symptoms may include fatigue, nausea, and vomiting. At higher (and probably lethal) exposure levels, patients will also experience fever, diarrhea, and hypotension. Patients with prodromal syndrome have likely been exposed to at least 100 rad, but symptoms will appear at any higher level of exposure. Patients exhibiting symptoms within 30 minutes of exposure have likely received a lethal dose of radiation, as have patients experiencing a very rapid (sometimes immediate) onset of diarrhea.

Hematopoietic Syndrome

The blood-forming organs are among the most sensitive to the effects of radiation, so these organs are among the first to show the results of high radiation exposure. Hematopoietic syndrome begins to appear at doses of

<table>
<thead>
<tr>
<th>DOSE (RAD)</th>
<th>SYNDROME OR EFFECT</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>—5</td>
<td>Chromosome changes</td>
<td>Increase in dicentric chromosomes and chromosome fragments noted.</td>
</tr>
<tr>
<td>15–25</td>
<td>Blood cell changes</td>
<td>Begin to see depression in numbers of red and white blood cells.</td>
</tr>
<tr>
<td>100</td>
<td>Radiation sickness</td>
<td>Mild at lower doses, severity and rapidity of onset increases rapidly with increasing dose.</td>
</tr>
<tr>
<td>300–800</td>
<td>Hematopoietic syndrome</td>
<td>Changes in blood cell count from damage to crypt cells, severe radiation sickness, recovery possible with medical support.</td>
</tr>
<tr>
<td>400</td>
<td>LD₅₀</td>
<td>With medical treatment, LD₅₀ is about 800 rem.</td>
</tr>
<tr>
<td>1,000</td>
<td>GI syndrome, LD₅₀</td>
<td>Relatively rapid onset for vomiting.</td>
</tr>
<tr>
<td>10,000</td>
<td>Cerebrovascular syndrome</td>
<td>Rapid incapacitation, death within a few days.</td>
</tr>
</tbody>
</table>
from 300 to 800 rad, when the precursor cells are sterilized or killed. This leads to a reduction in blood cell counts as older cells die and are not replaced, and it leaves the patient open to infection and other related problems. Following the initial prodromal syndrome, a patient may be relatively free of symptoms for some time, although a great deal is occurring. Patients with lower levels of exposure may recover from their exposure if the bone marrow can regenerate and if the patient receives medical support (typically antibiotic treatment). At higher levels of exposure, the patient will begin to exhibit chills, fatigue, hair loss, petechia, and ulceration of the mouth as well as infection, bleeding, immune system depression, and other symptoms resulting from the loss of blood cells. A dose of about 300 to 400 rad is lethal to 50% of the exposed population without medical support. This is called the LD50 dose. With medical support, the LD50 dose is about 700 to 800 rad.

Treatment for patients suffering from hematopoietic syndromes includes replacing blood cells via transfusion, isolation from sources of infection, and antibiotic treatment.

Gastrointestinal Syndrome

Exposure to 1,000 rad (10 Gy) or more will lead to gastrointestinal syndrome and, most likely, death within 3 to 10 days of exposure. Radiation exposure in this range sterilizes dividing crypt cells, leading to loss of cells from the villi. Within a few days, the villi become almost totally flat as the outer surface sloughs off and...

Photo 27.1 Ten days after exposure. Left hand of a patient who rubbed Cs powder on his palm. A diffuse secondary erythema is noted on the region proximal to fingers 2, 3, and 4. Delineation of bulla formation is barely visible. (Oliveira et al., 1991. Reproduced with permission of the Health Physics Society.)

Photo 27.2 Fifteen days after exposure. A large, tense bulla associated with edema limited finger movement. (Oliveira et al., 1991. Reproduced with permission of the Health Physics Society.)

Photo 27.3 Twenty days after exposure. Note rupture of the bulla, with dead skin becoming whitish and the surrounding epidermis showing areas of dry desquamation. (Oliveira et al., 1991. Reproduced with permission of the Health Physics Society.)
Disasters Caused by Chemical, Biological, and Radiological Agents

Cerebrovascular Syndrome

Exposure to exceptionally high doses of radiation (in excess of 10,000 rad or 100 Gy) will result in damage to the central nervous system, normally among the most radiation resistant parts of the body. Cerebrovascular syndrome is accompanied by symptoms of all other radiation syndromes, and it usually results in death within several hours to a few days of exposure. Patients exposed to such high levels of radiation will experience almost immediate nausea, vomiting, disorientation, seizures, and other symptoms of neurological distress, followed by coma and death. Although the exact cause of death is not known, it is thought that part of the cause is the buildup of cranial pressure that is due to leakage of fluid from blood vessels.

Treatment for cerebrovascular syndrome is limited to providing pain relief and sedatives to control convulsions and anxiety because the syndrome is invariably fatal.
Chronic Exposure to Low Levels of Radiation

Everyone is chronically exposed to low levels of background radiation, and this exposure appears to have no adverse effects. There are many questions about the effects of exposure to low levels of radiation above background levels, however, and this is one of the most contentious areas in the radiation safety profession. There are currently two primary models, each of which will be discussed briefly. This section may be of interest to all medical staff because, even in the absence of radiological incidents, most medical personnel are exposed to low levels of radiation from X-rays, fluoroscopy, or CT procedures.

The most serious concern is that long-term exposure to low levels of radiation may lead to cancer later in life. The two competing models describing the risk of cancer...
resulting from a given dose of radiation are the Linear, No-Threshold (LNT) model; and the threshold model. There are variations on both of these themes that will not be discussed.

**Linear, No-Threshold Model**

The LNT model is the most conservative, meaning that it predicts the highest level of risk for any given radiation exposure. This model says that any exposure to radiation in excess of background levels is potentially harmful, and that the risk of getting cancer is directly proportional to the radiation dose received. LNT is the basis for radiation regulatory policies in the United States and, indeed, in virtually every nation on Earth. The LNT model predicts five additional cancer deaths for every 10,000 person-rem of exposure. So, under this model, a single person with a lifetime radiation exposure of 10 rem will have 5 chances in 1,000 (about 0.5%) of getting cancer from this exposure. Alternatively, this model also predicts that exposing 10,000 people to a dose of 1 rem each will result in a total of five additional cancer deaths among the exposed population.

One problem with the LNT model is that it cannot be confirmed at low levels of exposure because of the statistical “noise” in the epidemiological studies performed. Because of this, the Health Physics Society has specifically advised against calculating risk for any exposures of less than 10 rem to any person. In addition, the International Council on Radiation Protection (ICRP) has advised against the misuse of what is called collective dose—the second example given earlier. According to the ICRP, if the most-exposed individual receives an insignificant radiation dose, it is inappropriate to calculate the cancer risk to an entire population receiving that level of exposure or lower exposures. One analogy that comes to mind is with stones. One ton is equal to 1 million grams. There is no doubt that dropping a 1-ton rock on somebody’s head will crush that person. The ICRP wants to avoid saying that throwing a million 1-gram rocks at each of a million people will lead to one person being crushed to death. In reality, we will have a million irritated people, but nobody will be crushed. Similarly, exposing a million people to low doses of radiation probably won’t make anyone sick, even if the collective dose is high.

**Threshold Model**

Another line of thinking suggests that there may be no adverse effects at all from exposure to low levels of radiation; that there may be a threshold, below which we see no risk. Under threshold models, there is a certain level of exposure that is completely safe, and it is only above that threshold that we begin to see an increase in cancer risk. Virtually all known harmful agents exhibit threshold effects.

One variation on the threshold model is the suggestion that exposure to low levels of radiation may produce beneficial effects. This is called hormesis, and it is not as far fetched as it might seem. We can all name substances that exhibit hormetic effects, including water, vitamin D, selenium, and aspirin. The theory behind hormesis is that, by providing a continuing challenge to our natural DNA damage repair mechanisms, these mechanisms are kept at their peak efficiency and are better able to repair the spontaneous DNA damage that takes place all the time. Some studies of people living in high natural background radiation areas and those who are occupationally exposed to radiation suggest that one of these models may be more accurate than LNT in describing the risks from radiation exposure, but the evidence is not definitive and the debate will likely continue for some time to come.

Under LNT, the risks of developing cancer from occupational radiation exposure are about the same as the risks of any other occupational illness or injury—about 1 in 10,000. By comparison, the background cancer death rate is about 1,600 in 10,000 (16%), and about 1 person in 7,000 dies each year in traffic accidents (more than 40,000 in the year 2000). For the vast majority of radiation workers, the drive to work is far more hazardous than their occupational radiation exposure, even using the LNT model.

**Reproductive Effects of Radiation Exposure**

Radiation has been used for medical purposes for about a century, and in that time, innumerable men and women have been exposed to radiation. This includes tens or hundreds of thousands of pregnant women, and many pregnant women were also exposed to radiation during the atomic bombings in Japan in 1945. Among all of these women, prenatal radiation exposure of less than 5 rem to the fetus has not been shown to have resulted in birth defects. Higher levels of fetal radiation exposure have been known to lead to birth defects; primarily mental retardation, low birth weight, and low organ weight. Table 27.3 shows the medical recommendations (from Wagner, Lester, & Saldana, 1997) for several combinations of fetal radiation exposure and postconception age.

**Radiology and the Pregnant Patient**

Although every radiographic procedure is different, there are some general statements that can be made. One is that radiographic procedures (X-ray, CT, fluoroscopy) administered above the diaphragm (e.g., head, chest) or below the knees will not give a significant radiation dose to the fetus. It is also safe to say that the fetal radiation dose from a single CT scan or from several X-ray films is not high enough to cause...
Medical Recommendations for Fetal Radiation Exposure

<table>
<thead>
<tr>
<th>POSTCONCEPTION AGE</th>
<th>FETAL DOSE (REM)</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–2 weeks</td>
<td>Any Dose</td>
<td>No action necessary.</td>
</tr>
<tr>
<td>2–15 weeks</td>
<td>Less than 5 rem</td>
<td>No action necessary.</td>
</tr>
<tr>
<td></td>
<td>5–15 rem</td>
<td>May consider terminating pregnancy, depending on presence of other risk factors.</td>
</tr>
<tr>
<td>15+ weeks</td>
<td>Greater than 5 rem</td>
<td>No action necessary.</td>
</tr>
<tr>
<td></td>
<td>5–15 rem</td>
<td>May consider terminating pregnancy, depending on presence of other risk factors.</td>
</tr>
<tr>
<td></td>
<td>&gt; 15 rem</td>
<td>May consider terminating pregnancy, depending on presence of other risk factors.</td>
</tr>
</tbody>
</table>


Radiological incidents and emergencies are any such events involving exposure of patients and/or emergency workers to radiation or radioactivity. A radiological incident is any instance in which people or the environment are exposed to radiation or radioactivity through accident or misuse (including deliberate misuse). A radiological emergency is any radiological incident in which there is the risk of injury or death, even if that risk is not from the radiation itself. For example, exploding a radiological dispersal device (RDD; colloquially called a *dirty bomb*) will not cause radiation injury, but the blast may place lives at risk. Attack with an RDD, then, is a radiological emergency, even though one will not expect to see any patients with radiation-caused injuries. Some examples of radiological incidents and emergencies are the following:

- Traffic accident involving a truck carrying research or medical radioactive isotopes.
- Terrorist attack with RDDs.
- Fire in a hospital or university radioactive waste storage facility.
- Unplanned radioactive release from a commercial nuclear power station.
- Detonation of a nuclear weapon.
- Loss of a radioactive soil density gauge or well logging gauge.
- Accidental exposure of a maintenance technician to radiation from an industrial linear accelerator.
- Radiation burns to the fingers from the beam of an X-ray diffractometer in a soil science laboratory.
- Accidental overexposure to an angiography patient from excessive fluoroscopy, resulting in radiation burns to the skin.
- Spill of radioactive liquids in a research laboratory.

The public, emergency responders, and medical personnel often respond inappropriately to radiological incidents and emergencies, owing to widespread misunderstanding of the risks posed by radiation and radioactivity. In particular, members of the public often panic and tend to attribute all real and perceived health problems to the effects of radiation. Emergency response personnel sometimes hesitate to approach the scene of such incidents.
radiological incidents, and medical personnel frequently delay or deny treatment to contaminated or irradiated patients. In addition, there are many instances in which medical personnel have failed to diagnose exposure to radiation, providing inappropriate medical care. Medical personnel must be able to recognize radiation injury and to provide appropriate medical assistance to personnel at the scene and in the hospital to all patients involved in radiological incidents and emergencies.

Samples

Virtually all radiological cases will require some sampling to confirm the level of exposure and to help determine a treatment plan (see Table 27.4). Samples must be treated as potentially radioactive until proven otherwise, and analytical equipment and areas may become contaminated, precluding their use for nonradiological patients until decontaminated. Blood samples must be obtained from uncontaminated (or decontaminated) areas to reduce the chance of inadvertent sample contamination and to prevent introducing contamination into a patient’s blood. Samples collected by the patient (e.g., urine or stool) may be inadvertently contaminated by the patient. The patient should wear gloves to reduce this possibility.

On-Scene Medical Assistance

Medical personnel at the incident scene may be called on to treat or triage patients suffering from the effects of exposure to high levels of radiation or to treat or triage patients contaminated with radioactivity. Medical personnel should take all possible precautions to avoid accidental uptake of radioactive materials. These include not eating, drinking, or smoking in contamination zones; promptly irrigating and covering open wounds; and thoroughly swabbing patients’ skin before giving injections, drawing blood, or suturing. All persons entering a contaminated area should wear protective gloves, shoe covers, outer protective clothing, and eye covering. All persons leaving a contamination area should
remove their protective clothing (including gloves and shoe covers) prior to exiting the area. Whenever possible (i.e., when patient care will not be compromised) all personnel—patients included—should be surveyed for contamination prior to exiting any contamination area. All equipment exiting the area should also be surveyed prior to release or should be sealed in plastic bags for later survey and release.

Caring for Patients Exposed to High Levels of Radiation

Patients exposed to moderately high levels of radiation (100 rad or less) will likely exhibit no symptoms of radiation sickness while at the scene. Laboratory work will show a depression in red and white blood cells, but this may not appear for several days after the exposure. About 10% of patients exposed to 100 rad will exhibit mild radiation sickness, but may not attribute it to radiation exposure.

The most critical range of exposures for medical intervention are those between about 200 and 800 rad. Patients with exposures in this range may experience nausea, vomiting, fatigue, physical weakness, and/or psychological distress.

Patients exposed to higher levels of radiation will experience more severe radiation sickness that will appear more rapidly. A patient receiving a dose of about 400 rad has a 50% chance of death without medical intervention, primarily from radiation-induced immune system suppression and subsequent infectious disease.

With medical support, such patients are likely to survive exposure. These patients will also experience radiation sickness. If radiation sickness appears within 30 to 60 minutes after exposure, however, the patient has likely received a fatal dose of radiation. Such patients should be made as comfortable as possible.

Some patients may be exposed to high levels of radiation that affect only a part of their bodies. For example, a scientist who places his or her fingers into the beam of an X-ray diffractometer may have very severe burns on the exposed fingers, but no other symptoms. In such cases, it may be necessary to perform skin grafts or even to amputate the fingers or hand, but the rest of the body will remain unaffected. Similarly, personnel may have "hot" particles fall onto their skin, giving severe radiation burns to very small areas. These patients must be decontaminated and the burns dressed at the scene, and skin grafts may be required after admission to the hospital.

Differentiating between radiation burns and thermal burns can be difficult, and it is not always possible to make this distinction based solely on clinical evidence. Most radiation burns will lead to erythema, blistering, and other tissue damage, but so do many thermal burns and serious sunburn (see Table 27.5). In some cases, the patient will be able to provide helpful information—they may recall recent radiology or radiation oncology procedures or may mention that they work in a facility with radiation generating equipment for example. Medical staff should also know that radiation injury is seldom, if ever, associated with burning, so charred tissue is almost always a sign of thermal injury. However, patients near the site of a dirty bomb explosion may suffer thermal burns from the chemical explosion and be radioactively contaminated. Remember that exposure to radiation does not cause a person to become radioactive—if you survey a patient and find positive counts with a radiation instrument, chances are that the burns are thermal burns, not radiation burns.

There is no health risk to medical or emergency personnel from working with patients exposed to high levels of radiation. Irradiated patients do not become radioactive.

Clinical Signs of Radiation Exposure

(see Table 27.6)

1. Nausea and vomiting (prodromal syndrome—if experienced shortly after exposure the patient has probably received a lethal radiation dose).
2. Possible erythema when patient denies thermal or chemical exposure (may be localized, depending on source of radiation).
3. Blistering, ulcerated tissue, possible necrosis (following exposure to very high, localized exposure to radiation).
4. Depression in red and white blood cell counts (usually occurs a few to several weeks after exposure).
5. Elevated levels of chromosomal aberrations.
27.6 Radiation Dose Producing Illness and/or Mortality

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>WHOLE-BODY DOSE</th>
<th>ASSUMING NO MEDICAL TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>No observed effects</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Chromosome damage</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>White cell depression</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Radiation sickness begins</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>LD$_{50}$</td>
<td>300–400</td>
<td></td>
</tr>
<tr>
<td>LD$_{100}^*$</td>
<td>800–1,000</td>
<td></td>
</tr>
</tbody>
</table>


Note. *LD$_{50}$ equals dose at which 50% of the population exposed will die.
**LD$_{100}$ equals dose at which 100% of the population exposed will die. Reprinted with permission from Managing Radiation Medical Emergencies, by R. E. Linnemann, 2001, Philadelphia: Radiation Management Consultants and Radiation Disasters: Preparedness and Responses for Radiology, by the American College of Radiology, 2002, Reston, VA: Author.

Treatment for Patients Exposed to High Levels of Whole-Body Radiation (see Table 27.7)

■ Patients exhibiting signs of radiation sickness immediately after an accident have likely received a fatal dose of radiation. Treating their symptoms will help to make them comfortable until a physician specializing in such cases can be contacted for the most recent medical advice. Such advice is available from the REAC/TS center at the Oak Ridge National Laboratory (http://orise.orau.gov/reacts/).

■ Patients receiving several hundred rem of exposure will exhibit reduced immune system function. Such patients require medical support until their immune systems can recover.

Patient Management—Doses Greater Than 200 Rad (Berger et al., 2007)

1. Use selective blocking of serotonin 5-HT$_3$ receptors or 5-HT$_3$ receptor antagonists to treat vomiting.
2. Consider initiating viral prophylaxis.
3. Consider tissue and blood typing in anticipation of possible blood transfusions and/or bone marrow transplant.
4. Treat trauma as necessary and appropriate.
5. Consider consultation with hematologist and radiation experts to determine dosimetry, prognosis, use of colony stimulating factors, stem cell transfusion, and so forth.
6. Draw blood for chromosome analysis (possible biodosimetry); use heparinized tube.
7. Note and record areas of erythema on body chart; take photographs if possible.
9. Prevent and/or treat infections.
10. Use growth factors (e.g., GCSF, GMCSF, interleukin) to stimulate hematopoiesis.
11. Provide psychological support to patient and family.
12. Consider transfusions of stem cells via umbilical cord blood, peripheral blood, or bone marrow.
13. Consider platelet transfusions if platelet count is low or in case of bleeding.
14. Observe for erythema, hair loss, skin injury, mucositis, parotitis, weight loss, fever.

Caring for Radioactively Contaminated Patients (See Table 27.8)

Patients contaminated, even at very high levels pose no threat to emergency response or medical personnel. Simple precautions, such as wearing latex gloves and a nuisance mask, changing outer clothing, and washing or showering after patient contact will suffice to protect medical staff. Even if such measures are not immediately possible, however, radioactive contamination does not pose a health risk to emergency responders or medical staff. It is imperative that medical staff treat significant medical problems with whatever degree of urgency is required. If a patient is only slightly injured, it may be appropriate to attempt decontamination before treating the patient, just as a physician will clean a laceration prior to suturing. However, serious injury requires immediate medical care that must be provided by the medical staff—the decontamination of staff, equipment, or facilities (including ambulances) can be performed by health physics personnel after the incident is resolved. Potassium iodine (KI) is only useful for incidents involving the release of radioactive iodine, such as a nuclear power plant accident or a nuclear explosion. The use of KI will be recommended by the state or federal government if it is appropriate. KI is usually recommended only for children and young adults.

Radiological Control Methods

Patient Decontamination

1. Remove patient’s clothing; dress in hospital scrubs or patient gown.
2. Rinse contaminated areas with saline solution or deionized water.
### Guidelines for Radiologically Exposed Patients at General Hospitals

<table>
<thead>
<tr>
<th>Exposure Type</th>
<th>Possible Effects</th>
<th>Initial Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Whole-Body Exposure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Localized exposure—usually to hands.</td>
<td>Localized erythema; possible blistering, ulceration, and necrosis.</td>
<td>Clinical observation and treatment of symptoms.</td>
</tr>
<tr>
<td>Total or partial whole-body exposure, minimal or delayed clinical signs.</td>
<td>No clinical signs in 3 plus hours after exposure, not life-threatening. Minor blood changes.</td>
<td>Clinical observation and treatment of symptoms. Sequential blood samples.</td>
</tr>
<tr>
<td>Total or partial whole-body exposure with early prodromal syndrome.</td>
<td>Acute radiation syndrome with severity depending on dose.</td>
<td>Treatment as noted earlier, possible specialized care. Full blood count and HLA typing prior to transfer to specialized center.</td>
</tr>
<tr>
<td>Total or partial whole-body exposure with thermal, chemical, or radiation burns.</td>
<td>Severe injuries, life-threatening.</td>
<td>Treat life-threatening conditions. Treat as above and early transfer to specialized facility.</td>
</tr>
<tr>
<td><strong>External Contamination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level contamination, intact skin, cleaning possible.</td>
<td>No likely consequences, possible mild radiation burns.</td>
<td>Decontaminate skin, monitor medical condition.</td>
</tr>
<tr>
<td>Low-level contamination, skin intact, cleaning delayed.</td>
<td>Possible radiation burns. Possible percutaneous intake.</td>
<td>Consult with specialist if possible.</td>
</tr>
<tr>
<td>Low-level contamination with thermal, chemical, radiation burns, and/or trauma.</td>
<td>Internal contamination possible.</td>
<td>Consult with specialist if possible.</td>
</tr>
<tr>
<td>Extensive contamination and associated wounds.</td>
<td>Internal contamination probable.</td>
<td>Consult with specialist if possible.</td>
</tr>
<tr>
<td>Extensive contamination with thermal, chemical, radiation burns, and/or trauma.</td>
<td>Severe combined injuries and probable internal contamination.</td>
<td>First aid and treatment of life-threatening injuries, early transfer to specialized center.</td>
</tr>
<tr>
<td><strong>Internal Contamination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhalation and ingestion of minor quantities of radionuclides.</td>
<td>No immediate effects.</td>
<td>Consult with specialist if possible.</td>
</tr>
<tr>
<td>Inhalation and ingestion of large quantities of radionuclides.</td>
<td>No immediate effects.</td>
<td>Nasopharyngeal lavage. Early transfer to specialized center to increase excretion.</td>
</tr>
<tr>
<td>Absorption through damaged skin.</td>
<td>No immediate effects.</td>
<td>Consult with specialist if possible.</td>
</tr>
<tr>
<td>Major incorporation, with/without external irradiation, serious wounds, and/or burns.</td>
<td>Severe combined radiation injury.</td>
<td>Treat life-threatening conditions and transfer to specialized center.</td>
</tr>
</tbody>
</table>

Note: From *Medical Management of Radiological Casualties*, by the Armed Forces Radiobiology Research Institute, 1999, Bethesda, MD. Author. Reprinted with permission.

3. Shower or bathe patient, using mild soap and cool-to-warm water.
4. Give sponge bath; discard sponge or washcloth as radioactive waste.
5. Flush open wounds with saline solution or de-ionized water.
6. Use standard sterilization practices prior to administering injections, suturing, or other practices that puncture or break the skin.

### Emergency Room Contamination Control

1. Wrap patient in blankets to contain contamination and reduce contamination of facilities.
2. Establish dedicated routes for transporting contaminated patients.
3. Establish dedicated rooms for decontamination and care of contaminated patients.
4. Line dedicated routes and rooms with plastic to reduce contamination of fixed surfaces.
Some Radiation Accidents and Their Effects

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PLACE</th>
<th>SOURCE</th>
<th>ACTIVITY</th>
<th>ORIGIN</th>
<th>DOSE (RAD)</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>Mexico</td>
<td>Co-60</td>
<td>Unknown</td>
<td>Industrial source</td>
<td>990–5,200</td>
<td>4 deaths</td>
</tr>
<tr>
<td>1965</td>
<td>U.S.A.</td>
<td>Accelerator</td>
<td>N/A</td>
<td>Industrial device</td>
<td>2,900–240,000 rad to partial body</td>
<td>One patient—leg and arm amputated</td>
</tr>
<tr>
<td>1967</td>
<td>U.S.A.</td>
<td>Accelerator</td>
<td>N/A</td>
<td>Industrial device</td>
<td>100–600 rad whole body; 600 rad to hands</td>
<td>3 persons irradiated, 1 person required amputation of hands</td>
</tr>
<tr>
<td>1968</td>
<td>Japan</td>
<td>Ir-192</td>
<td>5.26 Ci</td>
<td>Industrial source</td>
<td>15–130 rad</td>
<td>3 cases of radiation sickness among 6 exposed</td>
</tr>
<tr>
<td>1974–1976</td>
<td>U.S.A.</td>
<td>Co-60</td>
<td>Various</td>
<td>Medical therapy</td>
<td>Various</td>
<td>426 patients overexposed</td>
</tr>
<tr>
<td>1987</td>
<td>Brazil</td>
<td>Co-137</td>
<td>1400 Ci</td>
<td>Abandoned source</td>
<td>100–800</td>
<td>4 deaths</td>
</tr>
<tr>
<td>1991</td>
<td>Vietnam</td>
<td>Therapy accelerator</td>
<td>N/A</td>
<td>Medical therapy</td>
<td>Various</td>
<td>27 patients overexposed, 18 fatally</td>
</tr>
<tr>
<td>1996</td>
<td>Costa Rica</td>
<td>Co-60</td>
<td>Unknown</td>
<td>Medical therapy</td>
<td>60% overdose</td>
<td>115 patients overexposed, 17 deaths</td>
</tr>
<tr>
<td>1999</td>
<td>Japan</td>
<td>U-235</td>
<td>N/A</td>
<td>Reactor fuel</td>
<td>300–1,700</td>
<td>3 workers exposed, 2 workers died</td>
</tr>
<tr>
<td>2001</td>
<td>Georgia</td>
<td>Sr-90</td>
<td>40,000 Ci</td>
<td>RTG</td>
<td>Unknown</td>
<td>Severe radiation burns, 1 death, amputations</td>
</tr>
</tbody>
</table>

5. Do not use rooms for noncontaminated patients until checked and released by Radiation Safety personnel.

Medical Staff Contamination Control
1. Follow universal precautions—wear gloves, lab coats, shoe covers, and so forth, to reduce personnel contamination and to cover all exposed skin to the maximum extent possible.
2. Wear surgical masks to reduce chance of contamination inhalation.
3. Securely bandage or cover all open cuts, scrapes, and other wounds.
4. Change gloves after each patient.
5. Remove shoe covers prior to leaving any contaminated area.
6. Wash hands and exposed skin thoroughly after each patient.
7. Change clothes and shower at the end of the shift or when leaving patient decontamination or treatment areas.
8. Medical personnel working with highly contaminated patients should consider performing a urine bioassay 24 to 72 hours after exposure to check for evidence of radionuclide uptake. About 20 mL of urine is required, of which 1 mL will be counted in a liquid scintillation counter.

Emergency Care for Badly Injured, Contaminated Patients
1. If the patient requires immediate attention, treat the patient first and worry about radiological controls when the patient’s condition has stabilized. Rooms and medical staff can be decontaminated later.
2. Even badly contaminated patients pose no health risk to medical or emergency personnel.

Responsibilities of Radiation Safety Personnel, if Present
1. Survey all patients prior to their entry into medical facilities.
2. Assist with patient decontamination when practicable.
4. Survey controlled areas periodically to determine necessity for replacing or renewing coverings.
5. Establish and perform confirmation surveys of boundaries delineating controlled areas.
6. Survey medical and emergency personnel prior to exiting controlled areas.
7. Perform bioassay measurements as necessary (probably at end of shift or the following day) to determine uptake of radionuclides by medical and emergency response personnel.
8. Perform bioassay measurements as necessary for patients thought to have been exposed to radioactive contamination.
9. Identify contaminating isotope(s).

**MEDICAL RESPONSE TO NUCLEAR AND RADIOLOGICAL TERRORISM**

In the event of a terrorist attack, people will suffer physical and psychological trauma. Physical effects will include the effects of exposure to any explosion—broken bones, burns, shock, lacerations, and so forth. These may be compounded by the presence of radioactive contamination and, in some cases, radiation illness. In addition, any terrorist attack will, by definition, inflict psychological trauma, and medical personnel must be prepared to receive many patients who are worried, panicked, or suffering psychosomatically in spite of being physically well. In the aftermath of a terrorist attack, even a simple headache or anxiety attack may be seen as evidence of radiation sickness.

To that end, it may be prudent to develop a plan for addressing the psychological effects of a radiological attack. Medical staff must be able to differentiate between real and imagined illness, and hospitals should have personnel and literature on hand to help people understand why they were sent home instead of being treated or admitted.

To help determine the likelihood of whether a particular person might be suffering from radiation effects or contamination, medical personnel should make every effort to communicate with emergency response personnel at the scene of the attack so that area hospitals are aware of the nature of the attack (i.e., nuclear weapon, radiological dispersal device [RDD], large irradiator), the highest radiation dose rates and contamination levels measured, and approximate extent of radiation or contamination. With this information, medical staff will have a rough idea, based on a patient’s location at the time of the attack, as to whether the patient was likely exposed to sufficient radiation to cause various syndromes. For example, a person who is vomiting may have prodromal or gastrointestinal syndrome. If this person was a mile downwind of an RDD attack, however, this diagnosis makes no sense because they would not have been exposed to enough radiation to induce these syndromes. Before sending such patients home, though, they should be radiologically surveyed to make sure they are not contaminated—a precaution that would not be necessary for a patient who was upwind at the time of the attack.

**Medical Response to Radiological Dispersion Device (Dirty Bomb)**

An RDD (“dirty bomb”) is a chemical explosive laced with radioactivity. An RDD attack will probably lead to widespread contamination, contaminated patients and emergency responders, and victims of the blast itself, but will likely not result in radiation injury or illness. In the case of an RDD attack, medical personnel will probably be confronted with large numbers of patients who are contaminated with radiation, some of whom may have very high contamination levels. Many more people may appear who are anxious or panicked, but not ill.

One caveat is that radioactive sources may be incorporated into an RDD, and they may survive the explosion intact. Such sources could give very high radiation doses to personnel handling them and could lead to localized radiation burns. In most cases, however, patients are expected to exhibit injuries typical from an explosion itself, with the presence of radioactive contamination as a complicating factor.

The medical response to use of an RDD should focus on injuries from the blast—thermal burns, broken bones, shock, lacerations, internal injury, crushing, and so forth. Lightly injured patients may be decontaminated prior to arrival at the hospital, and may simply be decontaminated, treated, and released at the scene. Patients who are sent home should be instructed to change their clothes and shower when they get home. More seriously injured patients may be decontaminated prior to treatment if their injuries permit—these may include patients with lacerations requiring suturing, but that are not life threatening, or patients with sprains, contusions, or noncompound broken bones. Medical personnel must use their professional judgment in deciding how much, if any radiological controls to take. Patients with life-threatening injuries must be treated immediately, without regard to contamination levels. An alternative to decontaminating a patient is to wrap the patient in sheets, blankets, or anti-contamination clothing during transportation to the treatment room. This will help keep the patient from contaminating “clean” areas, although the treatment room will require decontamination prior to use by uncontaminated patients.

Although medical personnel may need to treat patients who are still contaminated, these patients pose no health risk to nurses or physicians. Universal precautions will serve to further reduce an already low radiation dose.
Medical Response to an Irradiator Attack

Instead of setting off an RDD, terrorists may simply set a high-dose irradiator in a public place. In such an attack, a relatively small number of people may suffer from radiation illness or injury (including the various syndromes or localized radiation burns if they handled the source). A larger number of people may appear at medical centers, suffering from anxiety rather than radiation sickness. Unfortunately, nausea and vomiting can result from either radiation sickness or extreme anxiety, and many patients may be unable to distinguish between the two. Although such an attack will likely injure fewer people than either an RDD or a nuclear weapon, there may still be hundreds of patients, depending on how the attack was planned andorchestrated. Because an attack of this type will likely not be associated with an explosion, it is prudent to assume that skin burns are radiation burns and to treat them accordingly. This may include skin grafts and removal of necrotic tissue, as well as pain relief.

All patients from the site of an irradiator attack should be evaluated for radiation sickness, and a health physicist or medical physicist should be consulted to attempt to determine the radiation dose to each patient. If the patient is conscious, it is essential to get as much information as possible about their exact location, travel paths, and the amount of time they spent in each place near the site of the irradiator. For example, if an irradiator is placed in an elevator, persons working on the 50th floor of a high-rise will generally receive more radiation dose than patients on lower levels. On the other hand, a person who has a nonstop ride to an upper level may receive fewer doses than one whose trip to the 10th floor was interrupted by frequent stops. Similarly, a person walking briskly by a large source may receive far less dose than someone working at a distance of several meters.

Regardless of the severity of a patient’s injuries, the patients pose absolutely no threat to medical personnel. Radiation burns from exposure to high levels of radiation are not radioactive, and there should be no radiation dose to medical personnel from treating such patients. The patients will likely be scared and in pain; this should not be exacerbated by medical staff taking unnecessary and elaborate precautions.

Finally, remember that the immune system is unusually sensitive to the effects of radiation exposure. Patients who have received enough radiation to cause burns or radiation sickness may suffer from suppression of their immune systems and may require medical follow-up and antibiotic support. Because there is sometimes an asymptomatic period following the prodromal period, it may be prudent to keep patients under observation for several days after treatment.

Medical Response to Nuclear Attack

Unlike the previous two scenarios, a nuclear attack will be truly devastating and many people will be killed and injured, many more will be traumatized, and a city’s infrastructure may be severely damaged. Radioactive fallout can be present in dangerous concentrations over many tens of square miles, and people can suffer from thermal and radiation burns as well as inhalation of fallout.

All other factors being equal, a larger weapon will produce more damage than will a smaller one. A weapon set off at ground level will produce more fallout (be “dirtier”) than a high altitude burst because soil and building debris will become radioactive and will be swept into the fireball. Rain will wash fallout from the air, giving higher radiation doses to people near the explosion, but lower dose to people at a distance. Other factors will influence the severity of any attack as well and are likely to vary considerably from site to site. Even under ideal circumstances, however, any nuclear attack will have a horrific impact on the city attacked.

Even a single nuclear weapon will stress an area’s emergency and medical response resources to the breaking point. If utilities are affected, medical personnel may be required to care for patients without reliable electrical power, heat, or water. Unlike many Cold War scenarios, though, it is not likely that any terrorist group will possess enough nuclear weapons to attack a city with more than a single device. This means that large parts of a city will likely remain intact and people from those parts of the city will be able to provide assistance at the site of an attack.
In spite of these effects, medical personnel can play an important role in saving lives and treating the injured, as was shown in Hiroshima and Nagasaki after their respective nuclear attacks. Today, with the advantage of more than a half century of research and planning, medical personnel can be even more effective at mitigating the health effects of a nuclear terrorist attack.

A nuclear attack will combine all of the elements noted earlier and on a large scale. People closest to the weapon will be killed immediately and those somewhat further away will receive a fatal dose of radiation. Depending on the yield of the device, local geography, weather, and other factors, however, people as close as several hundred meters may survive the explosion and its aftereffects. Radioactive fallout will lead to many patients being highly contaminated, some to the point of receiving a lethal radiation dose from their contamination if not promptly decontaminated. Complicating everything will be the presence of physical trauma—broken bones, thermal burns, crushing, lacerations, and so forth.

It is impossible to provide guidance in a book such as this one that will apply to any situation that may arise in a nuclear attack. Rather, it may be more appropriate to provide general guidance with the knowledge that medical personnel will have to react as appropriate, based on their own blend of experience, training, and knowledge. The general rules are the following:

1. Part of the triage process should include an assessment of radiation exposure received. For example, if a patient is vomiting or has diarrhea on arrival, there is a good chance the patient was exposed to a lethal dose of radiation, if the vomiting is due to radiation exposure and not to stress or illness.
2. Accept that the emergency room will become contaminated and will require decontamination after the crisis has passed. Instead of trying to limit contamination to a few areas, it may make more sense to designate a few areas as “cold” areas and to use those areas for treating nonradiological patients. Alternately, it may be necessary to designate the entire emergency room as “hot” and to treat nonradiological patients in other parts of the hospital.
3. Contingency plans should include the loss of potable water, electricity, and/or heat. Medical staff should consider how they would continue to provide medical care to existing and incoming patients if utilities are lost.
4. Radioactive fallout can include “hot” particles. These particles can burn very localized parts of the skin, not affecting areas only a few centimeters away.
5. The distribution of fallout can be very patchy, depending on peculiarities of terrain, weather, weapon characteristics, and other factors. People close to the site of the explosion may have lower radiation doses than those further away.
6. Patients from near the site of the explosion may look frightening and may have injuries that are simply impossible to imagine in advance. Medical personnel must expect to be confronted with situations for which their experience and training give them no appropriate tools—technical or emotional.
7. Even patients receiving a lethal radiation dose can be helped. Painkillers and antibiotics can help to make a patient comfortable and to help them survive until their family can be found.

Regardless of the severity of a nuclear attack and its consequences, medical personnel must do their best to respond to the best of their abilities. There will be many patients that cannot be saved, but they can be made more comfortable. There will be many more patients for whom medical care will mean the difference between life and death, and still others who may be able to assist with recovery once their injuries are treated.

QUESTIONS TO ASK WHEN RECEIVING AND CARING FOR RADIOLOGICAL PATIENTS (AMERICAN COLLEGE OF RADIOLOGY, 2002)

About the Incident
1. When did it occur?
2. What was the nature of the incident?
3. What other medical problems might we see?
4. What isotopes are involved and at what levels?
5. What on-site measurements have been made and what were the results?
6. Are other contaminants (biological, chemical) expected?

About the Patient
1. Was the patient contaminated? Is the patient now decontaminated?
2. Were contamination/radiation levels measured on the patient’s skin? If so, what were the results?
3. Was the patient exposed to radiation or radioactive contamination?
4. Are there any dosimetric measurements or estimates?
5. Have any therapeutic methods been attempted (blocking agents, isotopic dilution, chelation, etc.)?
6. What are the chemical and radiological properties of the contaminants?
Part IV
Disasters Caused by Chemical, Biological, and Radiological Agents

Figure 27.1 How to recognize and initially respond to an accidental radiation injury.

Follow-up
1. Has the patient’s clothing been saved (if removed at the site)?
2. Have any physical samples (blood, urine, feces) been collected? If so, where are they?
3. What further laboratory work is planned or recommended?

For further information, see Figures 27.1 and 27.2.

CONTENTS OF A CONTAMINATION CONTROL KIT

- Pens and pencils
- Blank paper
- Survey maps for human body (outline of front and back to note location of injuries and contamination levels)
- Cotton swabs (for obtaining nasal or oral wipes)
- Filter paper for smear wipes
- Small Geiger counter (such as a Ludlum Model 2401P) for measuring contamination from medium- to high-energy beta and gamma emitting isotopes
- Mild soap
- Alcohol swabs
- Paper towels
- Shoe covers
- Latex gloves (or equivalent)
- Lab coats or other outer contamination control garments for medical staff
- Hospital gowns, scrubs, blankets, sheets, or coveralls (for dressing either patient or medical staff)
- Boundary tape (to delineate contamination zones)
- Small envelopes (for holding smear wipes prior to counting)
- Nuisance mask or surgical mask
- Plastic sheeting (to cover floor, examination tables, patient transportation routes)
Chapter 27

Radiological Incidents and Emergencies

539

Figure 27.2 How to recognize and initially respond to an accidental radiation injury.

STUDY QUESTIONS

A radiological dispersal device (RDD) explodes, contaminating 10 square miles with radioactive cobalt (Co-60). The highest measured radiation level is about 10 meters from the site of the explosion and it reads about 150 mrem/hr. The average radiation dose through the affected area is 5 mrem/hr, and about 500,000 people live and work in this area. The device itself consisted of 1,000 pounds of explosive, set off near City Hall.

1. A firefighter is brought to the emergency room with extensive burns on his face and hands. Do you expect these to be radiation burns? Explain your reasoning.

2. A passerby is brought to the emergency room with severe lacerations and burns. She was about 100 meters downwind of the explosion. List the radiological precautions you should take prior to treating her injuries. List radiological precautions to take after she is treated.

3. The next day, a policeman is brought to the emergency room. He was one of the first people at the scene and spent 10 hours helping evacuate and recover victims. He has a severe headache and is vomiting. Is this due to radiation exposure? Explain your reasoning.

4. When the immediate emergency has ended, what actions should you take to recover from this incident and return to normal operations?

5. How many additional cancer deaths do you expect to see as a result of the radiation exposure from this attack? List your assumptions and explain your reasoning.

Answer the following questions individually.

1. What are four sources of natural background radiation? What is the average annual background radiation dose to people living in the United States and Canada?

- Stethoscopes, thermometers, blood pressure cuffs, and other “sacrificial” equipment for use on contaminated patients
- Small plastic bags (to cover stethoscope end and other objects that might become contaminated)
- Sample containers and zippered bags (to seal urine, feces, blood, dressings, wound exudates, clothing, bandages, etc.)
2. List three kinds of radiation. Which is most penetrating? Which does the most damage to living cells?

3. A young woman comes into the emergency room, unconscious, following a motor vehicle accident. Following a series of X-rays, the attending physician orders a pelvic CT because of concerns about internal injury. The patient is of childbearing age and has a little “tummy,” leading to questions about her pregnancy status. What actions should be taken?

INTERNET ACTIVITIES

Health Physics Society. Web site at www.hps.org
Radiation Emergency Assistance Center/Training Site (REAC/TS), includes class schedule for “Medical Care and Planning in Radiation Accidents.” Web site at http://orise.orau.gov/reacts/index.htm

REFERENCES


SUGGESTED READING


INTERNET ACTIVITIES

Health Physics Society. Web site at www.hps.org
Radiation Emergency Assistance Center/Training Site (REAC/TS), includes class schedule for “Medical Care and Planning in Radiation Accidents.” Web site at http://orise.orau.gov/reacts/index.htm

REFERENCES


SUGGESTED READING


INTERNET ACTIVITIES

Health Physics Society. Web site at www.hps.org
Radiation Emergency Assistance Center/Training Site (REAC/TS), includes class schedule for “Medical Care and Planning in Radiation Accidents.” Web site at http://orise.orau.gov/reacts/index.htm

REFERENCES

CASE STUDY

27.1 The Georgia Woodsmen

After the disintegration of the Soviet Union, Russian troops were withdrawn from the former Soviet republics. In many cases, equipment was left behind, including a number of radioactive sources. These sources included large radio-isotopic thermal generators (RTGs) that used the heat of radioactive decay to produce electrical power to run many devices, including a series of meteorological stations. Some of these sources contained very high levels of radioactivity.

In the winter of 2001, some woodsmen in the former Soviet republic of Georgia came across some cylinders that were unusually warm—they had melted the snow in their vicinity. The woodsmen camped for the night, using the cylinders as personal heaters to help keep them warm, not knowing that the heat came from radioactive decay.

Shortly after their exposure, all the woodsmen came to the local hospital with burns over parts of their bodies, including their backs, abdomens, and chests. Investigators determined the source of the burns and the RTGs were recovered when the snows cleared to make access possible. The woodsmen were treated for severe radiation burns and radiation sickness. One later died from his exposure and the others remained gravely ill for several months.

CASE STUDY

27.2 A Pregnant Radiology Patient

In September 1998, I received a call from Radiology saying that a woman had been involved in an automobile accident. Arriving unconscious, she received several X-rays and a CT scan of the abdomen and pelvis. When she awoke, she informed the physicians she was pregnant. I was asked to calculate the fetal radiation dose.

My calculations showed a fetal dose of just less than 5 rad, which I reported to the attending physician and the woman’s OB/GYN. I also reported that, for this level of exposure, the medical recommendation was to allow the pregnancy to proceed without consideration of the radiation exposure. This advice was followed and the pregnancy ended happily.

Several times each year, I receive phone calls or e-mail from women who have been advised to terminate their pregnancy after receiving only a few X-rays, some of which do not even image the uterus. Many medical personnel continue to fear that all fetal radiation exposure is harmful, and they inappropriately recommend therapeutic abortion. Before making this recommendation, medical personnel must perform a fetal dose calculation or ask a knowledgeable medical physicist or health physicist to perform these calculations. No recommendation to terminate a pregnancy should be made until these calculations have been performed and evaluated by a competent medical physicist or health physicist.
CASE STUDY

27.3 The Three Mile Island Experience

In March 1979 one of the nuclear reactor plants at the Three Mile Island (TMI) site (in Pennsylvania) had an equipment failure that led to a loss of cooling water from the reactor core. Operator errors compounded this mechanical malfunction, resulting in the destruction of most of the reactor core and melting some of the fuel. In spite of the extensive damage, the nuclear reaction was stopped and very little radiation was released to the environment. In fact, no person off site received more than a few millirem (equivalent to a few days’ background exposure) and no person on site exceeded their annual dose limit of 5 rem. This was not known at first, however, and the governor of Pennsylvania ordered the evacuation of many people from the area. Anticipating large numbers of contaminated people, the Hershey Medical Center established a decontamination center in their parking garage and geared up to receive, diagnosis, and treat large numbers of patients. Although they did not receive the anticipated flood of contaminated people, many people appeared, concerned that they may have been exposed to radiation because they had headaches, cramps, nausea, and other symptoms.

In following months and years, more nearby residents became concerned that any health problems, including cancer, miscarriages, anxiety-related symptoms, and birth defects were the result of radiation exposure from the TMI accident. In all cases, it was determined that insufficient radioactivity had escaped and the accident was not the cause of these symptoms. Even after more than 2 decades, however, this remains a contentious issue.

CASE STUDY

27.4 Goiania, Brazil

In September 1987 scavengers found and dismantled a canister containing a radiation therapy source—1,400 curies of Cs-137. Inside the canister, they found a sparkling blue powder so pretty that children rubbed in on their bodies and the rest was given to friends and family members. About a week after the incident, one of the people went to a public health clinic where she was diagnosed as having radiation sickness. When they responded, the Brazilian Nuclear Energy Commission found that 244 people were contaminated, 54 of them requiring hospitalization. Twenty persons had received doses ranging from 100 to 800 rad, 19 had skin burns, and all had ingested cesium. In all, more than 34,000 people were surveyed for contamination.

Patients were treated with Prussian Blue to remove the ingested cesium and were given antibiotics to help with infection. Unfortunately, because of the week-long delay in reporting this exposure, four patients died of pneumonia, hemorrhaging, and hematopoietic syndrome.

Medical personnel, in many cases, failed to take appropriate precautions. At least 42 technicians failed to wear protective clothing when working with contaminated patients or in contaminated rooms. Ambulances used to transport victims were not surveyed and decontaminated, and many homes remained contaminated for some time.

In addition to the medical effects, the city and citizens of Goiania experienced many social problems. These are described in some detail in the National Council on Radiation Protection & Measurements (NCRP) Report No. 137, which is worth reading in its entirety.
Key Messages

- Nursing education has a critical role in preparing the nursing profession to serve as an integral part of this country’s disaster preparedness plan and response.
- Collaboration among education and professional organizations, schools of nursing, accreditation and licensing bodies, and continuing education providers is critical for the successful attainment of nursing’s goals related to mass casualty education and specifically for the implementation of disaster preparedness competencies.
- Nursing education must provide nurses with an understanding of disaster science and the key concepts of preparedness.
- Nursing education must help nurses attain the skill sets that will allow them to respond to large-scale disaster and mass casualty events while still providing for their own personal safety. These skills include rapid physical assessment and disaster triage, decontamination and the use of personal protective equipment; and the allocation of scarce resources.
- Competencies related to disaster preparedness are based on principles, skills, and content that may not be included in the existing nursing curriculum.
- A change in emphasis or context in which these competencies are taught, the inclusion of new and different case studies, and varied clinical experiences can be strategies to integrate this newly defined set of competencies within the nursing curriculum.
- Academic institutions not currently providing disaster response and emergency preparedness content to their students are strongly encouraged to add this information into their curricula.

Learning Objectives

When this chapter is completed, readers will be able to

1. Discuss the various roles of education and professional organizations, accreditors and licensing bodies, schools of nursing, and continuing education providers in preparing the nursing workforce in emergency and disaster preparedness.
2. Assess, based on national expected competencies outlined, one’s own knowledge level related to disaster response and mass casualty preparedness.
3. Discuss the common areas of knowledge and skill needed by all nurses in various roles and settings in which nurses practice.
4. Describe several sources for competencies in disaster response and public health emergency preparedness.
5. Describe the Nursing Emergency Preparedness Education Coalition’s (NEPEC) goals for increasing nursing’s role in national and international preparedness plans.
This chapter includes an overview of the various entities that influence change in the nursing curriculum. Several innovative educational programs for disaster nursing are presented and sources for emergency preparedness competencies are reviewed. The importance of competency-based educational initiatives is emphasized.

**CHAPTER OVERVIEW**

A brief summary of the background, goals, and activities of the Nursing Emergency Preparedness Education Coalition (NEPEC), formerly the International Nursing Coalition for Mass Casualty Education, is presented. An outline of the INCMCE core competencies is included.

In response to the events and aftermath of September 11, 2001, and Katrina 2005, nursing education has begun to take a proactive position to prepare future and active nurses for disasters or public health emergencies that result in mass casualty incidents (MCIs). Nurses have traditionally provided essential health services in times of crisis, including the Oklahoma City bombing, Hurricane Andrew, and the Houston 2000 flood. However, nursing education’s response has primarily come in the form of curricula, course, and teaching material development. Nursing now must address issues surrounding dissemination of these materials, how best to educate the nursing workforce, maintain continuing competence of these nurses, and credentialing and licensing issues. As they responded to the horrors of Katrina, nurses, faculty, and students discovered the multitude of policies and regulatory issues that confront nurses when responding to a major disaster or mass casualty incident.

The 2.9 million nurses registered to practice in the United States (U.S. Department of Health and Human Services, 2005) represent a unique resource for developing a national response to future disasters or MCIs. The numbers of nurses not only exceed those of other health professionals but the diverse educational backgrounds, practice settings, experiences, and holistic focus of nursing practice place nurses in a position to fill a critical component of a national or international preparedness response. Because of this diversity, the potential roles nurses in an MCI may vary considerably. Nurses practicing in community settings may be the first to identify when an MCI has occurred, that is, a school nurse who sees multiple kids with rashes or gastrointestinal
symptoms. Nurses working in the emergency department or critical care unit may respond to a call to go to the scene of an incident or emergency field hospital where victims are being transported. Nurses with advanced specialty education, such as acute care nurse practitioners or certified nurse anesthetists, might fill more advanced triage, diagnostic and treatment roles. Providing counseling to victims, families, communities and other health care workers is another role which nurses may fill, particularly advanced practice nurses (APNs) with specialty preparation in psychiatry/mental health.

Regardless of practice setting or experience, all nurses must have a foundation or basic education to appropriately respond and protect themselves and others in a natural or man-made disaster, including chemical, biologic, radiologic, nuclear, and explosive events. Disaster relief nursing requires an awareness of the types of hazards that exist and health consequences associated with each category of event, knowledge base regarding the framework for a health systems response, and a unique skill set and ability to expand one’s practice parameters when necessary. As part of the country’s overall plan for disaster preparedness, all nurses must have a basic understanding of disaster science and the key components of disaster preparedness. This includes knowledge regarding: (1) definitions and classification systems for disasters and major incidents based on common and unique features; (2) disaster epidemiology and measurement of the health consequences of a disaster; (3) the five areas of focus in emergency and disaster preparedness (preparedness, mitigation, response, recovery, and evaluation); and (4) common challenges encountered in any disaster response effort. Not all nurses must or need to be prepared as first responders to an MCI. Every nurse, however, must have sufficient knowledge and skills to recognize the potential for an MCI, identify when such an incident may have occurred, know how to protect oneself, know how to provide immediate care for those individuals involved, recognize their own role and limitations and know where to seek additional information and resources. These skills include rapid physical assessment and disaster triage; decontamination and the use of personal protective equipment; and methods such as risk assessment, hazard identification and mapping, and vulnerability analysis. Nurses may be required to make decisions that determine the allocation of scarce resources. Nurses also must have sufficient knowledge to know when their own health and welfare may be in jeopardy and have a duty to protect both themselves and others (NEPEC, 2003, p. 5). These skills may represent information that the nurse has had no previous introduction to in any educational experience.

Currently, not all nursing education standards recommend that nurses be prepared with a minimum set of outcome competencies nor do regulatory requirements mandate nurses are prepared in mass casualty response. Nursing educators and organizations have responded to the events of 9/11 and the series of natural disasters that have struck in the past 5 years. They have reevaluated what nursing education’s role should and could be in addressing the national response to mass casualty incidents. For example, the Essentials of the Doctor of Nursing Practice addresses the need for all DNP graduates to attain emerging knowledge regarding infectious diseases and emergency/disaster preparedness (American Association of Colleges of Nursing [AACN], 2006). The White Paper on the Clinical Nurse Leader (AACN, 2004), a new generalist master’s-prepared nursing role being piloted by the American Association of Colleges of Nursing (AACN) with 89 education-practice partnerships, specifies that graduates “recognize the need for and implement risk reduction strategies to address social and public health issues, including mass casualty incidents, environmental exposures” (p. 19).

To better prepare nurses in areas of disaster preparedness and management, several schools of nursing in the United States have developed certificate and master’s programs to educate nurses regarding responses to public health emergencies, disasters, and mass casualty events. The University of Rochester School of Nursing (URSON) is a leader in this field and was the first school of nursing in the country to offer a 2-year master’s program in disaster preparedness (see Case Study 28.1). The URSON program represents a competency-based education and assessment initiative based on the CDC Bioterrorism and Emergency Readiness Competencies for All Public Health Workers. Following in the University of Rochester’s lead, John’s Hopkins University, Adelphi University, and the University of Tennessee–Knoxville opened degree-granting programs that prepare graduates in emergency preparedness. Other curricula include online certificate programs from George Washington University, Colorado Community Colleges, and the University of North Carolina at Chapel Hill; in-class certificate programs from Adelphi University and Vanderbilt University; subspecialty programs from Columbia University; and master’s of public administration programs from Jacksonville State University and Vanderbilt University.

These programs vary in length, requirements, intensity, and the type of degree awarded, and educate nurses in different areas of disaster preparedness and management. Schools such as Columbia and Jacksonville State, for instance, focus on areas of analysis, assessment, and management of disaster events. Others, such as Drexel University, Touro, and the University of North Carolina at Chapel Hill, prepare students for management and leadership positions. Programs at St. Louis University and Kaplan University focus specifically on
response to mass casualty incidents and terrorism, whereas the program at George Washington University covers a broad spectrum of disaster preparedness, from emergency services laws to counterterrorism response. Loyola University in Chicago has created a master’s and post-master’s certificate in “Population-Based Infection Control and Environmental Safety.” Baccalaureate nursing programs, including Trinity University in Washington, DC, have developed a course in the RN-BSN program that focuses on emergency preparedness and disaster management. Other undergraduate nursing programs, such as Fairfield University in Connecticut, have integrated emergency preparedness content into the series of public health nursing courses. All of these initiatives represent a commitment on the part of the school or university to provide nurses with the critical information they need to respond.

NURSING EDUCATION’S ROLE IN PREPARING FOR A MASS CASUALTY RESPONSE

Nursing education’s role in disaster preparedness revolves around four areas:

- Professional education organizations
- Regulatory entities, including accrediting, certifying, and licensing bodies
- Schools of nursing and faculty
- Continuing education providers

Challenges to adequately preparing our nation’s nurses include a gross lack of funding for disaster preparedness initiatives, an insufficient supply of nurse educators whose specialty focus is the domain of disaster nursing, compounded by a persistent shortage of nurse educators nationwide.

Deans, directors, and other nurse educators have monitored legislation and policies promulgated related to this country’s emergency response plan and preparedness. Individually and as a whole, nursing organizations have urged Congress to pass legislation that would provide funding for states and local communities to develop appropriate response capabilities. Funds have also been sought to support the education of practicing nurses, nursing students, and nursing faculty regarding MCIs, to ensure that nursing, as a profession, is prepared to respond to such incidents and serve as the critical health care resource it is capable of being. The Bioterrorism Training and Curriculum Development Program, authorized under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, has provided some monies for continuing education for health professionals and for curriculum development in health professional schools (Association of American Medical Colleges, 2003); however, only to a limited number of schools.

LACK OF NATIONAL STANDARDS FOR DISASTER NURSING

Nursing education standards, traditionally, have not mandated or recommended that nurses graduating from entry-level nursing programs or advanced practice nursing programs receive preparation related to a disaster or MCI response. Many nursing schools have evaluated and are augmenting their curricula related to disaster preparedness and response to MCIs. Likewise, now regulatory bodies, for example the Joint Commission, and most health care institutions have recognized the need or importance of requiring nurses and other health care professionals to receive training related to MCIs or emergency preparedness. To ensure that nurses across the country are prepared to respond appropriately and in a timely fashion to MCIs and to assist nursing schools and continuing education providers to meet this challenge, several organizations and universities have attempted to develop competencies for nurses and other health care providers with regard to these events.

RELATING CURRICULUM DEVELOPMENT TO EDUCATIONAL OUTCOMES

In the early 1950s, Benjamin Bloom and colleagues at the University of Chicago developed a framework called the Taxonomy of Educational Objectives that provides standard classifications for the development of educational objectives. The framework addresses educational outcomes in three core areas:

- Cognitive domain: Central to traditional curriculum development, the cognitive domain objectives deal with knowledge and intellectual ability.
- Affective domain: Affective objectives address attitudes and values.
- Psychomotor domain: These objectives will address motor skills.

These three domains are extremely helpful in curriculum design, planning and assessment activities, and evaluation in disaster nursing and emergency preparedness programs. From each domain, competencies can be identified that provide the foundation for content identification and curricular design.
COMPETENCIES

Competencies are defined as a “complex combination of knowledge, skills, and abilities”—frequently referred to as KSAs in the educational and instructional development literature (Center for Health Policy, Columbia University School of Nursing, 2001). Competencies for disaster nursing and emergency preparedness are critical as they represent the building blocks for curricular design. Competency-based education and training initiatives have historically met with resistance by educators due to the complexity involved with the modeling and design, fear of change, and lack of understanding of competency-based pedagogy practices and deployment techniques (Calhoun et al., 2005). Given the importance of the knowledge base (cognitive domain), attitudes of responders (affective domain) and skill-set (psychomotor domain), a competency-based program is the most relevant approach for disaster and emergency preparedness educational initiatives (Calhoun et al., 2005). Several sets of competencies have been proposed by different organizations that have attempted to create a foundation for health care workers in emergency response. With support from the Centers for Disease Control and Prevention (CDC) and the Association of Teachers in Preventive Medicine through a cooperative agreement, the Columbia University School of Nursing’s Center for Health Policy developed a competency model to provide a framework from which to build relevant training, exercises, and drills for eight types of CDC targeted public health workers (Columbia University, 2002). The final manuscript Bioterrorism and Emergency Readiness: Core Competencies for All Public Health Workers included nine domains of competencies.

Nursing-specific educational competencies for MCIIs has been addressed by the collaborative activities of the NEPEC. This coalition, comprised of nursing organizations, specialty organizations, schools of nursing, regulators, accreditors, and federal agencies, was spearheaded by the federal Office of Emergency Preparedness and the Vanderbilt School of Nursing. Since its inception in 2001, the membership in the coalition has expanded significantly and its scope has expanded to include an international focus. The goals of the NEPEC include:

- Increasing the awareness and knowledge of all nurses about mass casualty incidents
- Influencing research efforts designed to improve nursing care and responses to mass casualty incidents
- Monitoring legislation and regulatory policies related to mass casualty education
- Increasing effectiveness of all nurses responding to mass casualty incidents

The previously developed Competency Validation Tool (National Organization of Nurse Practitioner Faculties and American Association of Colleges of Nursing, 2002) was used to establish competency relevance, specificity, and comprehensiveness.

NEPEC developed a set of consensus-based core competencies related to mass casualty education for all entry-level nurses. A two-phase process, including an internal and external review phase, was used to develop a set of internationally recognized consensus-based competencies for mass casualty education of all nurses. These competencies were completed July 2003 and can be accessed at http://www.incmce.org/competenciespage.html. The 57 organizations and schools of nursing participating in the NEPEC have endorsed and widely disseminated the consensus-based competencies to members, policy makers, and the health professional community at large.

The need to develop competencies related to MCIIs for various subgroups and specialties within nursing, such as administrator, mental health counselor, primary care provider, and critical care nurse role, has been discussed by the Coalition. Initiated by the National Organization of Nurse Practitioner Faculties, a small group of educators and practicing APNs has met several times to begin discussions surrounding a core set of APN disaster-preparedness competencies. In addition to the broad-based generalist nursing competencies, the APN competencies would address the higher-level triage, diagnostic, and treatment capabilities of the APN.

COMPETENCIES FOR ALL NURSES RELATED TO MASS CASUALTY INCIDENTS

As they developed this set of national consensus-based competencies, NEPEC members wrestled with multiple questions, including what is meant by all nurses. Should this include all education levels? Retired nurses? Nurses practicing in all settings and specialty areas?

A general consensus among coalition members prevailed—that all registered nurses currently licensed to practice and all nurses educated from now on should have some basic level of knowledge and skill related to mass casualty incidents.

A second goal of the subcommittee, charged with developing the competency set, was to use an existing nursing curricula framework to facilitate the integration of the new competencies into the existing nursing curricula. The Essentials of Baccalaureate Education for Professional Nursing Practice (AACN, 1998) currently provides a framework for baccalaureate nursing curricula. The Essentials of professional nursing education include five key components: liberal education, professional values, core competencies, core knowledge, and role development. Borrowing from The Essentials, the MCI document addresses core competencies, core knowledge, and
role development. Much of the knowledge and skills required to master the MCI competencies is based on principles and content already included in the current nursing curriculum. A different context or focus, the use of different case studies, and new clinical experiences may be all that is required to prepare graduates with this new set of competencies. For example, most if not all of the 64 competencies, using innovative or new pedagogical methods, could be integrated into the following courses found in the nursing curriculum:
- Professional role development
- Public health, adult health, pediatric, mental health courses
- Pathophysiology
- Physical assessment
- Advanced clinical skills lab
- Ethics
- Health policy
- Communication and leadership courses

An updated version of *The Essentials of Baccalaureate Education for Professional Nursing Practice* will be released in 2008, and it is anticipated that the new document will address the need for disaster content in nursing programs (AACN, 2007).

**MCI COMPETENCIES FOR ENTRY-LEVEL NURSES IN RESPONSE TO MASS CASUALTY INCIDENTS (NEPEC, 2003)**

Core Competencies

1. Critical Thinking
   1. Use an ethical and nationally approved framework to support decision making and prioritizing needed in disaster situations.
   2. Use clinical judgment and decision-making skills in assessing the potential for appropriate, timely individual care during a mass casualty incident.
   3. Use clinical judgment and decision-making skills in assessing the potential for appropriate, individual ongoing care after a mass casualty incident.
   4. Describe at the predisaster, emergency and post-disaster phases the essential nursing care for:
      - individuals;
      - families;
      - special groups, for example, children, elderly, pregnant women; and
      - communities
   5. Describe accepted triage principles specific to mass casualty incidents.

II. Assessment

A. General
   1. Assess the safety issues for self, the response team, and victims in any given response situation in collaboration with the incident response team.
   2. Identify possible indicators of a mass exposure (i.e., clustering of individuals with the same symptoms).
   3. Describe general signs and symptoms of exposure to selected chemical, biological, radiological, nuclear, and explosive agents (CBRNE).
   4. Demonstrate the ability to access up-to-date information regarding selected nuclear, biological, chemical, explosive, and incendiary agents.
   5. Describe the essential elements included in an MCI scene assessment.
   6. Identify special groups of patients that are uniquely vulnerable during an MCI, for example, the very young, aged, immunosuppressed.

B. Specific
   1. Conduct a focused, health history to assess potential exposure to CBRNE agents.
   2. Perform an age-appropriate health assessment, including:
      - airway and respiratory assessment
      - cardiovascular assessment, including vital signs and monitoring for signs of shock
      - integumentary assessment, particularly a wound, burn, and rash assessment
      - pain assessment
      - injury assessment from head to toe
      - gastrointestinal assessment, including stool specimen collection
      - basic neurological assessment
      - musculoskeletal assessment
      - mental status, spiritual, and emotional assessment
   3. Assess the immediate psychological response of the individual, family, or community following an MCI.
   4. Assess the long-term psychological response of the individual, family, or community following an MCI.
   5. Identify resources available to address the psychological impact, for example, Critical Incident Stress Debriefing (CISD) teams, counselors, Psychiatric/Mental Health Nurse Practitioners (P/MHNPs).
   6. Describe the psychological impact on responders and health care providers.

III. Technical Skills

1. Demonstrate safe administration of medications, particularly vasoactive and analgesic agents, via oral (PO), subcutaneous (SQ), intramuscular (IM), and intravenous (IV) administration routes.
2. Demonstrate the safe administration of immunizations, including smallpox vaccination.
3. Demonstrate knowledge of appropriate nursing interventions for adverse effects from medications administered.

4. Demonstrate basic therapeutic interventions, including:
   - basic first aid skills;
   - oxygen administration and ventilation techniques;
   - urinary catheter insertion;
   - nasogastric tube insertion;
   - lavage technique, that is, eye and wound; and
   - initial wound care.

5. Assess the need for and initiate the appropriate CBRNE isolation and decontamination procedures available ensuring that all parties understand the need.

6. Demonstrate knowledge and skill related to personal protection and safety, including the use of Personal Protective Equipment (PPE) for Level B protection, Level C protection, Respiratory protection.

7. Implement fluid/nutrition therapy, taking into account the nature of injuries and/or agents exposed to and monitoring hydration and fluid balance accordingly.

8. Assess and prepare the injured for transport, if required, including provisions for care and monitoring during transport.

9. Demonstrate the ability to maintain patient safety during transport through splinting, immobilization, monitoring, and therapeutic interventions.

10. Demonstrate use of emergency communication equipment and information management techniques in an MCI response.

IV. Communication

1. Describe the local chain of command and management system for emergency response during an MCI.

2. Identify your role, if possible, within the emergency management system.

3. Locate and describe the emergency response plan for one’s place of employment and in the community, state, and regional plans.

4. Identify one’s own role in the emergency response plan for the place of employment.

5. Discuss security and confidentiality during an MCI.

6. Demonstrate appropriate emergency documentation of assessments, interventions, nursing actions, and outcomes during and after an MCI.

7. Identify appropriate resources for referring requests from patients, media, or others for information regarding MCIs.

8. Describe principles of risk communication to groups and individuals affected by exposure during an MCI.

9. Identify reactions to fear, panic, and stress that victims, families, and responders may exhibit during a disaster situation.

10. Describe appropriate coping strategies to manage self and others.

Core Knowledge

I. Health Promotion, Risk Reduction, and Disease Prevention

1. Identify possible threats and their potential impact on the general public, emergency medical system, and the health care community.

2. Describe community health issues related to MCI events, specifically limiting exposure to selected agents; contamination of water, air, and food supplies; and shelter and protection of displaced persons.

II. Health Care Systems and Policy

1. Define and distinguish the terms disaster and mass casualty incident (MCI) in relation to other major incidents or emergency situations.

2. Define relevant terminology, including:
   - CBRNE
   - weapons of mass destruction (WMD)
   - triage
   - chain of command and management system for emergency response
   - personal protective equipment (PPE)
   - scene assessment
   - comprehensive emergency management.

3. Describe the four phases of emergency management: preparedness, response, recovery and mitigation.

4. Describe the local emergency response system for disasters.

5. Describe the interaction between local, state, and federal emergency response systems.

6. Describe the legal authority of public health agencies to take action to protect the community from threats, including isolation, quarantine, and required reporting and documentation.

7. Discuss principles related to an MCI site as a crime scene, for example, maintaining integrity of evidence, chain of custody.

8. Recognize the impact MCIs may have on access to resources and identify how to access additional resources, for example, pharmaceuticals, medical supplies.

III. Illness and Disease Management

1. Discuss the differences/similarities between an intentional biological attack and that of a natural disease outbreak.
2. Describe, using an interdisciplinary approach, the short-term and long-term effects of physical and psychological symptoms related to disease and treatment secondary to MCIs.

IV. Information and Health Care Technologies
1. Describe use of emergency communication equipment that you will be required to use in an MCI response.
2. Discuss the principles of containment and decontamination.
3. Describe procedures for decontamination of self, others, and equipment for selected CBRNE agents.
4. Describe how nursing skills may have to be adapted while wearing PPE.

V. Ethics
1. Identify and discuss ethical issues related to CBRNE events:
   - Rights and responsibilities of health care providers in MCIs, for example, refusing to go to work or report for duty, refusal of vaccines
   - Need to protect the public versus an individual’s right for autonomy, for example, right to leave the scene after contamination
   - Right of the individual to refuse care, informed consent
   - Allocation of limited resources
   - Confidentiality of information related to individuals and national security
   - Use of public health authority to restrict individual activities, require reporting from health professionals, and collaborate with law enforcement
2. Describe the ethical, legal, psychological, and cultural considerations when dealing with the dying and/or the handling and storage of human remains in a mass casualty incident.
3. Identify and discuss legal and regulatory issues related to:
   - abandonment of patients;
   - response to an MCI and one’s position of employment; and
   - various roles and responsibilities assumed by volunteers.

VI. Human Diversity
1. Discuss the cultural, spiritual, and social issues that may affect an individual’s response to an MCI.
2. Discuss the diversity of emotional, psycho-social and socio-cultural responses to terrorism or the threat on one’s self and others.

Professional Role Development
1. Describe these nursing roles in MCIs:
   - Researcher
   - Investigator/epidemiologist
   - EMT or First Responder
   - Direct care provider, generalist nurse
   - Direct care provider, advanced practice nurse
   - Director/coordinator of care in hospital/nurse administrator or emergency department nurse manager
   - On-site coordinator of care/incident commander
   - On-site director of care management
   - Information provider or educator, particularly the role of the generalist nurse
   - Mental health counselor
   - Member of planning response team
   - Member of community assessment team
   - Manager or coordinator of shelter
   - Member of decontamination team
   - Triage officer
2. Identify the most appropriate or most likely health care role for oneself during an MCI.
3. Identify the limits to one’s own knowledge/skills/abilities/authority related to MCIs.
4. Describe essential equipment for responding to an MCI, for example, stethoscope, registered nurse license to deter imposters, packaged snack, change of clothing, bottles of water.
5. Recognize the importance of maintaining one’s expertise and knowledge in this area of practice and of participating in regular emergency response drills.
6. Participate in regular emergency response drills in the community or place of employment.

SUMMARIZING NURSING EDUCATION’S ROLE IN DISASTER RESPONSES AND THE IMPLEMENTATION OF MCI COMPETENCIES

Four key but interconnected components were identified at the outset of the chapter as necessary for the successful implementation of nursing education’s role in ensuring that nursing as a discipline is prepared to meet its critical role in the international and national community’s plan for emergency preparedness. These four entities included professional nursing education organizations; regulatory entities, including accrediting, certifying and licensing bodies; schools of nursing and individual faculty; and continuing education providers. The roles of these four entities are not demarcated. Rather, integration of activities, collaboration, and communication among all participants is essential.

Professional nursing education organizations may contribute to the preparedness of nurses through such activities as:

- Participation in the development and validation of core competencies
Dissemination of competencies to constituents
Inclusion of MCI competencies in national education standards
Faculty development related to the core competencies and nursing education’s role
Development and assembling of resources to prepare nurses in the area of MCI
 Provision of continuing education programs/materials for practicing nurses
Seeking monies to support preparation of nurses and faculty
Development and support of a research framework related to MCIs
Collaborate and support efforts to eliminate or reduce policy/regulatory barriers which restrict nurses responding to disasters

During recent disasters, particularly Hurricane Katrina, a number of institutional-, state-, and federal-level regulatory and policy issues that directly impact nursing schools’ and nurses’ ability to respond effectively were raised. These include liability and licensure/regulatory issues.

The role of regulatory bodies, including accreditation, certification, and licensure agencies, can be broken down similarly. The role of specialty nursing accreditation bodies, such as the Commission on Collegiate Nursing Education (CCNE) and the National League for Nursing Accrediting Commission (NLNAC), could include such activities as

Participation in the development and validation of core competencies
Determining whether nationally recognized MCI competencies should be required of a program or school to receive accreditation.
Determining whether MCI content in any form should be mandated for inclusion in a nursing program.
Review degree granting programs in emergency preparedness against a national set of standards.

In addition to specialty nursing accreditation bodies, the Joint Commission, formerly the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), mandates specific areas in which health care institutions must ensure that employees are prepared. As part of the national emergency preparedness plan, JCAHO (2001) has mandated that all health care institutions be required to design and implement an emergency preparedness plan. In addition, each institution must establish an orientation and education program for staff and must conduct emergency preparedness drills at least twice a year.

Mandatory requirements for professional licensure present another regulatory approach to increasing nurses’ emergency preparedness and ensuring a minimum level of competence. Registered nurses are licensed to practice by state boards of nursing or umbrella health professions’ boards. Individual state boards of nursing also maintain a nursing education program review function, some to a greater degree than others. A state board of nursing could mandate that a candidate for a registered nurse license graduate from a program that includes MCI content. A number of state boards also mandate continuing education credits for licensure renewal. A certification or continuing education program in mass casualty response could be developed and required for license renewal. The National Council Licensure Examination (NCLEX), administered by the National Council of State Boards of Nursing is based on role delineation studies of practicing nurses. As the role of the practicing nurse has evolved to include preparation for emergency preparedness, MCI content is now included in the national licensure exam.

Schools of nursing and faculty have a fundamental role in preparing nurses for emergency preparedness. Specific contributions could include:

Participation in the development and validation of core competencies
Inclusion and integration of content and clinical experiences in the nursing curriculum
Assessment of the competence of graduates
Development of teaching resources and materials
Evaluation of nursing care and response in mass casualty responses
Developing and maintaining the expertise and competence of faculty

To meet the goal of preparing registered nurses regarding MCIs, continuing education providers will be required to play a critical role. Specifically, the role of continuing education providers includes:

Development of continuing education modules or courses in various formats, including traditional classroom and Web-based formats
Dissemination of learning resources and materials
Implementation of education programs for registered nurses in diverse practice settings and with varied education backgrounds
Assessment of learning outcomes and ongoing competence

SUMMARY
Nursing education’s role in addressing the country’s emergency preparedness for response to future mass
casualty incidents requires a cohesive, collaborative effort among all involved entities. Preparation cannot be unilateral or unifocused but must be multidimensional and ongoing. The work of the NEPEC demonstrates such a collaborative effort. To prepare even a portion of the 2.9 million licensed nurses and future nurses is no small feat; however, this is what is necessary if nursing is to fill its critical role within the health care delivery system. Nursing education also must work with policy makers at the local, state, and federal levels to ensure that laws and regulations permit faculty in schools of nursing, nursing students, and nurses to fill the roles they are capable of in responding to natural or man-made disasters.

STUDY QUESTIONS

1. What do you see as nurses’ role(s) in relation to mass casualty incidents? To fill these roles what do they need to know and be able to do?
2. Based on your past and current experience and education, what do you see as your role in an emergency preparedness and response plan?
3. Obtain and review a copy of the emergency response plan at a health care institution in your community. What is nursing’s role(s) in this plan? Is it clear and appropriate? Could nursing’s role(s) be expanded? If yes, in what ways?
4. Obtain and review a copy of your local community or state emergency response plan. What is nursing’s role(s) in this plan? Are these roles clear and appropriate? Could they be expanded? If yes, in what ways?
5. Review the course syllabi at your school of nursing. What content related to mass casualty incidents or emergency preparedness is included? If not included, where could content be integrated?
6. Contact the local Emergency Medical Technician unit where you plan to practice or education standards regarding mass casualty or emergency preparedness and response. Atlanta, GA: Author.
7. Discuss the roles of professional nursing and education, nursing students, and nurses to fill these roles they are capable of in responding to natural or man-made disasters.

REFERENCES

Acquaviva, K. (2006, March 30). Assistant Research Professor at the George Washington University School of Medicine and Health Services, Department of Nursing [Personal electronic communication].


National Organization of Nurse-Practitioner Faculties, & American Association of Colleges of Nursing. (2002). Nurse practitioner primary care competencies in specialty areas: Adult, family, gerontological, pediatric, and women’s health. Rockville, MD: Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Division of Nursing.


Uniformed Services University of the Health Sciences Graduate School of Nursing. (2001). Materials and personal communication from Faye G. Abdellah, Dean and Professor, Graduate School of Nursing, including examples of APN objectives, course description, and course offerings. Bethesda, MD.

University of Ulster, University of Glamorgan School of Health Sciences School of Nursing. (1998). Course document for postgraduate diploma/MSc in disaster relief nursing for entry September 1999. Ulster, UK. Author.


CASE STUDY

28.1 Master’s Degree Program in Leadership in Health Care Systems in Disaster Response and Emergency Preparedness

In January 2004, the University of Rochester School of Nursing implemented an innovative master’s degree program entitled the Leadership in Health Care Systems in Disaster Response and Emergency Preparedness Program (LDREP), designed specifically for individuals interested in becoming leaders in disaster preparedness and emergency health care preparedness. LDREP is believed to be the first such program sponsored by a school of nursing in this country. It focuses on the development of nurses and other health care leaders to gain the knowledge, skills, and abilities to design, implement, and evaluate programs and services related to disaster response, emergency operations management, and emergency medical services. Graduates are prepared to:

- Respond in a timely and appropriate manner to a natural or technological disaster.
- Coordinate health care systems to meet the acute and long-term care needs of victims of disasters, including pediatric, elderly, disabled, and other vulnerable populations, in a safe and appropriate manner.
- Participate in a coordinated, multidisciplinary response to biological, chemical, or radiological terrorist events and other public health emergencies.
- Rapidly and effectively alert the public health system of such an event at the community, New York State, and national level.
- Provide leadership in the profession for future disaster nursing initiatives.

The LDREP program was predicated on the beliefs that a new paradigm was needed for public health nursing education and that a coordinated, comprehensive multidisciplinary team response for education and training is the most effective method for countering any major public health emergency. Based on this premise, the program was designed to develop a workforce of nurses competent to respond to the medical consequences of bioterrorism and other public health emergency preparedness and response issues. In this context, other public health emergencies include other forms of terrorism (such as use of chemical, explosive, incendiary, or nuclear agents against the civilian population), as well as natural disasters and catastrophic accidents.

The program employs the “all-hazards” approach to disaster planning recommended by the Federal Emergency Management Agency, which states that disaster planning should take place at a system level as well as within the organization and community, and is competency based.

In keeping with the need to create a multidisciplinary experience for students and to provide hands-on learning opportunities truly reflective of disaster and public health events, the LDREP program established formal ties with local disaster and emergency health services community organizations. These included the Monroe County Department of Health, the Center for the Study of Rochester’s Health, Emergency Medical Services of Monroe County, the Public Safety Training Facility, the Visiting Nurse Service of Rochester, the Department of Emergency Medicine at Strong Memorial Hospital, and the American Red Cross. These partnerships were established to fill an urgent need for health care leaders who are educationally and administratively prepared to design, to implement, and to evaluate programs in disaster response and emergency management. Each organization agreed to provide the program with faculty expertise, administrative field placement sites for students, and unrestricted access to their training facilities. Students thus had the opportunity to experience the actual workings of emergency operations centers and interact directly with individuals responsible for oversight of all county or state disaster events.

The 30-credit program is presented in an executive development style format (1,680 contact hours) over the course of four semesters. Students are required to complete two administrative field experiences in disaster preparedness, emergency medical systems, or emergency operations management. The program objectives are consistent with the stated goals of the Department of Homeland Security, which are to ensure that emergency response professionals are prepared to provide a coordinated, comprehensive federal response to any large-scale crisis and mount a swift and effective recovery effort.

The program objectives are also consistent with the Association of Academic Health Centers proposal presented to the Association of Academic Health Centers Biodefense Council in November of 2002. This proposal called for the establishment of a national network of
academic health centers to coordinate local biodefense strategies in order to: (1) educate and equip first responders; (2) coordinate local, regional, and federal activities; (3) benchmark program effectiveness; (4) establish best practices; and (5) respond to terrorist attacks. During the course of the program, the students complete two administrative field experiences and build a portfolio of projects that demonstrate competencies in the areas of disaster preparedness, emergency public health response, and emergency operations management. During the administrative field experiences, students analyze organizations and the programs and services they offer from a public health (population-based) perspective. Disaster preparedness, mitigation, response, recovery, and evaluation activities for both internal disasters (inside of the hospital) and external disasters (outside of the hospital) are presented through case studies with an emphasis on evidence-based planning.
Key Messages

The purpose of research to be conducted related to disasters and mass casualty events is to ensure and measure quality of health care throughout the phases of prevention, preparedness, response, and recovery in the event of a man-made or natural disaster.

In order for the research related to be effective and comprehensive, a quality-driven framework familiar to health care providers is used.

Because of the nature of the research problem(s), significant challenges are presented for access to subjects, research design, and data collection.

Nurses and professionals in other disciplines must plan ahead and think through the opportunities for research for all areas of focus—specifically prevention, preparedness, response, and recovery. It is critical that evaluation be done from an evaluation-research approach.

Learning Objectives

When this chapter is completed, readers will be able to

1. Identify the purpose and value of research related to emergency care in disaster prevention, preparedness, response, and recovery.
2. Assess the value of a framework for the research study of mass casualty events.
3. Identify the challenges of designing and conducting research during the phases of disaster prevention, preparedness, response, and recovery.
4. Explore ethical and legal aspects of the conduct of research in mass casualty events.
5. Determine the value of both qualitative and quantitative methods to the conduct of research in disaster situations.
6. Explore the research already conducted in order to build on current knowledge and focus new research on gaps in the research.
7. Identify gaps in the research in the present literature that should become part of the future nursing research agenda for disaster nursing, terrorism, and other emergencies.
8. Examine the value of collaboration among nurse researchers and with other disciplines in the development of the future nursing research agenda related to disaster nursing.
The potential for man-made or natural disasters will always exist. The degree of mortality, morbidity, and impact on society greatly depends on our disaster resilience at the community, national, and international levels. The capacity to prevent, mitigate, prepare for, respond to, and recover from disasters will increase disaster resilience and thus improve our nation’s capacity to confront disasters. Conducting research related to mass casualty events is a distinct challenge. Consequently, this chapter is primarily designed to provide a framework for future research efforts, which is based on the framework for assessing and evaluating quality of care and focuses the researcher on the structure, processes, and outcomes of mass casualty events. An adaptation to Donabedian’s traditional quality model introduces the client (who can be described as individuals, families, and communities) to the quality framework. In addition, a brief overview of research related to this effort is described.

The conduct of research in disaster situations presents many challenges from a scientific point of view—in addition to those of a legal and ethical nature. However, research related to all aspects of disasters and mass casualty events is critical to mitigate the degree of injury and damage and prevention of repeated mistakes in the response to future disasters. Although stringent research design and prospectively designed studies would be the ideal, research focused on disaster situations is usually performed retrospectively. With a systems focus, however, using a quality framework, more of the research can focus on the preparedness, planning efforts, and the necessary provider and client education that have a greater potential to improve outcomes in a real mass casualty event. In this chapter, the authors suggest a framework, building on previous related research wherever possible. Assessment of current strengths and identification of gaps in education, practice, research, and health policy are an important approach for the future. The next step is structuring a research agenda, focusing on three areas: the patient/individual/community (as client), health care providers, and the health care system needs for improved planning and response. Within this context, researchers interested in both prospective and retrospective research projects can design studies that have the potential to improve care during disasters. Attention to the legal and ethical issues is paramount, and researchers must be sensitive to the challenges in addressing these issues, particularly in retrospective studies involving victims of disasters.
Conducting nursing research focused on mass casualty events and disasters is a legitimate and appropriate task for the nursing profession. Several strengths of the nursing profession are key to improved management of disasters: (1) nurses are team players and work effectively in interdisciplinary teams needed in disaster situations; (2) nurses have been advocates for primary, secondary, and tertiary prevention, which means that nurses can play key roles at the forefront in disaster prevention, preparedness, response, recovery, and evaluation; (3) nurses historically integrate the psychological, social support, and family-oriented aspects of care with physiological needs of patients/clients; and (4) nurses are available and practicing across the spectrum of health care delivery system settings and can be mobilized rapidly if necessary. In order for these historical strengths of the profession to make a difference in disaster situations, however, research must be conducted related to the nursing role and the impact of nursing on both the client (individual and community) and on the health care delivery system.

Consistent with other challenges, the nursing profession should take the lead in identifying how nursing research can inform practice, education, and health policy. Development of an agenda for future directions for nursing research related to disaster care is one of the first steps. As with disaster medicine, the research must be purposeful, and should be outcomes driven, that is, conducted with the intent to change or to improve the outcomes of care in disaster situations. Ideally, this would involve collaboration among nurse researchers with differing strengths in research design and focus, in order to achieve improved outcomes at the client level, the provider level, and the systems level. More specifically the research agenda would include the following: research related to education and intervention at the individual and community levels; educational research targeted toward the nurse as a provider; and health services research targeted toward maximizing the potential of the appropriate use of nurses by systems with health policy implications highlighted for the future. This agenda would explore the possible roles for nurses in all phases of a disaster response, evaluate the education and preparation for these roles, and analyze how nurses have been used by health systems and communities in actual disaster situations. In addition, since September 11, 2001, and Hurricane Katrina, the community at large is looking to health care providers (including nurses) for guidance, education, and advocacy in disaster preparedness at both the individual and community levels. Nurse researchers must be leaders in the planning, development, and execution of interdisciplinary research in the areas of disaster preparedness and mass casualty response. Since the purpose of the nursing research agenda is to improve quality of care received in a disaster situation, an appropriate framework for a nursing research agenda is one designed to manage quality improvement. Donebedian’s (1982) structure, process, and outcome approach to quality management provides a beginning. However, Holzemer and Reilly (1995) expanded the original approach to develop an Outcomes Model for Health Care Research, which provides a comprehensive framework for the development of a nursing research agenda for disaster management. By extending the work of Donebedian, Holzemer and Reilly focus attention on the interactions and linkages among structure, process, and outcomes at the levels of the client, the provider, and the setting. Because the disaster research agenda needs to address outcomes at the client level, the provider level, and the systems level, this framework is useful in analyzing the research that has been accomplished and in identifying gaps that would inform needed future research.

Nurse researchers have much to learn both from the work done historically and more recently by nurses, as well as from interdisciplinary researchers in disaster medicine. Although both highlight the approach and value of retrospective research, by defining the target population as those impacted by the disaster situation, more research can be accomplished with potential for a greater impact in phases of prevention, preparedness, response, and recovery. From a systems evaluation perspective, it is also critical that nurses be at the forefront in developing the science and planning to be appropriately used in disaster situations. This can start with an active involvement in the process to evaluate the lessons learned from recent disasters such as the terrorist acts of 9/11 and Hurricane Katrina.

PERSONAL ACCOUNTS OF NURSES IN DISASTER SITUATIONS

Previous research studies focused primarily on the personal accounts of nurses in a number of disaster situations. Field study approaches and unstructured interviews focused mostly on the nurse as “provider” with very little research addressing the needs of the client (individual victims and communities). Some of the first research related to nursing’s role in disasters was conducted by Rayner (1958). Her findings included identification of stressors of health care workers and the need for additional research related to the long-term impact on health care workers. Demi and Miles (1984) reported the lack of integration of nurses in planning and subsequently in response as a key area for future research. Rivera (1986) describing the response to the Mexico earthquake noted confusion due to lack of guidelines for the utilization of nurses, doctors, and medications, and further identified needs for educational institutions to prepare nurses for disasters in coordination with local
agencies such as the American Red Cross and Civil Defense. Consequently, health systems research conducted by nurses will help in exploring the ways nurses with differing levels of preparation can be better utilized, and in determining the appropriate educational material for preparation, including information related to coordination activities with local and national response agencies.

With the recent heightened awareness of the possibility of man-made disasters and bioterrorism, it is even more important to understand the current state of the science. Although there are still very few specific studies in the bioterrorism literature conducted by nurses, federal sector and military nurses have been quite active in research. In the context of the framework mentioned previously, the majority of the research conducted still focuses primarily on the provider role, with some focused on health systems implications. Much of the research focuses on the role of nurses and the care of patients in wartime or deployed environment(s) where biochemical hazards could be encountered. Although before 9/11 these studies did not appear to be relevant to disaster response in the civilian sectors, there is increasing relevance to the understanding of the role and preparation of nurses as providers in mass casualty events on U.S. soil.

Specifically, these studies appear to be grouped thematically into several categories. Historical studies conducted by military nurse researchers appear to offer a grounding of the wartime experience through the use of first-person narrative analysis or review of source documents (Dittmar, Stanton, Jezewski, & Dickerson, 1996; Lasalle, 2000; Stanton, 1993; Stanton-Bandiero, 1998). Most recently, nurse researchers are conducting both historical analysis and active research documenting the experiences of nurses during Vietnam, the Korean War, and World War II to detail experiential coping, nursing skill needs, and patient care challenges experienced during those wars as lessons learned for more recent conflicts (Connor-Ballard, 2000; LaSalle, 2000; LeVasseur, 2000, 2001; Messecar, 2005; Mosha & Neidel-Greenlee, 2005; O'Neill, 2003; Sarnecky, 2001). Similar methodologies were used here, as they were in the previously mentioned studies conducted by civilian nurses in post-disaster periods.

Although at first blush, studies documenting the history of the Army, Navy, and Air Force Nurse Corps might not seem relevant to current nursing research needs, they offer insight into the wartime experiences of the nurses, reflecting preparation requirements, emotional reactions, and nursing challenges as medical science evolved from World War I through WWII, the Korean War, and Vietnam. References in the literature that highlight preparation requirements and still relevant nursing challenges include Sarnecky's (1994) comprehensive history of the Army Nurse Corps from its origins through the period of the Vietnam War; Scannell-Desch’s (1996, 1999, 2000a, 2000b) accounts of the hardships and experiences of nurses in Vietnam following their adjustments as female veterans; Norman’s (1999) interviews of nurses who served in Vietnam as well as those nurses imprisoned on Bataan during World War II (1999); and Smolenski’s (1999) current historical documentation of the Air Force Nurse Corps. As in the previous conflicts, studies regarding nursing and patient care issues in Operation Desert Shield/Desert Storm have begun to document activation experiences (Agazio & Gurney, 2001; Gurney, 2001; Nelson, 1994). Apart from this historical context, other related research has documented the physical and mental health effects of deploying nurses to wartime environments. These studies have included nurses who were deployed primarily in Vietnam, the Gulf War, or in more recent humanitarian missions such as Somalia and Bosnia (Stanton, 1993).

Most provider-oriented research has been conducted by nurse researchers with implications for women and nurses involved in disaster situations in which response and recovery are not resolved in a short time. Research on women’s needs by Ryan-Wenger (1996) and Czerwinski and associates (2001) specifically focused on gynecological and urological health of deployed women, first describing modification of hygiene practices and documenting health care needs in the field, and then developing and testing field sanitation kits. As more women with families have been deployed away from their families, studies have been recently focused on supporting deployed personnel as well as their families. Earlier studies by Ryan-Wenger (1994) on the impact of the threat of war on military children and Messecar’s (1993) investigation of family stress associated with wartime separation would be more client-oriented studies according to Holzemer’s framework. Two studies are currently in process to expand on this work: White (2004) is investigating coping interventions for children of deployed parents and Russek (2003) is exploring resiliency in Army Reserve families. Reflecting the unique concerns stemming from increased numbers of women involved in wartime and mass casualty situations, the Triservice Nursing Research Program has funded several studies considering the health and readjustment of Persian Gulf war veteran women (Pierce, 1992, 1994, 1999); family integration following Guard deployment (Messecar, 2005); and a more recent focus on retention due to the increased rotation schedules and deployment (Cox, 2004; Ross, 2003, 2005). Again, in the current, post-9/11 and Hurricane Katrina environment, many of these studies have implications for the care and well-being of civilian nurses involved in mass casualty events, as well as important considerations of the impact of the threat of terrorism (or any warlike events) on children and families today.
MILITARY NURSING RESEARCH

A separate category of military nursing research literature revolves around nursing care delivery with health systems implications and could be included in the systems component of the quality framework proposed by Holzemer. These descriptive studies focus on nursing practice in humanitarian missions or operations other than war (Schafer, 1996); shipboard practice environment (Connor-Ballard, 1998; Cox, 2005), advanced practice nurses (Aberle, Bethards, Orsega, & Ricciardi, 2003) and flight nursing (Chamings, 1995). Foley, Minick, and Kee (2000) focused on a particular aspect of nursing care, describing the operationalization of advocacy in a mobilized environment. Similarly, Bridges (2001, 2002) and Schmelz (1998) have developed an ongoing program of aeromedical nursing research studying specific nursing care practices, such as preventing hypoxemia from suctioning at altitude; considerations for litter placement during air transport; and implications for skin pressure and CPR using the NATO litter for evacuation. With the advent of the current wartime operations in Afghanistan and Iraq, studies and conceptual articles are emerging to differentiate nursing care delivery challenges in humanitarian versus wartime missions (Agazio, 2002; Gehring, 2005; Houlihan, 1999; Warren, 2004). Nursing care delivery has also been the focus of several studies to detail the expertise and training necessary to provide care within austere environments. Air transport nurses, primarily members of the Air Force Nurse Corps, must possess a high level knowledge, according to work conducted by Topley, Schmelz, Henkenius-Kirschbaum, and Horvath (2003); Terru (2003); Ryan-Wenger (2005); and Dresma (2005) to include understanding preflight preparation, in-flight nursing care implications, and a flexibility to adapt in hospital skills sets within an in-flight often critical care environment. Similarly, researchers have focused on the different skill sets required in ground operations, such as performed by Army Nurse Corps officers. Gehring (2005) is currently conducting research on defining nursing core values and caring during Operation Iraqi Freedom. Agazio (2002) recently completed a 3-year project to compare nursing competencies and patient care challenges in humanitarian or operations other than war missions such as in Bosnia, Hungary, and Somalia from those skills needed in wartime operations. These studies provide important contributions to the research agenda that have implications for nurses involved in emergency response teams and in the planning for nursing-related issues in disaster evacuation plans.

PREPARATION AND READINESS

Although the previously mentioned studies are important, it is clear that one of the most significant areas of interest today is the preparation of providers, and the self-care preparation of civilians, for possible future mass casualty events related to bioterrorism. Crucial to self-preservation of civilians and the delivery of quality care by providers in these difficult situations are skill sustainment training and readiness competency research. Clearly, the research documented in the current literature can inform future directions for a nursing research agenda for the client, for individual providers, and for the educational systems that teach and train current and future providers. In addition, as health care delivery systems along with community leaders develop and revise disaster plans in the post-9/11 and Hurricane Katrina environment, it will be important to build on prior relevant research specifically related to readiness competencies and the sustainability of readiness into the future. Reineck (1996, 1998, 1999; Reineck, Finsuem, Connolly, & Murdock, 2001) defined the components associated with readiness competency and, subsequently, developed and tested an instrument to assess individual readiness. Additional research has focused on specific skill retention, including trauma skills (Driscoll, 2001; Pierce, 1999; Topley, 1997), readiness-related factors (Dresma, 2000; Rivers, 2002; Sisk, 1997), retention of BCLS/ACLS skills (K. Smith, 1999), and triage knowledge (Janousek, Jackson, De Lorenzo, & Coppola, 1999). Related to skill sustainment, additional research has focused on optimal training methods to affect retention of critical readiness skills (Agazio, 2002; Dorn, 1999; Johnson, 1997; Page, 2000; Sykes, 1999). Operation Iraqi Freedom research has further provided opportunities to expand on this knowledge base. For example, Johnson (2005) and his team are currently testing the effects of an educational intervention on sustainment of combat trauma care, King (2003) is testing a model for bioterrorism education for both military and university nurses; and B. Smith (2004) is replicating a previous study to determine readiness to care for casualties with the most common combat injuries.

Operation Iraqi Freedom and Operation Enduring Freedom have stimulated military nurse researchers to expand previous work on nursing in a biochemical environment (Agazio, Pavlides, Lasome, Flaherty, & Torrance, 2002; Johnson 1997; Schoneboom, 1998), to include patient care challenges in an operational environment. Current studies funded by the Triservice Nursing Research Program clearly demonstrate military nurse researchers move to more complex clinical trials and interventional research. Ricciardi (2005) is focusing on the impact of body armor on physical work performance to document the physiological load from personal protective gear and to identify protective strategies to mitigate deleterious effects on work performance. Mortimer (2005), Bridges (2005), and Thurmond (2004) are investigating aeromedical transport effects on patients to identify and improve care during evacuation.
for war-injured service members. Similarly, Young-McCaughan (2005) is investigating sleep disturbances and pain in soldiers experiencing extremity war injuries to improve their care and rehabilitation. In addition, master’s and Ph.D. students at the Uniformed Services University of the Health Sciences are accruing a body of research focused on deployment and wartime nursing skill sets and patient care requirements as part of their thesis and dissertation research projects (Frank, 1999; Houlihan, 1999; Kiebler, 1999; Lee, 2001; Majna, 2000).

Since 9/11, Americans feel an increased vulnerability to terrorism or exposure to acts of war, including the use of biological and chemical agents. As evident here, previous, and current, research conducted by military nurses lends an initial understanding of nursing practice in austere environments, primarily during wartime. To date, however, there has been less research into biochemical defense for both the provider and the patient under these conditions. More research is needed so that nurses and other health care providers can provide quality care for patients, families, and communities in disaster situations.

FUTURE NURSING RESEARCH AGENDA

Any future nursing research agenda must focus on not only provider outcomes that include preparation, readiness, and protection but also increasingly on both client and health care system outcomes. With the use of technology (particularly the Internet) and advances in computer and communication systems, the challenge is to use both to the fullest extent in all phases of disaster management. In order to improve outcomes as described in Holzemer’s framework, there is ample opportunity for a new research agenda that must involve nurse researchers. Nurses, as mentioned previously, have traditionally focused on patient or client advocacy and education for health promotion and prevention. One of the clearest needs for the future is the research that must be focused on the client’s needs at both the individual and community level. In order to explicate this aspect of the research, however, nurses will need to think creatively about how to adapt some of the research that has been conducted related to provider preparation and readiness. With the continued threat of terrorism after 9/11 and Hurricane Katrina, health care consumers’ awareness and need for preparation and education are heightened. Nurses providing for patients/clients across health care settings have a unique opportunity to respond to interest and concerns. Consequently, there is an opportunity for practice-based research initiatives in public health departments, primary care clinics, and acute care settings.

Another new direction is the focus on provider needs for personal safety and readiness. For the nursing profession, particularly advanced practice nurses, there is a need for research related to assessment of the knowledge of practicing nurses about the communicability of different biological agents and other seldom-used skills. Demonstration research projects are needed, exploring how to use technology (particularly the Internet) to educate practicing nurses through continuing education, as well as contributing to the development of curricula for schools of nursing. Civil defense efforts from the 1960s were designed to accommodate as little dislocation of the provider as possible through train-the-trainer programs. The use of modern technology can allow similar programs that will decrease the current demands on a nurse’s time and may result in a larger number of response-ready nurses. For example, the American Burn Association and the Department of Health and Human Service worked together to train burn nurses for surge capacity for mass casualty burn events. However, the requirement to train the nurses at a central location decreased participation and increased the cost. Research is needed to demonstrate the effectiveness of technological methods of skills training for disaster events in order to make effective training available to rural communities and other areas where travel to distant training sites is not practical. Demonstration of the effectiveness of simulation tools and online training for disasters is essential for adequate surge capacity, especially when the training is related to illnesses and injuries that are infrequently or rarely encountered by nurses or the health care system.

In addition, there is a need (based on previous research conducted following disasters) to explore how nurses with differing knowledge and expertise might be used in a mass casualty event and man-made or natural disasters. During the 2005 hurricane season Hurricanes Katrina and Rita struck the Gulf Coast within a few weeks’ time. In addition to the U.S. Public Health Service, Department of Defense, and Disaster Medical Assistance Team nurses who are trained to respond, there were many volunteers who were not trained and responded either as individuals or as part of an organized team. Unfortunately, other volunteers simply arrived on the scene without being part of the organized effort and expected to be allowed to participate in the response. Understanding the capabilities and limitations of untrained volunteers and how to insert them into the existing structure is critical to a successful response. Through anecdotal accounts and lessons learned some literature is available; however, qualitative research studies wherein actual response activities are observed would greatly enhance current knowledge and provide evidence to drive policy. In addition, the qualitative approach would allow for more focused research regarding the use of volunteers, communication among response partners, approaches to civilian response for mass casualty events, and expectations of health care responders from all response backgrounds.
Finally, there is an opportunity to explore the impact of the provider–client relationship at the community level. In many communities, providers are known—particularly nurses—as neighbors and friends. One example of a community-level research intervention may be to explore ways to use nurses (as providers) in communities as resource persons with linkages to hospitals and other health care delivery agencies in disaster drills. Of course, this again would require some agreement and standards of practice defining the level(s) of competencies in disaster preparedness (which may be the first research question that needs to be explored).

Lieutenant Colonel Harriet Werley, a pioneer in nursing research, stated that nursing is well positioned to have great influence on communities and to conduct research on mass casualty events and disasters (Werley, 1956). She realized the power of community action and combined with her experience as an army nurse and researcher she identified the following four principles for conducting community-based research on mass casualty events and disasters, which are still relevant today:

- Identify methods of teaching all citizens the essentials of survival care to reduce the workload on trained responders at the site through self-aid and buddy-aid.
- Plan for mass casualty events and disasters and train in a purposeful and realistic manner.
- Use resources economically, including supplies and trained personnel in order to do the greatest good for the greatest number of people.
- Conduct research on the principles of triaging—especially the psychological impact on nurses during a mass casualty event.

Looking beyond the needs of the client and provider, it is critical that a health system’s research agenda be included in any future disaster planning. Nurses, as one of the largest groups of health care providers, need to be effectively and efficiently utilized throughout all phases of a disaster. Nurse researchers whose studies have historically focused on the care of vulnerable populations and issues related to lack of access to care would need to be involved in setting the research agenda for the future.

From a health systems perspective, the appropriate use of members of the nursing profession is paramount to the success in any type of disaster. Because of the changing nature of the threats related to bioterrorism, it is critical to explore new approaches to mass vaccination and providing other medications to large groups of people in community-based settings. Demonstration research projects need to be designed and conducted that include all of the health professions, particularly nurses in training exercises between and among health care systems, communities, and government representatives. These models need to be tested and validated in rural settings as well as urban settings in multisite research projects. In many of the urban settings, advance practice registered nurses (APRNs) are the providers of primary care to vulnerable populations. In rural settings, the APRN is also frequently the only available provider.

In many of the disaster plans and training exercises that are being developed, however, nurses may not be at the table at the onset of the planning by health systems representatives. Research demonstration projects are needed to explore ways for nurses to help shape the community safety agenda in all phases including preparation, readiness, and recovery.

Health systems researchers and public health experts need to address the requirement for rapid assessments of health care infrastructure that quickly identifies the status of the critical assets for providing care (facilities, medical supplies, and the workforce) during a disaster. Natural disasters are not predictable and there are rarely more than a few days’ warning of an impending event. Time does not allow for testing and retesting of tools or analysis of definitions and measures, and therefore they must be established in advance. Because needs assessments should be done as rapidly as possible it leaves little time for refining the processes. Further, the uniqueness of each disaster complicates research because of the variable populations, socioeconomic status, health care availability, and environmental conditions in every community.

Geospatial Information System (GIS) with preloaded demographic and standardized data definitions for all frequently used sources of government information is a powerful tool for disaster research and nurses are ideally suited to use the tool because of their close relationship with communities. It may be impractical for a researcher from outside the local community to populate a GIS in advance since disasters do not follow a predictable pattern. However, a populated GIS that is utilized for community-based public health research could be designed during the prevention and preparedness phases of disaster planning.

Finally, the nursing research agenda must also consider health policy implications and the ethics of individual decision making for individuals and communities versus governmental decision making. In the context of national security and population health, there is a need for qualitative research related to how to balance the consumer (client) voice and input into public policy decisions that necessarily must be based on ensuring the health of the public in disaster situations. Research and demonstration projects that account for cultural perspectives and differing values from communities (through multisite projects) have important health policy implications.

Additional health policy research includes the impact of mass casualty events and disasters on the financial health of health care delivery systems. For example, during the events of 9/11 in New York City, many
Collaboration among nurse researchers and with interdisciplinary colleagues will be needed to both develop the future agenda and to conduct the research necessary to improve care in disasters and mass casualty events. The nursing research community has a broad set of expertise in qualitative, quantitative, and health services research methodologies that can be brought to the table. Nurse researchers will face the challenges identified by researchers in disaster medicine that are well documented, such as the development of a sound, scientific study; identification and recruitment of subjects from an extremely vulnerable population base; dealing with the ethical and legal issues of timely data collection in sometimes threatening and difficult environments; and the development of strategies to maintain objectivity in highly emotionally charged research setting(s) (Quick & Hogan, 2002). It is important that with the future direction there is an attempt to address some of these issues while planning for research related to client care, provider safety and preparedness, the role of government and nongovernmental agencies in the community response plan, and health system changes needed to improve quality of care. Health system changes are needed to improve collaboration between provider organizations and communities for the best protection of the public. In addition, a number of health policy questions will continue to emerge for health care researchers, as we learn more and strive to balance the needs of the health of the public with current health policy and public policy questions for the future.

The complexity of the agenda needed to study the “variables, variability and variations of research” related to the quality management of care (according to Holzemer and Reilly, 1995) in disasters is significant, particularly with the experience and threat of terrorism. This chapter has proposed a possible framework for the organization of the research agenda, highlighted some of the research that has been conducted by federal-sector and military nurses with emphasis on the relevance to the current environment and threats, and has explored some of the challenges for nurse researchers in a rapidly changing environment.

**Summary**

Conducting research related to mass casualty events and man-made or natural disasters poses a multitude of challenges for nurse researchers; however, nurse researchers can contribute much to the state of the science.

**Study Questions**

1. What is the purpose and value of nursing research in disaster situations?
2. How would the agenda for nursing research be shaped for the future in order to address client needs, provider needs, and issues for and effect on health care delivery systems?
3. What is the nature of the research already conducted that can be applied to current concerns about terrorism?
4. How does prior research conducted by federal and military nurses shape research in the context of disaster nursing today?
5. What are some of the challenges for researchers trying to conduct both retrospective and prospective research related to disaster care?
6. Is there research related to preparedness and to the development of provider competencies that can serve as a building block for future research?
7. Are there health policy questions that need to be addressed in a future research agenda for nursing research in disaster situations?
8. How can the lessons learned in the field from nurses and other health care providers responding to Hurricane Katrina be captured and translated into future research?
9. What are some of the key interdisciplinary research questions surrounding the use of advancing technologies by local communities and on a national scale during disaster prevention, preparedness, response, and recovery?

**Internet Activities**

Several Internet sites are available for nurse researchers to obtain information related to current research and opportunities for future funding of research related to disaster situations. These include but are not limited to:
Part V  Special Topics

The Center for Communicable Disease, http://www.cdc.gov/
The Division of Nursing, http://bhpr.hrsa.gov/nursing/

Additional sites that might be helpful to nurse researchers and students attempting to locate re-
search and other content related to disaster nursing include:

Center for Disaster and Humanitarian Assistance Medicine, http://www.cdiham.org/
Columbia University Mailman School of Public Health, National Center for Disaster Preparedness, http://www.ncdp.mailman.columbia.edu/
Emory University, Rollins School of Public Health, http://www.sph.emory.edu/CPHPR/
Johns Hopkins, Hospital Epidemiology and Infection Control, http://www.hopkinsmedicine.org/heic/bioterrorism/index.html
Saint Louis University School of Public Health, Center for the Study Bioterrorism, http://www.bioterrorism.slu.edu/
UCLA Center for Public Health and Disasters, http://www.cphd.ucla.edu/
UIC School of Public Health, http://www.uic.edu/sph/prepare/
University at Albany, School of Public Health, http://www.albany.edu/sph/
The Uniformed Services University of the Health Sciences, http://www.usuhs.mil/
U.S. Army Medical Research Institute of Infectious Diseases, http://www.usamriid.army.mil/education/instruct.htm

REFERENCES
Chapter 29 Directions for Nursing Research and Development


Key Messages

- Disasters occur worldwide and are mostly caused by natural phenomena. Most disasters occur in the developing world where economic and political factors strongly influence the level of preparedness and capacity for response. Poorer countries experience more disasters and suffer a higher proportion of deaths.
- Disaster relief nursing is focused on the poorer countries where nurses help to alleviate suffering and mitigate loss of life in the acute phase, support communities through mourning and remembrance as well as providing education for resilience building and community recovery.
- Awareness and sensitivity to the ways in which other cultures respond to disaster is an important part of international disaster relief nursing.
- As is the case with all aid relief workers, nurses are accountable for preservation of the human dignity of those in their care. Nurses must be able to operate within the context of the International Red Cross Red Crescent Code of Conduct and display sensitivity to the political and cultural complexity of disaster situations.
- Nurses may have to take an advocacy stance in relation to protection of human rights ensuring that victims are treated according to International Humanitarian principles in the Code of Conduct, United Nations Declaration of Human Rights and the Geneva Convention. This, however, must be set in the context of the difficulties associated with being neutral and independent while maintaining delicate relationships with host governments, other aid relief organizations, and donors.
- Nurses providing aid relief to communities across the world must be aware of the international standards for delivery of aid. These are referred to as the Sphere Standards and are used by aid relief agencies worldwide.
- Irrespective of location, disasters result in communication and transport difficulties. Those involved in disaster response must always have a well-thought-out and easy-to-use communication and transport plan.
- Disasters worldwide are best seen as “complex emergencies” where the main issue, that is, famine, flood, or pandemic normally is underpinned by political, ethnic, or tribal conflict. Working in such environments presents an increased risk to personal security. Nurses must always ensure that personal safety is of the utmost priority.
- Displaced populations and refugees are normally a feature of most disasters.
- The nursing metaparadigm and nursing grand theories help to orient nurses to the parameters of accountability and the essential belief systems required to practice nursing in a disaster situation.

Learning Objectives

When this chapter is completed, readers will be able to

1. Appreciate the scale of disasters worldwide and how sociopolitical, economic, and cultural factors contribute to the development of complex human emergencies.
2. Determine the contribution of nurses to global aid relief and the range of roles that exist for nurses at all levels and stages of the disaster situation.
3. Affirm the importance of cultural awareness and sensitivity for nurses working in multinational teams or in the care of individuals and communities who fall victim to disaster.
4. Identify the key ethical issues associated with nursing in disaster situations and show increased awareness of the difficulties associated with neutrality and independence.
5. Discuss the key elements of quality assurance in international disaster response and preparedness and how rigorous evaluation contributes to improvements in nursing practice for disaster situations worldwide.
6. Identify transportation and communication as potential major obstacles to relief efforts during disasters.
7. Complex emergencies present increased risk to the personal safety of nurses working in disaster relief.
8. Describe the unique challenges for international disaster nursing that are posed by refugee or internally displaced populations requiring care in the acute or postacute phases of disasters.
Global Issues in Disaster Relief Nursing
Pat Deeny, Kevin Davies, Mark Gillespie, and Wendy Spencer

CHAPTER OVERVIEW

The changing context of disasters on a global scale provides backdrop to a discussion on the growth of aid relief and the associated contribution of disaster nursing at an international level. Disasters are more often than not caused by natural events but increasingly they have become “complex human emergencies” due to economic, political, and cultural factors. Nurses care for nations, communities, families, groups, and individuals worldwide. Care is provided at all levels and across all phases of a disaster. Effective disaster response at an international level requires nurses to have knowledge and skills for work in other cultures. Such competency facilitates in the care of victims and helps with functioning in an international team.

This chapter makes a case for education and training within an international group. Specific areas such as communication, transport, personal security, establishing priorities in the care of victims of disaster, refugee health, and an increased ethical awareness are discussed. The notable dearth in nursing research literature on the topic of disaster relief nursing means there is an urgent need to develop an empirical base for practice. This chapter also presents the idea that selected grand theories of nursing are valuable to orient practitioners and researchers to the belief systems that are applicable to the goals of international disaster relief nursing.

INTRODUCTION

Disasters such as floods, famine, armed conflicts, and mass refugee movements are commonplace in our world today. Since the time of Florence Nightingale, nurses have contributed at an international level to the care of nations, communities, families, and individuals who have fallen victim to disasters. While local nurses normally provide most of the care, it is common practice for some nurses to travel abroad in order to provide assistance in disaster situations. Disaster by its definition normally requires outside help. As the major profession involved in health care worldwide, nurses are well placed to make an international contribution to disaster
response. Through their work in all phases of disaster relief, they contribute to disaster preparedness, response, management, recovery and resilience building to reduce the impact of future disasters.

Although it is a common sight on the international news reports to see nurses working in the world’s disaster zones, record of their contribution is scant. A search of literature reveals that the written nursing contribution to knowledge on disasters and the associated care of victims is small and most of the time it does not go beyond anecdotal accounts from those nurses who experience disasters. Some literature reviews and prepositional papers outline the key issues for nurses in disaster relief worldwide. This chapter in itself is one such contribution. Although these accounts are valuable and point to important needs of victims, communities, and nurses, it seems reasonable to propose that nursing science in relation to disaster relief nursing is still embryonic. This picture seems consistent across the world and is one of the main issues for science in disaster relief nursing in the 21st century.

This chapter explores the key issues associated with disaster relief nursing worldwide and how the context of aid relief is changing toward more complex emergencies. The scale of disasters worldwide, with special emphasis on the 2004 Indian Ocean tsunami, is examined. Slow disasters, such as the AIDS epidemic, are also discussed. Outlining the contribution of nurses to global aid relief and the range of nursing roles therein points up the importance of cultural awareness and sensitivity in disaster situations. A case is made for the education of nurses in international groups in order to foster such awareness and improve competence in working with other cultures either as victims of the disaster or colleagues in an international team.

As disasters are normally associated with population displacement and social upheaval there is always the potential for victims of disasters to feel that their dignity is compromised and their health as whole human beings is under threat. Nurses as key health professionals who value providing a holistic approach must become advocates for maintenance of dignity and human rights for victims of disasters. Ethical issues are commonplace in disaster situations mainly because of the complexity and mix of political and cultural dimensions that exist in the affected population. This complexity may even exist in the international aid relief team.

As providers of aid relief to communities across the world nurses must be aware of the need for accountability and quality of care. This is not easy as there is no universally accepted international minimum standard. In the absence of a single universal standard, some international government organizations (IGOs) and nongovernmental organizations (NGOs) have developed their own standards. The Sphere project has attempted to develop the universal international minimum standards, and it is around the Sphere standards that the discussion related to accountability and quality in this chapter will be based.

Transportation and communication needs are explored as potential obstacles to successful relief efforts and are presented as core knowledge for anyone considering entering the field of disaster relief. The unique health requirements of displaced persons and refugee populations are described as an example of the types of humanitarian challenges nurse’s face. Fundamentally, nurses should be aware that most international disasters are now “complex emergencies” and are best perceived as volatile situations. As is the case with all aid workers nurses are in almost constant threat of being robbed, kidnapped, raped, or taken hostage. Personal security is critical so sound advice on personal security is presented. The chapter closes with a challenge to all involved in the field of disaster relief nursing to develop further the empirical base of practice. An amalgam of the grand nursing theories of Nightingale, Neuman, and Leininger is proposed as a starting point to orient practitioners and researchers to the main concepts of nursing as applied to the field of disaster relief nursing. A case example of how Roy’s Adaptation Model can assist in developing a conceptual framework for a research project is introduced.

**THE SCALE OF DISASTERS WORLDWIDE**

During the last decade of the 20th century, an average of 75,250 people per annum across the world have lost their lives because of natural or human-initiated disasters. During the same period, 210 million per annum have been affected by disasters (International Federation of the Red Cross and Red Crescent [IFRC], 2001). However, the numbers of lives lost during the 1990s is lower when compared with the 1980s. The high number of deaths caused by the war and famines in Sudan and Ethiopia during the 1980s may contribute to this occurrence. Ryan, Mahoney, Greaves, and Bowyer (2002) list 38 selected natural disasters of the 20th century to emphasize the sheer scale of human loss. They estimated that approximately 18 million lives were lost in these events. This figure does not include any of the conflicts, large or small, which occurred during the last century.

While it is too early in this decade to draw comparisons, early indicators are that deaths resulting from disasters may be on the increase again in the first decade of the 21st century. According to the International Federation of Red Cross Red Crescent 249,896 people worldwide died as result of disasters in 2004 (IFRC, 2005). Statistics are strongly influenced by the Indian Ocean (or Sumatran) tsunami that occurred at the end of 2004 (December 26, 2004) when over 280,000 people lost their lives or went missing (see Table 30.1). These
30.1 Deaths and Missing Persons as a Result of the Indian Ocean Tsunami of December 26, 2004

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>NO. OF DEATHS</th>
<th>NO. MISSING</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>10,749</td>
<td>5,640</td>
<td>16,389</td>
</tr>
<tr>
<td>Indonesia</td>
<td>125,443</td>
<td>94,706</td>
<td>220,149</td>
</tr>
<tr>
<td>Kenya</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Myanmar</td>
<td>90</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Maldives</td>
<td>82</td>
<td>0</td>
<td>108</td>
</tr>
<tr>
<td>Malaysia</td>
<td>68</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td>Seychelles</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Somalia</td>
<td>298</td>
<td>132</td>
<td>430</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>31,147</td>
<td>4,115</td>
<td>35,262</td>
</tr>
<tr>
<td>Tanzania</td>
<td>10</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Thailand</td>
<td>5,396</td>
<td>2,932</td>
<td>8,328</td>
</tr>
<tr>
<td>Total</td>
<td>173,296</td>
<td>107,573</td>
<td>280,869</td>
</tr>
</tbody>
</table>


figures are now accepted as being conservative with the United Nations in 2005 stating that over 230,000 individuals were killed and 2 million people were affected (Wahlstrom, 2005). Until such time that another cataclysmic disaster occurs, the tsunami, as it has become known, will remain as the worst natural disaster in living memory. For many years to come this disaster will be required curriculum for anyone who is studying disasters or planning to work in aid relief.

The sheer scale and rapidity of the Indian Ocean tsunami disaster mean that all response systems from the preparedness level of the affected countries through to the recovery phase were tested and are still being tested. Many valuable lessons have been learned for future disaster relief worldwide. Wahlstrom (2005) points to three main conclusions that could be drawn from the aid relief effort in this disaster. These were the realization of a truly interdependent world, the need to design an accountability system that can report back quickly to the range of donors involved in a disaster response, and the need for better coordination of the international disaster relief system so that affected communities and host governments are not put under as much pressure in the acute phase. In a review of the lessons for public health management in disasters, Nabarro (2005) suggests new ways to develop public health capacity within disaster management systems in the wake of the tsunami (see Table 30.2). He proposed that from the World Health Organization (WHO) perspective it was no longer acceptable to merely observe and analyze. The need to monitor actions that emerged from the analysis of the response to the tsunami indicate that WHO must continue to press world governments on disaster preparedness (Nabarro, 2005). The tsunami will continue to influence disaster response and preparedness for many years to come and will be used as a measuring stick by everyone in the field.

It is reasonable to suggest that disasters are probably one of the greatest global threats to the existence of the human race. This proposition exists even before consideration is given to the increased threat of pandemics. To date, most disasters have been caused by natural phenomena such as drought, windstorms, and floods. For this reason, it is necessary to consider the impact of natural disasters on the world, as it is from this source that the greatest demand is placed on nursing internationally.

The most vulnerable areas are those that very often make up the developing world (perhaps more importantly what one may term the majority world) and as such have little in the way of resources to cope with any disaster. This is further complicated by the effects of globalization, whereby the wealthier countries are able to exploit further developing technology to become wealthier, and the poorer countries struggle in their wake.

The United Nations Development Program has analyzed disasters according to their impact on different countries across the world. Countries are can be categorized as being at low, medium and high stages of human development (IFRC, 2001). Of the 2,557 natural disasters reported over the 10-year period 1990–2000, more than half were in countries of medium human development. Two-thirds of those killed were from countries of low human development with less than one-third from countries of medium human development. Only 2% of the overall total killed came from countries at a high stage of development. When comparing the numbers of deaths per disaster there is also wide variation according to the level of human development. On average, 22.5 people die per reported disaster in highly developed nations, 145 die per disaster in nations of medium human development, while each disaster in low human development countries claims an average of 1,052 people (IFRC, 2001).

It is important to note, however, that in poorer countries it is more common to experience a “slow” or “progressive” disaster event. (See Nur [1999] for further discussion in relation to progressive disasters in Africa.) This is where a disaster occurs over a period of months or years but can have the same devastating consequences as a sudden disaster. In addition, slow disasters often occur in countries that have endemic problems such as malnutrition and disease. Africa is an excellent example of this. As 23.5% of the population of Africa suffers from chronic hunger (Nur, 1999), they are at high risk of malnutrition and disease if a disaster
1. National capacity for risk management and vulnerability reduction.
   - Development of public health capacity within disaster management systems was discussed at the WHO Tsunami Health Conference, May 4–6, 2005.
   - Participants requested capacity building in supplies management and logistics and requested additional support in these critical areas from UN systems’ agencies, including WHO.
   - They noted that effective supply systems and logistics are key to efficient disaster management. At times of major disasters, adequate logistic support must be made available through external assistance—through WHO serving as the health arm of the UN system.
   - When external assistance reaches a disaster-affected country, it should be managed through a participatory structure that involves representatives from both the recipient and donor communities. This is particularly relevant for actions in the health sector where needs can change quickly over time, and the cost of handling inappropriate assistance.

2. Information for post disaster needs assessments and programme management.
   - Participants requested that WHO establish more effective relations with key media groups (to brief them on health issues during disasters and to identify myths that hinder response efforts), and to develop guidance on media relations.
   - Accountability and ethics
     - All health humanitarian actors need to be able to operate within accepted humanitarian principles and to ensure the integrity of humanitarian space, many participants saw the value of further developing this cooperation. The concerns, though, are valid—hence the need for careful work to enable different groups to understand each others’ motives (and fears), and to agree the procedures through which they can work together.

   - Participants sincerely appreciated the active role of public and private donations in support for preparedness, mitigation and vulnerability reduction, as well as permitting a prompt and comprehensive response to disasters (most notable in the response to the tsunami).
   - Increased funding and commitment from National governments in relation to risk management and vulnerability reduction.
   - The need for benchmarks, standards and codes of practice.
     - Agencies should be helped, by WHO, to agree benchmarks, standards and codes of practice for the health aspects of disaster preparedness and response, as well as for supporting post-disaster recovery. These could be based on the well-known SPHERE standards, and agreement should be taken forward through processes of the global Inter-Agency Standing Committee (IASC).

4. The need for benchmarks, standards and codes of practice.
   - Participants requested capacity building in supplies management and logistics and requested additional support in these critical areas from UN systems’ agencies, including WHO.
   - They noted that effective supply systems and logistics are key to efficient disaster management. At times of major disasters, adequate logistic support must be made available through external assistance—through WHO serving as the health arm of the UN system.
   - When external assistance reaches a disaster-affected country, it should be managed through a participatory structure that involves representatives from both the recipient and donor communities. This is particularly relevant for actions in the health sector where needs can change quickly over time, and the cost of handling inappropriate assistance.

5. Management and co-ordination of disaster responses.
   - Participants requested capacity building in supplies management and logistics and requested additional support in these critical areas from UN systems’ agencies, including WHO.
   - They noted that effective supply systems and logistics are key to efficient disaster management. At times of major disasters, adequate logistic support must be made available through external assistance—through WHO serving as the health arm of the UN system.
   - When external assistance reaches a disaster-affected country, it should be managed through a participatory structure that involves representatives from both the recipient and donor communities. This is particularly relevant for actions in the health sector where needs can change quickly over time, and the cost of handling inappropriate assistance.

   - Participants requested capacity building in supplies management and logistics and requested additional support in these critical areas from UN systems’ agencies, including WHO.
   - They noted that effective supply systems and logistics are key to efficient disaster management. At times of major disasters, adequate logistic support must be made available through external assistance—through WHO serving as the health arm of the UN system.
   - When external assistance reaches a disaster-affected country, it should be managed through a participatory structure that involves representatives from both the recipient and donor communities. This is particularly relevant for actions in the health sector where needs can change quickly over time, and the cost of handling inappropriate assistance.

7. The key role of voluntary bodies in preparedness and response.
   - Participants requested capacity building in supplies management and logistics and requested additional support in these critical areas from UN systems’ agencies, including WHO.
   - They noted that effective supply systems and logistics are key to efficient disaster management. At times of major disasters, adequate logistic support must be made available through external assistance—through WHO serving as the health arm of the UN system.
   - When external assistance reaches a disaster-affected country, it should be managed through a participatory structure that involves representatives from both the recipient and donor communities. This is particularly relevant for actions in the health sector where needs can change quickly over time, and the cost of handling inappropriate assistance.

8. Donors and donorship.
   - Participants sincerely appreciated the active role of public and private donations in support for preparedness, mitigation and vulnerability reduction, as well as permitting a prompt and comprehensive response to disasters (most notable in the response to the tsunami).
   - Increased funding and commitment from National governments in relation to risk management and vulnerability reduction.
   - The need for benchmarks, standards and codes of practice.
     - Agencies should be helped, by WHO, to agree benchmarks, standards and codes of practice for the health aspects of disaster preparedness and response, as well as for supporting post-disaster recovery. These could be based on the well-known SPHERE standards, and agreement should be taken forward through processes of the global Inter-Agency Standing Committee (IASC).

9. The potential contribution of government military forces and the commercial private sector.
   - Participants sincerely appreciated the active role of public and private donations in support for preparedness, mitigation and vulnerability reduction, as well as permitting a prompt and comprehensive response to disasters (most notable in the response to the tsunami).
   - Increased funding and commitment from National governments in relation to risk management and vulnerability reduction.
   - The need for benchmarks, standards and codes of practice.
     - Agencies should be helped, by WHO, to agree benchmarks, standards and codes of practice for the health aspects of disaster preparedness and response, as well as for supporting post-disaster recovery. These could be based on the well-known SPHERE standards, and agreement should be taken forward through processes of the global Inter-Agency Standing Committee (IASC).

10. Supply systems, communications and logistics.
    - Participants sincerely appreciated the active role of public and private donations in support for preparedness, mitigation and vulnerability reduction, as well as permitting a prompt and comprehensive response to disasters (most notable in the response to the tsunami).
    - Increased funding and commitment from National governments in relation to risk management and vulnerability reduction.
    - The need for benchmarks, standards and codes of practice.
      - Agencies should be helped, by WHO, to agree benchmarks, standards and codes of practice for the health aspects of disaster preparedness and response, as well as for supporting post-disaster recovery. These could be based on the well-known SPHERE standards, and agreement should be taken forward through processes of the global Inter-Agency Standing Committee (IASC).

Adapted from Nabarro (2005), full paper available at http://www.who.int/hac/events/tsunamiconf/final/presentation/en/print.html
strikes. This problem can be exacerbated by the overcrowding in refugee centers, thereby contributing to an increased mortality and morbidity as a consequence of gastrointestinal disease and measles in particular.

All disasters are not acute or sudden. The slow disaster of the AIDS epidemic remains a major problem for aid agencies worldwide. By the end of 2004 an estimated 39.4 million people worldwide were living with HIV/AIDS; 25.4 million of these were in sub-Saharan African countries (United Nations Programme on HIV/AIDS [UNAIDS] & WHO, 2004). Although some evidence indicates that the countries in East Africa are winning the battle against AIDS, there continues to be an increase in AIDS in other countries across the continent. Unlike other disasters, the AIDS epidemic is not strongly related to poverty but correlates with household wealth, thereby permitting adults to maintain sexual networks, which in turn increase the risk of transmission (Shelton, Casell, & Adetunji, 2005). In general, however, acute and slow disasters have the greatest impact in poorer countries, and these countries are more susceptible to disasters in the first place (Davies & Higgson, 2005). For this reason, the primary focus of international disaster nursing is on poorer countries and most nurses involved in aid relief agencies work in such countries.

Disaster response is always influenced by global politics and this often sets the context in which agencies have to operate in. The passing of the Cold War era has resulted in a new world order or disorder that directly affects the provision of disaster relief nursing. Janz and Stadl (2000) point out that NGOs involved in aid relief must demonstrate a more reflective learning style and develop new skills in order to operate in an increasingly hostile and complex world. Described as the “disaster cauldron” by Katoch (2006), it is clear that disasters are highly volatile and complex situations that require highly trained and specialist people in order to operate effectively.

THE GROWTH OF AID RELIEF ORGANIZATIONS

The delivery of humanitarian aid is an attractive and challenging experience for many of the world’s health care professionals. Nurses are drawn to relief aid for a number of reasons. The driving force may be religious, altruistic or of an academic nature. Deployments are usually undertaken under the auspices of an IGO such as the United Nations (UN) or NGOs such as Médecins Sans Frontières. In addition, they may seek employment with organizations such as the International Federation of the Red Cross and Red Crescent, which has a philosophy of complete impartiality. Additionally, there may be a national or cultural focus to the aid-delivering organization. Most Western countries are associated with disaster relief. This, however, is expanding to the Arab countries. Japan as a nation has been striving for some years with a considerable degree of success to become a key player in terms of aid relief and academic pursuit in the field. Aid relief is becoming increasingly culturally diverse.

The roots of the aid “industry” can be traced back to the Swiss national Henri Dunant who following the battle of Solferino in 1859 set in motion the processes that resulted in the formation of the ICRC in 1880 with its distinctive Red Cross insignia. In 1909, 37 IGOs and 176 NGOs were operating worldwide. However, by 1998, there were 260 IGOs and 5,472 NGOs operating. Ryan and Lumley (2000) make two observations regarding this increase: that there is an ever increasing demand and that, until recently, there was freedom to work in a climate of relative safety.

THE CONTRIBUTION OF NURSING

Nursing has a long association with the care of individuals, groups, and communities that experience disasters. Involved at local, national, and international levels, nurses have, with other health care professionals, played a key role in disaster prevention and in the delivery and management of care in disaster situations (International Council of Nurses [ICN], 2001; WHO, 1999). The types of roles nurses may hold range from senior managerial and leadership posts to provision of direct care. Such roles not only exist to assist with the preservation of life and maintenance of health during the acute phase but also in the sequel or recovery phase of the disaster. A critical role is the involvement of nurses in “development work” in countries that are at risk of disasters. This type of work contributes to resilience and capacity building to prevent disasters occurring.

The contribution of nursing to disaster response and preparedness is viewed as being immense because nurses are one of the largest groups of frontline workers within the humanitarian community (ICN, 2001; WHO, 1999). The International Council of Nurses holds the view that:

Nurses with their technical skills and knowledge of epidemiology, physiology, pharmacology, cultural-familial structures, and psychosocial issues can assist in disaster preparedness programs as well as during disasters. Nurses, as team members, can play a strategic role cooperating with health and social disciplines, government bodies, community groups, and non-governmental agencies, including humanitarian organizations. (ICN, 2001, p. 1)
Part V Special Topics

Despite this perception, critical evaluation of nursing’s contribution is scant, with little evidence to confirm that nursing input in disasters at an international level improves health outcomes. Disaster relief is a team affair where nurses contribute to the provision of health care in a multinational and multiprofessional environment. On the one hand, it may seem futile to delineate nursing from other professional groups, but on the other, it is valuable to focus on the unique contribution of nursing to this field. Nurses are the largest group of health care professionals worldwide. They normally have a broad skill base that allows flexibility, adaptability, and creativity to adjust roles and accommodate rapidly changing circumstances. Such attributes are at the hub of working in disasters. As they have the largest numbers worldwide, they also have the largest number of students and thereby provide the greatest future resource for working in disasters.

There is an immediate need for nurses to carry out valid and reliable evaluative studies that explore and document the value of nursing in this field. While there is widespread recognition of the contribution of nursing at an international level to disaster response and preparedness more needs to be done in relation to development of a foundation for nursing science in the field. Nursing knowledge in this field is wholly dependent on personal accounts and literature reviews, which are of interest and value, but do not contribute to providing a quantitative empirical base value (see, e.g., Davies & Brichnell, 1997; Davies & Higginson, 2005; Deeny & McFetridge, 2005).

Conducting nursing research during disasters is not easy. There are ethical issues associated with research involving vulnerable groups. Lavin (2006) refers to the difficulties with the HIPAA Privacy Rule in the United States and points up some important legal and ethical issues associated with research in disasters. Our experience of facilitating research programs for Master’s degree students means that small qualitative studies are the easiest to manage. Interviews, focus groups, and ethnographic methods are the most common methods used and are the easiest to employ when seeking access to another culture and wishing to speak to people who are vulnerable.

Sorting out the ethical issues in relation to conducting research in disasters is a worthwhile starting point. Ownership of data can be an issue. If data are collected in a community that has just experienced a disaster, the data belong to that community. They should have first call on the dissemination and implementation of findings. Just as in mainstream health care research where participants in the form of patient groups are heavily involved in research so too should be the case in disaster research. Nurses are in a prime position to develop this process whether they wish to use an action research approach or carry out projects that are immediately applicable to the communities in which they work. Many nurses are closely involved with vulnerable communities in disasters and could develop the science at the point of practice where it is most required. Although empirical work is scarce at present, it is only a matter of time before nurses carry out empirical studies that contribute to knowledge about nursing in disasters.

DEVELOPMENT OF AN INTERNATIONAL NURSING WORKFORCE

Growing global instability has resulted in changes in the nature of international disaster relief efforts. The work effort in disaster relief has increased in its intensity and demand along with a serious increase in risks to the personal safety of international workers. These changes mandate that the preparation of health care workers (in this case nurses) needs to be as comprehensive as possible. It is essential that the individual be as prepared as possible for eventualities that may arise in what may be a potentially volatile and unpredictable environment. Equally, it is essential that the deploying nurse does not become a burden on his or her fellow workers in times of hardship and stress.

Until recently the preparation for nurses undertaking international relief work was facilitated solely by the employing agency and often in isolation from other agencies deploying to the same area. These courses of preparation are of short duration and concentrate on team building and special role activities. Many of those participating in the past were doing so as “to do their part” and considered it a short-term assignment. With the plethora of aid agencies now in place there has been identified a clear need to ensure that there is comprehensive preparation of nurses undertaking this kind of work as a long-term career option and to ensure professional development in the area. Career development in disaster relief nursing requires a solid academic preparation as well as practical preparation and many agencies now require Master’s level qualifications.

CULTURAL AWARENESS AND SENSITIVITY

When responding to a given disaster of any kind, the need for predeployment intelligence is absolutely crucial if the response is to be in any way meaningful. Of particular importance is the need to have a strong understanding of the culture and cultural norms of the population the disaster response aspires to aid. Due cognizance must be given to the hierarchical structures within communities and the role of gender. To ignore these issues is to court failure. It may be that a traditional needs...
assessments as undertaken from the Western perspective with Western disaster responses is not what the population either wants or is willing to accept. This is undoubtedly challenging to the Western practitioner but to respond in a culturally sensitive and community-focused way is to respect the culture within which the work is to be undertaken. Any interventions are far more likely to be successful if designed within the cultural norms of the community that is affected. Disaster nurses are much more likely to gain support for their efforts by working with the traditional health care providers within the population.

Involvement of significant personalities within a community from the outset will ensure a positive attitude in the recipients of the given response. The aim must always be to empower giving as much ownership of the response to the local community rather than adopting a paternalistic stance. At the completion of the disaster response, relief workers and other health care providers will leave, and the community will need to become self-sufficient and sustain the gains that have been made. It is not acceptable to create dependent communities as has happened in the past only to abandon them to their fate at the end of a given period of time.

A further critical appointment that needs to be made in any area where there is a language difference is that of interpreter. An interpreter is very different from a translator and a clear distinction must be made. A translator is a person who merely states words from one language to another; the interpreter not only conveys words but also adds context and meaning to the words that can be crucial in a culturally sensitive environment. Consider the meaning of the word “terrorist,” for instance; this is a culturally defined term dependent on the country one is located in; for one person’s terrorist may be another’s “freedom fighter.” Individuals may consider humanitarian aid to one population or community as preferential treatment. A skilled interpreter can make a very powerful difference when conveying meaning, context and appropriateness of the discourse with enhanced communication as an outcome.

The importance of predeployment education and training must be addressed. Most NGOs run in-house preparatory training, which are agency and often mission specific. However, in a world where nurses are pursuing a full career in the provision of aid there is a need for career development that meets both employment and academic development needs. Such programs should be multicultural and multinational in order that those students can experience cultural diversity and its complexities. This experience then can be transferable to the field to positive effect. There is a need for a physical component to the preparation as often-deployed personnel have to live and work in some very harsh and hazardous conditions, where teamwork and mutual support strategies are essential to group harmony and well-being. Survival and coping strategies for living in hostile environments are also valuable and should be included in all training programs.

**ETHICAL ISSUES IN DISASTER RELIEF NURSING**

Awareness of the ethical underpinnings of aid relief is critical if nurses wish to participate in such work and be effective in the long term either as practitioners in disaster relief health care or advocates for individuals and communities who experience disaster. Nurses in all parts of the world normally have a focus on the care for individuals, families, groups, and communities and should be accustomed to the ethics underpinning such work. Normal working ethics associated with respect for persons, confidentiality, veracity, fairness and justice that have now to be applied in a culturally complex world (see Rowson, 2006) are also applicable in disasters. However, health care in disasters not only requires practitioners to continue with their normal ethical practice but most importantly they must be able to modify it to suit the challenge of the environment. Providing health care in a disaster situation especially in another country is unlike the normal day-to-day environment at home. Disasters are complex and demanding situations that nurses may not have experienced before. There are issues over fair distribution of aid, triage, and prioritizing need, and, most importantly, the whole presence of an international aid relief team in a country outside their own is an ethical issue.

To ensure effectiveness and even survival, it is critical that nurses dispense with naivety that aid relief is only about being altruistic and caring toward those who have experienced loss because of disaster. Aid relief is principally a political action undertaken by those who have resources to help those who do not. Arriving in another country or community with resources in the form of food, water, sanitation facilities, medicine, knowledge, and skills has both cultural and economic impacts. It is critical therefore to ask, “Why are we here?” “What do we want to achieve?” It is necessary to reflect on the many reasons why an individual nurse decides to participate in disaster relief. This may include religious beliefs, past experiences, family history, or self-esteem issues where the individual craves the social recognition. It is important to answer the question fully and be honest, otherwise the ethical tensions experienced in the disaster situation will be more difficult to deal with and may result in difficulties with relationships at all levels. This process of reflection should not be limited to individuals but extend to teams, organizations, and even governments. There is little point in participating in aid relief if the communities and nations who receive...
the aid do not benefit in the long term. Preserving dignity is about respect and tolerance for all elements of life and culture. As with all helping behaviors, aid has the potential to patronize and mitigate dignity. It is this type of ethical awareness that is needed prior to embarking on any mission to provide aid relief to other nations, communities, families, and individuals. This awareness is almost an ethical principle in that it should be considered when making ethical decisions in disaster relief nursing. At its core, however, disaster relief nursing is based on the ethic of being humanitarian. The International Federation of Red Cross/Red Crescent define this humanitarian ethic as:

An ancient and resilient conviction that it is right to help anyone in grave danger. This deeply held value is found in every culture and faith, as well as in the political ideology of human rights. The ideas of the “right to life” and an essential “human dignity” common to all people are framed in international humanitarian law (IHL), human rights conventions and the principles espoused by humanitarian organizations (IFRC, World Disasters Report, 2004)

These values are similar to the values and ethics of nursing worldwide. The International Council of Nurses Code of Ethics (ICN, 2000) emphasizes the centrality of respect for human rights including the right to life and to dignity. Appreciating that those who fall victim to disaster are at risk of losing life and having their dignity compromised or removed it is critical that a full appreciation of the ethics of disaster is accommodated. The IFRC (2004) recommends that in order to apply the humanitarian ethic it is necessary to be neutral and independent. Although nurses irrespective of culture or country should find it easy to accommodate the ethics of humanitarianism, the reality may be very different. Most disasters worldwide are now complex emergencies and are fraught with political, ethical and tribal conflict. In order to display respect for the dignity of all groups it is often difficult to be neutral and independent. Even if an individual nurse or group of nurses claims to be neutral their nationality, flag under which they operate, passport they hold, color of their skin or perceived religious beliefs may place them in a particular box that will not be perceived as neutral.

Walker (2005) discusses the need to reflect upon the Code of Conduct for the International Red Cross and Red Crescent. He outlines that the Code was principally devised for natural disasters and is not as applicable in complex emergencies. In 2004, however, Hugo Slim, the resident scholar and ethicist at the International Federation of Red Cross Red Crescent, proposed five “moral hazards” aid-relief workers should be aware of. These are as follows (IFRC, 2004):

- Complicity in abuses (feeding refugees may help armed factions regroup).
- Legitimizing violations (prioritizing aid over investigating rights violations may encourage a climate of impunity).
- Aid’s negative effect (too much aid may undermine local markets or depopulate areas).
- Targeting and triage (the neediest may be left to die if others can be more effectively helped).
- Advocacy or access (condemning abuses can mean agencies are expelled).

As is the case in all ethical situations, the most important thing is that the individual practitioner is aware of the consequences of action and inaction. A clear understanding that aid is a political action and aid relief has potential to destroy as well as build for the future is important. Awareness especially in complex emergencies of the difficulties with neutrality and independence is very helpful. Most importantly, however, promoting the ethic of humanitarianism not in a naïve way but in the context of full political and cultural awareness is critical. Increased political awareness may come at a price. The case example (Figure 30.1) presents a situation where a nurse who is politically aware prior to getting involved in disaster relief, experiences an issue when he arrives at the disaster. In this case, the political awareness results in an ethical situation that has potential to compromise the mission.

QUALITY ASSURANCE IN INTERNATIONAL DISASTER RESPONSE: THE HUMANITARIAN CHARTER AND THE MINIMUM STANDARDS

Florence Nightingale may be considered to have first introduced the concept of quality and audit into nursing practice when she recorded mortality figures during the Crimean War.

Average rates of mortality tells us only that so many percent will die. Observations must tell us which in the hundred they will be, who will die. Nightingale (1860, p. 124)

The need for financial and business governance has been acknowledged by NGOs for several years. Tandon (1989) states:

The governance of NGOs focuses on policy and identity rather than the day-to-day issues of the implementation of programs. Governance requires the creation of structure and processes which enables the NGO to monitor performance and remain accountable to its stakeholders. (p. 42)
Over recent years, an increasing amount of project evaluation has been conducted. The founding of the Active Learning Network for Accountability and Performance (ALNAP) in 1997 provided a central repository for project evaluations and reports. ALNAP produces an annual report based on the evaluations, and this information should be used to learn lessons from and improve the quality of care and disaster response.

Rosen (2002) argues that a review of working practices is required within humanitarian agencies. It is therefore unsurprising that donors are now demanding an assurance that the myriad of aid agencies delivering humanitarian relief on their behalf are doing so to a recognized and predetermined standard.

A high-quality, effective, efficient, and coordinated response is required to a disaster to ensure the needs of those affected by calamity or armed conflicts are met. It is widely recognized that those affected by disasters have an increased risk of becoming ill or dying from, among other things, diseases associated with inadequate or poor sanitation or water supplies, which are often inevitable following a disaster. Therefore, affected individuals may become reliant on the skills of those involved in humanitarian assistance for their survival (see chapter 10, “Restoring Public Health Under Disaster Conditions,” for further discussion). An initial assessment of the disaster area is therefore essential in order to gain an understanding of the situation or emerging situation, health risks and population needs.

The Sphere Project was launched in 1997 from concerns that the basic human rights of those affected by calamity and conflicts were not being upheld. In 1994,
a multidonor evaluation concluded there were unness-
essary deaths in Goma (Overseas Development Insti-
tution, 1995). This catalyst brought about the Sphere Project. Initially those involved developed The Humanitarian Charter and followed this with The Sphere Project Minimum Standards in Disaster Response (Sphere, 2000) both of which were derived using input from hun-
dreds of experts from 228 aid agencies from 30 Coun-
tries. Input to the second edition (2004) included input from 400 agencies from over 40 countries. Sphere’s standards have been described as forming the basis of a quality assurance system (Stockton 1999), making it possible to gauge the quality of humanitarian responses. This represents a giant step toward en-
hancing accountability and quality in the humanitarian sector.

The purpose of the Humanitarian Charter and the Minimum Standards in Disaster Response was to improve the effectiveness of humanitarian assistance initiatives, and to increase the accountability of interna-
tional agencies, and arguably even the donors par-
ticipating in humanitarian efforts. The charter and the standards are based on the belief that first, all possi-
ble steps should be taken to alleviate human suffering that arises out of conflict and calamity, and second, that those affected by a disaster have a right to life with dignity and therefore a right to assistance (The Sphere Project, 2000). There is a common belief that all possible measures should be taken to alleviate human suffering arising out of conflict or calamity. The principle of a right to a life with dignity is drawn from the UN Charter and the Uni-
versal Declaration of Human Rights. Life with dignity is a fundamental human right, however, individuals and cultures may have different perceptions of what this concept means. Nurses must therefore, participate and collaborate with local representatives of the community to ensure understanding and cultural compliance.

The humanitarian charter is committed to achieving a quality service and encourages both agencies and gov-
ernments to adopt such standards. Standards have been drawn up to ensure adequate supplies of water and to minimize the spread of disease, sanitation, vector con-
trol, and management of waste and promotion of hy-
giene (see chapter 10 for further discussion). Addition-
ally Sphere minimum standards arguably demonstrate the minimum level of assistance required for all people at any time. Achievement of the minimum standards can, however, depend on a range of factors sometimes beyond the control of the agencies (e.g., environmen-
tal factor). A need for such a strong focus on stan-
dards has been questioned when grave issues such as lack of access to populations or gross violation of pro-	ection persist. Sphere has argued that such standards were initiated for the purpose of improving quality and accountability of a humanitarian response. Griekspoor and Collins (2001) are critical of the Sphere standards because they are reliant on unhindered access to ad-
equate resources and that trying to adhere to preset standards when the need is overwhelming could lead to inappropriate planning. Therefore, although there is a commitment to quality, their scope and limitations have to be recognized. The Sphere Project’s evaluation of the first edition recognized some of its limitations and has included the following in the second edition:

- Children
- Older people
- Disabled people
- Gender
- Protection
- HIV/AIDS
- The environment

Nurses are one of the largest groups in the frontline within the humanitarian community especially in the health care arena. They, as highly skilled professionals, have a vast contribution to make in relation to quality assurance in international disaster response especially with respect to knowledgeable, effective, efficient use of resources and as educators and promoters of health. Evaluation of the effectiveness and quality of any con-
tribution is important for overall quality assurance and improvement in aid relief worldwide. Continuous qual-
ity improvement and quality assurance are key to ensur-
ing accountability for efficient and effective delivery of humanitarian aid. Nurses are ideally placed to influence and monitor these two processes.

**COMMUNICATION AND TRANSPORT AS MAJOR OBSTACLES TO RELIEF EFFORT IN INTERNATIONAL DISASTERS**

It is common for a disaster to affect more than one coun-
try at a time, or to cross borders. Disasters that involve multiple nations create additional obstacles that must be effectively addressed in order for humanitarian efforts to be successful. The two primary obstacles faced by disaster relief professionals are those of communication and transport. The success or failure of the communica-
tion and transport systems in any disaster response will influence the overall outcome of the relief effort. In the developed world high-tech communications systems are often ineffective in disaster situations. Equally, in the de-
veloping world, communication and transport may not have existed in the first place. Irrespective of location, disasters will result in communication and transport dif-
ficulties. Those involved in disaster response must al-
ways have a well-thought-out and easy-to-use commu-
nication and transport plan.
The physical size, location, and geography of the countries affected by the disaster may also contribute to transportation hardship. Some types of disasters (such as floods, hurricanes, and earthquakes) physically disrupt roads, bridges, tunnels, and railway lines. Transportation needs include movement into the situation (human resources, supplies, and equipment) and movement out of the situation (moving victims away from chemical or radiation disasters). International environmental disasters occurring with nationalities at war pose even larger challenges as conflicting members of the society may limit transportation, making the safety of those involved an additional consideration. Natural disasters such as famine may result in thousands of people migrating from one area to another.

It is therefore essential that expertise is available and appropriately tasked to undertake a command and control role in ensuring that there is a coordinated and focused response. It is essential to ensure that those involved in the relief effort are appropriately trained in the use of a wide variety of communications systems and can use with confidence accepted protocols for passing information accurately, for example the International Phonetic Alphabet.

Few areas of the world do not have the capability to use mobile phones; they are small, compact, easy to use, and easy to recharge from mains or vehicle batteries. However, there is a need for caution because mobile phones can be expensive and more crucially difficult to secure; that is, transmissions can be monitored. This may be a critical factor in some areas where security is a high consideration. Both high frequency and very high frequency radios are efficient but primarily rely on line of sight or atmospheric conditions being suitable. High frequency can be made more efficient by utilizing a system of unmanned relay stations although this may not be possible in remote or security compromised areas. E-mail, teleconferencing, and telemedicine are all systems that can greatly help with personal survival equipment are essential additional items.

Types of vehicles that may be locally procured in frequent remote areas. Drivers must be capable of driving heavy manual vehicles often without the benefit of power steering and many of the accessories that are standard in the developed world. The ability to maneuver such vehicles over difficult and sometimes hostile territory is an essential skill as is the ability to recover vehicles should they go off the “road” (road here means anything from a track to a formal road).

It is important to have a co-driver who acts as navigator, even in vehicles well down the line, as the movements of the lead vehicle also have to be checked. Co-drivers can assist the driver, help prevent mistakes when driving under pressure and provide relief when battling fatigue. The temptation to fill a vehicle to the maximum capacity may well be laudable; however, other considerations need to be made in the use of available space. Vehicles must be maintainable on the journey; therefore, a comprehensive range of spares and accessories must be carried as well as the tools to implement essential repairs. Modifications may need to be made dependent on environmental conditions such as snow chains or sand tracks, heating or air conditioning (if available and fuel allows). Replacement automotive parts can prevent a roadside breakdown. Adequate amounts of fuels and lubricants, at least two spare tires that are functional and in good order should be brought along. The driver must have the capability to change them if required. This is often a major undertaking with large vehicles. Maps, compasses, torches, first aid kit, rations, water and personal survival equipment are essential additional items.

There are challenges to ensuring that an effective communications and transport plan is in place and operating to potential. A great deal of effort and cost is required to ensure that this takes place. Poor communication and a less than timely arrival of transport carrying essential aid can seriously compromise the credibility of the organization involved (see Figure 30.2).

The issue of personal safety when deployed in response to a disaster is highly important. It is evident from the numerous kidnapings over recent years that the symbols that once gave at least some semblance of protection are no longer respected as such and it could be argued to accentuate the risk to the wearer. Predeployment training must be given to address the issue of personal security that is country/region specific as there is clearly no one training package that fits all scenarios. Post-9/11 there has been a shift in the paradigm where the military were seen as deploying in order to create the so-called “humanitarian space” within which humanitarian actors; that is, the NGO organizations could operate in some safety to a state of affairs where the risks are inherent to all regardless of philosophy, mandate,
or mission. As Wheeler and Harmer (2006) point out, there is also the issue of private military firms (PMFs) to consider. It is clear that there is a proliferation of such organizations working to contract in areas such as Iraq. The use of PMFs is somewhat controversial. They may support military operations, they may be used to support infrastructure development, and they may also be employed to provide security to humanitarian organizations. This raises the question of neutrality (if one believes this is possible) and impartiality given that the PMFs operate under contract.

CARE OF DISPLACED PERSONS OR REFUGEE POPULATIONS

Individuals, families, and communities are often forced to leave their homes or their country as a result of disaster or the threat of disaster (UNHCR, 2006; WHO & UNHCR, 1994). Internally displaced people (IDPs) is the term used to describe individuals who are displaced within national boundaries. The term refugee is used to describe an individual who is displaced and moves across a national boundary. This distinction is very important. Refugees have a right to receive international protection, whereas IDPs remain the responsibility of the home government. The United Nations High Commissioner for Refugees (UNHCR) has legal responsibility for refugees not IDPs (see UNHCR, 2006). Aid organizations can help in situations where populations are displaced within national boundaries but this is often random and inadequate (Médecins Sans Frontières, 1997). Negotiations with host governments or sometimes local authorities can be more difficult in the absence of UNHCR. Nurses who work in aid organizations or indeed local nurses must be aware of the distinction between the terms “IDP” and “refugee.” It is suggested that IDPs are more vulnerable due to the absence of international protection (Médecins Sans Frontières, 1997). UNHCR currently cares for 19.2 million people in all corners of the world and in all types of situations (UNHCR, 2004). Since the end of the 1960s most refugees have originated from countries in the southern hemisphere (Médecins Sans Frontières, 1997; UNHCR, 2004). The mass population movements often associated with sub-Saharan Africa during the eighties have also occurred in Eastern Europe during the Balkan conflict and more recently in Afghanistan. The images of large groups of displaced people mostly women, children and older people walking on roads or traveling in heavily laden vehicles
are synonymous with disasters worldwide. Being uprooted from one’s community, losing family members and more often than not experiencing intimidation, persecution and rape, result in most refugees being physically and mentally traumatized (Englund, 1998).

The priorities for management of health care in relation to such groups should center on basic requirements such as water and sanitation, food and nutrition, shelter and safety, control of communicable diseases and psychosocial recovery. Organizations such as Médecins Sans Frontières have proposed a top 10 priorities (see Médecins Sans Frontières, 1997). Medically focused, these priorities can be shortened or amended for use by nurses.

Individuals and groups who are refugees may be disoriented and traumatized but may retain their creativity in survival methods. Individuals and communities who experience disasters may have already established coping mechanisms and methods for survival.

Placing the existing cultural sensitivity and meaning of what it is like to experience displacement at the center of care, nurses can modify the Médecins Sans Frontières priorities. These include initial assessment, measles immunization, water and sanitation, food and nutrition, shelter and site planning, life-saving interventions in the emergency phase and maintaining normal social structures required for feelings of security and maintaining psychosocial well-being.

**APPLICATION OF THE NURSING METAPARADIGM AND SELECTED GRAND THEORIES FROM NURSING SCIENCE**

There is a need for ongoing evaluation of all disaster response initiatives. Such work requires that nurses have the necessary research knowledge and skills to formulate evaluation reports. Nurses need advanced research knowledge regarding study design, data collection and analysis, and epidemiological and health services methods. The profession of nursing worldwide requires more publicized qualitative and quantitative research related to nursing in disaster situations. Such science not only improves the overall knowledge base for nursing but also contributes to the required multiprofessional approach to disaster response and preparedness.

The nursing metaparadigm of the person, health, the environment, and nursing (Newman, 1983) provides a useful starting point for a discussion on the application of nursing grand theories to any field of nursing. The knowledge base for international disaster nursing is not well developed and requires a framework to orient growth. Not meant to be a confining framework, the metaparadigm provides orientation to the key concepts and helps practitioners with identification of parameters related to accountability. In other words, it helps nurses delineate their work from that of other professional groups.

Teamwork is central to all international disaster relief efforts. To provide focus for accountability it is necessary to be clear about what nurses need to know in order to function and be effective in disaster relief teams. Frequently disaster situations will require nurses to expand their practice parameters beyond what they had traditionally considered nursing practice. Certain situations demand additional responsibilities so that the nurse becomes the doctor, the engineer, or the nutrition expert by proxy. There are many health care situations where nurses do a little piece of everyone else’s work in order to ensure completeness and continuity of care. The same applies in the disaster situation.

Nurses need advanced research knowledge related to disaster response and preparedness. Through focusing on the key concepts of person, environment, nursing, and health as applied to disasters, nursing has contributed to the field of nursing knowledge related to disaster response and preparedness. Through focusing on the key concepts of person, environment, nursing, and health as applied to disasters, nursing has a template for knowledge development and for the advancement of nursing science as applied to disasters.

**SELECTION OF APPROPRIATE MODELS OR GRAND THEORIES**

There may be a need to consider the application of selected models or grand theories of nursing in order to provide further philosophical orientation on the application of the concepts of person, environment, nursing and health. Models should contain all the variables of the subject matter (Meleis, 2005) and are valuable in the identification of what should be included in the nursing situation. Metzger-McQuiston and Webb (1995) in the foreword to their book on *Foundations of Nursing Theory*, point to the value of nursing models as having the potential to develop a critical self-consciousness. In this sense, they should be valuable in order to provide further clarification of nursing in this situation. Models or grand theories provide an orientation to particular philosophical perspectives on the key concepts but it is difficult to accept or even propose that they help to describe all the concepts in the nursing situation.

Deciding which model is most appropriate has to do with selection; however, a combination of models that capture the key elements of nursing in a disaster situation may be adapted and applied. Empirical investigation is then required to determine if the model matches reality. When selecting appropriate models or grand theories it is possible to select any theory and apply it to
nursing in disasters. The authors suggest Nightingale’s, Leininger’s or Neuman’s (see Metzger-McQuiston and Webb [1995] for detail on these theories) as being appropriate but really it is a matter of choice.

Nightingale’s theory is highlighted in this chapter because of the context in which it was developed. The watershed event in Nightingale’s thinking about nursing was her experience in the Crimean War (Selander, 1995). The Crimean War was a human-generated disaster of significant proportions. Nightingale’s focus on the environment and the need to modify factors in the environment in order to facilitate healing and recovery can be applied to nursing in disasters. The environment in the disaster situation contains many risks (hazards) that may cause further harm to victims and nurses. Disaster nursing focuses on these threats to the environment and develops approaches that reduce risk.

Leininger’s theory may also be applied to nursing in disasters. The explicit assumption in this theory is that care and culture are inextricably linked and cannot be separated in nursing actions and decisions. Provision of nursing care required to recover and a feeling of compassion are key components. Leininger’s Transcultural Health Model may be applied to nursing in disasters as it provides a guide for the study and analysis of variables within cultures in order to gain a transcultural health perspective. This philosophy will aid nurses working within disaster areas to gain insight into cultural diversity and then build on this knowledge in the pursuit of nursing practice that is holistic and tailored to the needs of specific ethnic groups or subgroups within a population. Identification of existing cultural care patterns and facilitating such patterns to achieve full potential are key to the application of Leininger’s philosophy. Recognition of these cultural care patterns requires that the nurse act as an ethnographer immersed in the culture to learn about the ways in which the community deals with stress and implement care patterns (see Leininger [2002] for further details of the model).

Neuman’s Systems Model offers a valuable perspective in the context of nursing in disasters. This model is considered a systems model with the main focus on interactions of the parts or subsystems. A series of concentric circles surround a core such as the community at risk from a disaster. Each line of defense has certain properties, but the main function is to protect the structure and help maintain a stable state. If the community at risk is viewed as the client, the basic structure includes resources for survival. Concentric rings around the basic structure form the basis of resource protection of the system. This could be viewed as structures that are already in place for example community emergency plans (see Neuman [1982] for further details of the model).

The nursing grand theories are particularly relevant when it comes to deciding on a conceptual framework for a research study. Not only does this ensure that the researcher is operating within the key pillars of nursing knowledge as defined by the nursing metaparadigm but also a grand theory will provide clarification on the interrelatedness between concepts. In the case example (see Figure 30.3) the nurse is a postgraduate student who wishes to carry out a research project when she is on an aid relief mission. While doing research alongside working in disaster situations is a major challenge it can often be combined with the particular role that the individuals has in the disaster situation.

SUMMARY

Because of inequities in the distribution of global wealth, for some the consequences of disasters are of a magnitude that cannot be dealt with unless there is a timely and appropriate response from outside agencies. The scale of disasters slow and acute threatening the developing world is outstripping the capability for response. This is despite the exponential growth in NGOs and international groups providing aid. Disasters are becoming more complex and in many cases highly volatile situations. There is a need for an acute awareness on the
part of all who participate in disaster relief of the ethical underpinnings, cultural and political issues, transport, communication and personal security issues associated with disasters. Although a significant nursing presence in disaster response worldwide exists, there is a paucity of empirical evidence documenting nursing influence on health outcomes. Clearly, there is a need for robust preparation of nurses that is both theoretical and practical and this should be underpinned by empirical evidence about nursing in disasters. Such preparation must equip nurses to meet the holistic needs of nations, communities, families and individuals who fall victim to disaster and require support and education to recover and build resilience to mitigate future disasters.

In a multinational/multicultural setting, there is a defined need for cultural awareness to be at the forefront of any disaster response. A community focus as opposed to a medical focus is recommended if the key concepts of the nursing metaparadigm are to be realised in the disaster situation. Nursing grand theories can be applied to a disaster response and may facilitate accountability and evaluation of the unique contribution of nursing to disaster and require support and education to recover. Nursing response needs to be evaluated in a more rigorous fashion with findings distributed widely in order that nursing science related to disaster care is expanded and utilized.

STUDY REVIEW QUESTIONS

1. Identify the 10 most affected countries by natural and human-initiated disasters in the past year. Examine the perinatal mortality and GDP of these countries. What are your conclusions?
2. Select a recent paper on the management of health care in disaster situations and determine how nurses contribute to the overall relief effort.
3. Reflect on how you would cope in a disaster situation as a health care professional. List the major difficulties and advantages associated with working in multinational teams in disaster situations.
5. Explain the importance of cultural awareness and cultural considerations in planning care during a disaster response.
6. Identify an ethical issue that you are likely to encounter in a disaster situation.
7. Select a recent complex human emergency in a country or group of countries. Write a short plan on how you would set about organizing a team of nurses to go and assist. Go to the World Vision http://www.wvi.org/wvi/home.htm, CARE http://www.care.org/ or Islamic Aid http://www.islamicaid.org.uk/ Web sites. Find out how you can assist. Concentrate on the transport and communication difficulties, cultural issues, and ethical issues. When you arrive in the host country you are faced with assisting, the local nurses establish a health care facility for a large refugee camp. Outline how you would organize your team in the first 72 hours. Concentrate on achieving the minimum standards for humanitarian relief and remain focused on accountability for nursing and personal security.

REFERENCES

ALNAP Secretariat, Overseas Development Institute, 111 Westminster Bridge Rd, London SE1 7SR, UK, Tel: +44 (0) 20 7922 0000; Fax: +44 (0) 20 7922 8399; e-mail: alnap@odi.org.uk.
Key Messages

- The role of the public health nurse (PHN) in an all-hazards event must be recognized and understood by all partners within a multidisciplinary emergency response team.
- The guiding principles of public health nursing practice are well suited to the role of the public health nurse in a disaster.
- Public health nurse leaders must be a part of the disaster planning process to assure the efficient, appropriate use of the skills that PHNs bring with them.
- Public health nurses’ clinical skills in identifying WMD/CBRNE agents in the field may be greatly enhanced through the use of simulation technology and repeated field-scenario drills and exercises.

Learning Objectives

When this chapter is completed, readers will be able to

1. Discuss the role of the public health nurse within a multidisciplinary emergency response team.
2. Understand the basic tenets of public health nursing and their application to practice during a disaster.
3. Describe existing population-based resources the public health nurse can use to assist the victims of all-hazards incidents.
4. Explore the use of human patient simulators and desktop simulation software as a tool to further develop clinical assessment and communication skills during an emergency.
5. Recognize the need for the continued development of a public health nursing workforce as the best way to assure compassionate, competent care of disaster victims, their families, and the community-at-large.
The Role and Preparation of the Public Health Nurse for Disaster Response

Joy Spellman

CHAPTER OVERVIEW

The rich history of public health nursing illustrates the enduring contribution nurses have made in responding to disasters and aiding communities in their recovery process. Public health has always been about protecting and promoting the health of entire communities. From the time Florence Nightingale walked the halls of the wards at Scutari, public health nurses (PHN) have used their skills of assessment, intervention, and evaluation to improve health outcomes. Their influence has contributed to the development of local, regional, state, and national policies that have positively affected the lives of countless individuals. Today’s public health nursing workforce continues in the tradition embodied by Nightingale, delivering services to assure that community members have access to preventive care, immunizations, safe food and water, and contact with needed services that may fall outside of medical needs.

INTRODUCTION

The need for effective terrorism preparedness, encompassing chemical, biological, radiological, nuclear, and explosive (CBRNE) agents, has placed new demands on the PHN. To continue in the tradition of assessment, assurance, and policy development, new skills must be developed relating to CBRNE events.

A well-trained frontline response will reduce the impact of an emergency event. While nurses in all specialties of practice are a considerable part of this response, PHNs in particular will need to make critical on-site decisions that will impact the victims and acute care institutions that must receive them. The tragedy that unfolded on 9/11 in New York City, Washington, DC, and the Pennsylvania countryside also brought home the fact that the PHN must be an integral part of a multidisciplinary response team.

The provision of comprehensive public health services is critical to the nation’s health and well-being, and to homeland security and defense. Directing mass immunization programs, assessing the immunization needs of school-aged children, identifying infectious disease threats and delivering treatment are public health
challenges in their own right. Following the October 2001 anthrax attacks and the increase in emerging infectious diseases such as severe acute respiratory syndrome (SARS) and West Nile, it became necessary to add new skill sets in order to respond to events in the prehospital arena. Since an inherent characteristic of a terrorist attack or naturally occurring threat is its unpredictability, the challenge has now become to identify an effective way to educate, train and engage PHNs to raise their competency level through the acquisition of new clinical and improved communication skills.

The Centers for Disease Control and Prevention (CDC) has classified biological and chemical agents of foremost concern to the nation’s health (see chapters 21 and 25 for further discussion) and has provided many resource materials in an attempt to help health care responders become more familiar with unusual illnesses and their respective sequelae. PHNs and emergency responders can benefit from these resources in preparing for response; however, without practice in dealing with the consequences of such incidents, they may still voice concerns about their ability to respond safely during a real event. Human patient simulators are being used in a variety of field hospital settings as well as in full-scale scenario-based exercises to sharpen clinical assessment skills and strengthen critical decision-making abilities (Figure 31.1). Building training scenarios that include CBRNE agents improves response capabilities and generally elicits enthusiastic participation on the part of the nurses. Simulation has also afforded the opportunity to drill entire response teams, allowing them to practice working as a cohesive group. Through regularly scheduled training activities, PHNs can maximize their contribution in an emergent event.

THE UNIQUE CONTRIBUTION OF THE PUBLIC HEALTH NURSE

In the years since the tragic events of 9/11, consistent efforts have been made to educate nurses to be better prepared to respond to disasters and public health emergency events. Various disciplines within nursing are developing new clinical skill sets designed to address the biological, chemical, and radiological threats that responders could face. In an emergency response effort, PHNs must continue their commitment to promote the broader health of the communities they serve. Public health nursing draws on a wide variety of disciplines to adopt a population-based perspective on disease (Figure 31.2).

The PHN is called on to “protect the health of populations using knowledge from nursing, social and the public health sciences” (American Public Health Association, 2003). Building partnerships within their community, the PHN assures ongoing access to the resources necessary to maintain the health of the public they serve. It is important to be familiar with the three principles of public health nursing as they will be referred to throughout this chapter. Through assessment, problems or gaps in service are identified. The PHN applies a broad-based clinical knowledge and an in-depth understanding of their district or region to the assessment process. Collaboration with other agencies and individuals to address the needs of the public will help in assuring that the identified gap in service is filled. With the successful implementation of new programs that have a positive effect on the residents, policy development can ensue. These policies may be adopted within the health department or have a broader application. The PHN uses skills to advocate for their district by working with elected officials to institute change. These tenets of public health nursing practice make the PHN well suited to perform effectively in an emergency event.

Historical Perspective

Lillian Wald recognized public health nursing as a distinct discipline within the profession as early as 1915.
Miss Wald first used the term *public health nurse* in 1893 to describe those nurses who practiced in the community (Association of State and Territorial Directors of Nursing, 1999). One can, however, look further back to the years when Florence Nightingale used her skills of patient assessment to improve hospital care for Crimean War casualties. Drawing on observations of incidence and mortality, her written reports to the War Department in England resulted in meaningful hospital reform. Nightingale’s commitment to evidence-based decision making and her understanding of the broader environmental context of health (Nightingale, 1859) helped cement the role of epidemiology in public health nursing practice (Figure 31.3).

McDonald (2001) notes that Florence Nightingale practiced evidence-based nursing 150 years ago. Her actions embodied the principles of *assessment*, *assurance* and *policy development* and laid the groundwork for modern public health nursing. Nightingale’s dedication was recognized by the establishment of a statistics department at a London college for the purpose of tracking disease patterns among hospital patients.

**Figure 31.3 Early public health nurse.**

The current increase in the need for public health services comes at a time when the national public health infrastructure has been weakened by years of financial neglect. While the public health workforce has always provided for community disasters, the level of preparedness called for by the terrorist attacks on 9/11 necessitates training on a new and different level. The times in which we now live make it imperative that public health nursing keep pace with the demand for skills in the disaster and emergency response arenas.

The public health workforce is estimated by the Centers of Disease Control and Prevention (CDC, 2002a,b) to number some 500,000 professionals, with nurses making up the largest percentage of that group. The CDC has charged the workforce to develop and implement community preparedness activities as well as to assure increased competency for practitioners responding to a disaster event. Levy and Sidel (2003) state that it is essential to respond to the emergency at hand while continuing to address the existing public health concerns present in the district. PHNs have done just that in New Jersey. In 2001, the discovery of anthrax-laced mail processed through a large postal center in suburban Trenton resulted in a large-scale investigation and the closing of that facility. While conducting surveillance activities and answering the questions of thousands of concerned Trenton residents, the public health nursing staff at the local health department continued to hold child health clinics, audit school immunization status records, run mass immunization clinics, and see to it that pregnant women had proper prenatal care.

PHNs are a recognized and appreciated part of their communities. Like all branches of nursing, they benefit from an established history of public trust. With their expertise coordinating and implementing large-scale programs that address the needs of the community, PHNs are well positioned to assume a leadership role in a disaster response.

**ROLE OF THE PUBLIC HEALTH NURSE IN A DISASTER**

The Public Health Security and Bioterrorism Response Act of 2002 authorized the spending of $4.3 billion to improve public health preparedness and strengthen infrastructure. This act focuses on three components necessary to fight bioterrorism: detection, treatment, and containment (ANA, 2003). Employing the art and science of nursing with established public health sciences, that is, epidemiology, statistical analyses, and incident response and management, PHNs are prepared to do the following in an emergency response effort:

- Assess the needs of the community (including special populations) as the event unfolds based on the information available.
- Conduct surveillance activities within the health department as well as in cooperation with in-hospital infection control practitioners to control the spread of communicable disease.
- Assure the health and safety of themselves as well as their fellow responders.
- Maintain communication with local, state, or federal agencies, assuring the accurate dissemination of information to colleagues and the public-at-large.
- Operate points of distribution (POD) mass prophylaxis centers as needed.
592 Part V Special Topics

- Provide on-site triage of victims as needed.
- Maintain nursing documentation throughout the event.

During a white powder incident at another New Jersey post office in the autumn of 2004, the public health nursing director at a large county health department learned firsthand how important the role of the PHN is in dealing with the worried well and establishing the necessity of a nursing presence at a disaster site. Although one worker was transferred to the hospital based on her physical response to the questionable agent (it was later determined that she was allergic to the caffeine contained in the substance), 86 employees working the shift were confined to a parking lot adjacent to the sealed-off facility. Building on the public trust mentioned earlier, the director of nursing sent a team of nurses from the health department to meet with the detainees and answer their many questions. Each postal employee was given contact information for a hotline manned by PHNs and encouraged to call. As media coverage intensified, so too did the number of calls. Within 5 days of the incident, 467 calls were answered by the nursing staff. The director of nursing, also on site, established herself as part of the management team as well.

Every disaster response begins on the local level. This public health nursing response was effective because of the existence of a known and tested emergency plan. To assess real-world effectiveness, every plan must be tested before it is put into widespread use. Preliminary steps to be taken to assure the value of a plan may include:

- PHN leadership within an agency must insist on being included as key players in the planning process. Resource identification is an essential part of disaster planning. (Veenaema, 2003) and since the PHN is an acknowledged expert in resource allocation, her inclusion in all aspects of the planning process is crucial to the success of the plan.
- Many agencies respond in the positive when asked if their agency has an emergency plan. To enact it, however, its contents must be shared, discussed, revised when necessary and exercised repeatedly with those staff that will be called on to respond in a disaster. Since each agency determines the role that the PHN will assume in an emergency, it is essential to review and discuss the contents of the plan on a regular basis. This is not a static document and must be amended as the community or agency itself changes.
- The prevention and control of the spread of disease is a significant part of public health practice. A yearly review of the agency’s blood-borne pathogen policy is advisable. PHN infection control specialists conduct at least yearly in-services for community organizations, many of whom are part of the first responder team.

- With the distribution of federal dollars to promote preparedness activities, health departments have purchased and stockpiled personal protective equipment (PPE) for their team members. The ability to quickly locate and properly use the PPE necessary to protect staff when needed is just as important as having access to the department’s emergency response plan. For optimum protection, fit testing should be conducted on a regular basis. The nurse must be included in all demonstrations of proper use of personal protective equipment to assure her ability to use more complex apparatus. (See chapter 26 for further discussion.)
- Participation in these demonstrations and meetings is an excellent and nonthreatening way to introduce the PHN as a member of the response team. It is imperative that all nurses, no matter where they are practicing at the time of a disaster, are aware and accept that they must first protect themselves in order to be effective in an emergency response. Only by assuring their own safety will the PHN be able to calmly assess, evaluate and communicate the status of the field operation. Individual Go-Kits can be assembled by health agencies and distributed to their PHN staff for storage in their automobiles, thereby ensuring a swift response in the event of a disaster.
- As nurses, the mantra, “If you do not document it, it did not occur,” also holds true in a disaster response. Recognizing that the PHN will not be charting, per se, as she moves through the scene, the PHN should carry a small pocket notebook to jot down observations if possible. A multitude of field-disaster documentation systems are currently on the market for rapid triage, documentation, and teletransmission to the receiving hospital. Referring again to the white powder incident detailed previously, a nurse educator was identified to circulate among the responders and serve as the conduit for accurate information. The PHN responders also provided clear, detailed clinical information as needed. Of utmost importance for assuring accurate communication between on-site personnel and the treatment facility is the use of a clinician to update all responders continually. Upon arrival at the post office affected by this event, a postal manager reported that he had spoken with the emergency department (ED) physician and that the victim was in “respiratory arrest.” The PHN designated as the communication go-between called the doctor herself to confirm the information supplied and was told that the injured party was admitted in “respiratory distress.” Quite a difference. By updating the anxious co-workers with factual information, rumors were effectively squelched and the employees accepted the PHN contingent as a reliable information source. All activity was noted by the nurse communicator for analysis after the incident. Nursing documentation is
an effective evaluation tool in the debriefing process. Without disclosing patient identifiers, the systematic process employed in public health nursing will identify the immediate needs of disaster victims and their families. Interventions will be implemented for this group of citizens who may now be at risk of illness, disability or premature death. Furthermore, nursing documentation will serve as a reliable link in follow-up studies conducted to assess the long term health effects of the causative agent.

After reviewing the long list of questions posed to the PHN staff operating the white powder hotline, this nursing division developed a fact sheet for future use among health care providers in the area. Assessment of the population’s concerns led to assurance that all responders will be better prepared in the future which, in turn, resulted in policy development on a multiagency basis, including the PHN as part of the emergency response team. This is public health nursing in action.

ROLES OF THE PUBLIC HEALTH NURSE
IN A BIOLOGICAL EVENT

The CDC has categorized critical biological agents into classifications A, B, and C. Category A agents, anthrax, botulism, plague, tularemia, smallpox, and the viral hemorrhagic fevers, are seen as those agents with the greatest potential to cause mass casualties. (See chapter 21, “Biological Agents of Concern,” for further discussion.) Categories B and C organisms are mainly composed of emerging infectious threats and existing and regularly occurring biological agents which, if weaponized, will result in widespread illness and deaths. These infectious agents would quickly disable a community and overwhelm the health care system. (See chapter 23, “Emerging Infectious Disease,” for further discussion.) The PHN sees many of these Categories B and C illnesses during day-to-day surveillance of their local area. Salmonella, shigella, E. coli (0157; H7), cryptosporidium, and Hantavirus can be found in nature. Multiple-drug-resistant tuberculosis is seen frequently among health department nurses. PHNs who work in state and local health departments are familiar with all facets of planning, detecting, containing, and responding to an outbreak cause by a biological agent. Through an extensive reporting network, PHNs in every state report any unusual incidence of communicable diseases. Pharmacies report elevated sales of over-the-counter remedies such as cold preparations, antidiarrheal medications, and pain relievers. These reporting mechanisms serve as an early warning system, assisting public health practitioners to begin a local response based on up-to-date evidence. Similar surveillance and monitoring efforts are being contemplated by several states and the federal government. (See chapter 22, “Early Recognition and Detection of Biological Events,” for further discussion.)

Unlike some nurses who specialize in a defined area of direct patient care, the scope of the public health nurse’s practice can extend from community pre-event planning, surveillance and detection, delivering care during an event, to postdisaster evaluation and recovery. This expanded scope of practice is what makes the PHN such a valued and integral member of an effective disaster response team. PHNs are accustomed to infectious disease management strategies, have preexisting collaborative arrangements with other community agencies, are used to working with other health care professionals in primary and acute care systems, and may be familiar with local law enforcement personnel.

The specific role of each PHN during a biological event is a function of national competencies for public health preparedness, state and local regulations, and their home agency’s preparedness plan. Competencies for public health preparedness have been eloquently described in three separate but overlapping categories (Gebbie, 2002). These three categories are (1) core competencies (Council on Linkages Between Academia and Public Health Practice, 2001), (2) public health nursing competencies (Quad Council of Public Health Nursing Organizations, 2003), and (3) specific bioterrorism and emergency preparedness competencies (Columbia University School of Nursing Center for Health Policy, 2002). The overlap of these categories is in the areas of analytic assessment skills, basic public health, communications, and community-based practice; however, most of the competencies apply in some measure to bioterrorism response. The CDC (2001) has endorsed competencies for public health emergency preparedness as well.

Levy and Sidel (2003) have described four overall roles for all health professionals in terrorism and public health. These are (1) develop improved preparedness, (2) respond to the health consequences of terrorist attacks and threats, (3) take action to prevent terrorism, and (4) promote a balance between response to terrorism and other public health concerns. When aligned with the public health emergency preparedness competencies, these four roles create a framework for the public health nursing response to a biological event.

ROLE OF THE PUBLIC HEALTH NURSE
IN POINT OF DISTRIBUTION PLANS

Public health nurses will often be asked to participate in the implementation of local point of distribution (POD) plans. Point of distribution plans are activated (primarily under the direction of the local county medical director) when large numbers of the population will require vaccination or treatment within a short span of time (for
instance, in the event the Strategic National Stockpile is activated. To assist in understanding the PHN’s role in a biological disaster, a prehospital model of practice must be defined:

- Follow agency protocol and report to disaster site or to point of distribution (POD) center.
- Don appropriate PPE (if needed) before approaching site if appropriate.
- Familiarize yourself with on-site non-clinical and clinical responders and establish yourself as a leader.
- Assess the status of patients at a POD and triage them accordingly.

Triage, perhaps the most important part of the role of the PHN in a biological event, will differ significantly from basic hospital daily triage as practiced in an acute care setting. The symptomatic must be moved to a sick bay as soon as possible and transferred to the closest hospital; exposed persons can proceed through the POD to the dispensing station; the worried well may be seen by nonnursing personnel who will give them accurate information and instructions on how to remain informed. In a disaster, however, there are a few changes that need to be made. To maximize patient throughput for a point of distribution or triage station, the normally high level of patient care delivered by the PHN may need to be sacrificed. When speed is of the essence the PHN will try to distribute medications as rapidly as possible but self-screening of citizens (with PHN review) may be used to lighten the burden. (See chapter 24, “Design and Implementation of Mass Immunization and Treatment Clinics” for further discussion.)

As an expert in community resource management the PHN should arrange for the delivery of medications to a site other than the POD so that special needs populations can obtain easier access. If there isn’t time to set up an alternate location, a PHN on the POD premises should be assigned exclusively to assisting special needs populations. For this reason it is especially important to identify special populations when an emergency plan is being developed. (See chapter 16, “Identifying and Accommodating High-Risk and High-Vulnerability Populations,” for further discussion.)

ROLE OF THE PUBLIC HEALTH NURSE IN A CHEMICAL DISASTER

A chemical emergency occurs when a hazardous chemical has been accidentally or intentionally released and has the potential to harm the health of people (CDC, 2002a). Unlike biological agents, which require an incubation period before symptoms appear, a chemical agent, when released, makes its presence known immediately by means of observation (explosion), self-admission (accidental release) or by the presence of rapidly emerging symptoms, such as burns, redness to the affected area, difficulty breathing or convulsions. The CDC has classified chemical agents as nerve, incapacitating, pulmonary, blister-vesicant, blood agents, and biotoxins. (See chapter 25, “Chemical Agents of Concern,” for further discussion.)

In a chemical emergency, the PHN may be called on to do the following:

- Follow agency protocol and report to duty site.
- Don appropriate PPE before approaching disaster site.
- Establish the role of the PHN within the response team.
- Act quickly and assess the status of the victim’s airway. Loosen any constrictive clothing and advise patient to sit upright if possible.

Emergency medical service squads may arrive on the scene with water to assist victims to irrigate their eyes as soon as possible. The PHN may assist in this effort until patients can be transferred to the hospital for treatment.

Gross decontamination may occur at the site of the chemical release. (See chapter 26, “Mass Casualty Decontamination,” for further discussion.) This involves the removal of the outer layer of clothing followed by washing with soap—or at least a water wash. While ambulatory victims may be able to walk through decontamination under their own power, the PHN may be called on to assist those people who are unable to move freely. Those debilitated the most severely will be triaged by the PHN for hospital treatment immediately. The PHN will alert the acute care facility that patients needing decontamination are en route. Most hospitals are able to set up their own decontamination system outside of the emergency room, assuring the safety of those patients and staff in-house.

The PHN manager should brief area hospitals to prepare them for walk-in patients not seen at the accident site. Limited nursing documentation need be maintained for this activity.

Health departments must prepare to disseminate shelter-in-place information to the residents of surrounding areas. A redundant communication system should also be in place so that citizens can be given an all-clear notification when the event has ended and it is safe to go outside.

PHNs must assure their own safety during a chemical event. After leaving the field, however, decontamination should be carried out before returning to the health department or home. In the event of an evacuation of residents, the PHN may be called on to staff a shelter where assessment of the population will be ongoing.
ROLE OF THE PUBLIC HEALTH NURSE IN A RADILOGICAL EVENT

When large doses of radiation are released accidentally (nuclear power plant) or deliberately (terrorist act), there is an increased risk that adverse health conditions may develop (CDC, 2002b). Every agency should develop protocols for implementation during a radiological emergency. The PHN should be available to answer any questions about radiation that typically flood health department phone lines in this sort of crisis. The PHN should be aware of the following:

- Being available to help others will not occur if you do not take steps to protect yourself first. If by chance you are near the release site, move away from ground zero immediately. In the event that you are in the area when the event unfolds, minimize your exposure by increasing your distance from the source of radiation and put a shield between you and the source, such as a nearby building.
- PHNs working in a receiving station who observes people arriving with what appears to be dust on their clothing, should assume that it is radioactive and don the appropriate level PPE, notify HAZMAT and refer people to them for decontamination. (See chapter 26, “Mass Casualty Decontamination,” for further discussion.)
- When leaving the scene of a possible radiological release by automobile, wash your car before putting it in your garage. Once home, remove and bag (if possible) your clothing before entering your home and shower thoroughly using soap and water. Eyeglasses may be decontaminated by vigorously washing them with soap and water, but contact lenses should be thrown away.
- The PHN stationed at the health department should prepare for the dissemination of accurate information to the public-at-large. (See chapter 27, “Radiological Incidents and Emergencies,” for further discussion.)

THE ROLE OF THE PHN ON A MULTIDISCIPLINARY RESPONSE TEAM

The importance of the role of the PHN in disaster planning is demonstrated by their widespread inclusion on county, regional and state wide planning committees. These committees provide an initial opportunity for the PHN to share their unique abilities and experiences with the rest of the first responder team. It is also a chance for the PHN to learn more about what the role of other responders in the field will be. The PHN is well prepared to advise on community resources and make suggestions regarding planning. By collaborating with other health and human service professionals, the PHN is accustomed to being part of a large interdisciplinary framework. Being a player in a disaster response requires developing a better understanding of the duties of one’s fellow responders and demonstrating how you can best contribute.

The functionality of a disaster plan can only be appreciated once it has been tested. Drills and exercises are the best way to test a plan and for PHNs to “try on” their role as a team member. Desktop exercises are valuable and convenient for in-house drills but a full-scale scenario-based drill involving all facets of the response plan, though expensive to run, offers the most rigorous way to ensure real-world success.

Interagency cooperation and coordination are vital to planning, training and response efforts. The PHN can call on existing community partners—police, fire, hospital, school system personnel, and social service agencies—to provide support in all phases of emergency preparedness. During the 2003 smallpox immunization campaign, public health nurses worked side by side with state and federal authorities. To ensure a successful inter-disciplinary effort, well-defined lines of authority and role responsibilities must be clearly communicated. In response to 9/11 and, most recently, Hurricane Katrina, each state has been asked to recruit members of the Medical Reserve Corps, a volunteer organization that would respond in some capacity during an emergency. In many states, these groups are recruited by and trained at local health departments. In many instances, a PHN supervises or conducts the training of these individuals.

TRAINING OPPORTUNITIES FOR THE PHN

A well-trained frontline response will reduce the impact of an emergency event. Since a terrorist event or a naturally occurring threat to the public’s health is considered a low-probability/high-consequence event, the challenge exists to identify ways to educate, train, and engage the PHN to raise competency levels by sharpening clinical and communication skills.

The PHN and other emergency response personnel may harbor concerns about their ability to respond in a clinically responsible way. A survey entitled, “Ready and Willing” revealed that 80% of nurses and physicians polled are willing to respond to a disaster while only 20% feel that they have the knowledge and skills to do so safely (Health Affairs, 2003). Preparing public health professionals to respond to incidents that they have never seen before and may encounter very infrequently requires new and creative approaches to education and training. (See chapter 28, “Directions for Nursing Education,” for further discussion.)

In New Jersey’s Center for Public Health Preparedness on the science campus of Burlington County College, patient simulators are being used in field hospital, virtual emergency room, and a home setting (Case Study 31.1) to train multidisciplinary groups in...
The response to biological agents. The simulators can be preprogrammed for a variety of agents and a secondary layer of sequelae can also be added to further test the assessment and response skills of responders. The use of the simulators can be used to increase the training realism. For example, the system might be preprogrammed to present a victim exposed to a radiological agent who develops chest pain while seeking assistance. The placement of eight simulators in a room is a realistic way to illustrate the conditions that responders may face in a real event. A sound track, complete with flashing lights and loud background noise is part of the way in which the environment can be manipulated to make the training experience as real as possible. Simulation is an excellent way to introduce the PHNs to what they may face in a real-world incident.

Additional stressors may also be introduced into a scenario. The simulated patient, once treated successfully by the team, might suddenly develop a cardiac arrhythmia; or once intubated might begin to convulse. In this way simulators may be used to improve the critical thinking required during an emergency. These high-fidelity simulators also respond physiologically when treatments are administered: administer 2 mg of morphine and respiration decreases; increase the oxygen flow and the pulse oxygen value will show a higher value.

A key benefit of training with simulation is the ability to role play and drill with the entire response team and subsequently evaluate the individual’s role within this multidisciplinary setting. This can help identify what worked and what did not work, and what adjustments need to be made. If the simulated patient does not respond, it is an opportunity to review what may have been a better approach to ensure a positive outcome.

PHNs have the opportunity to work on their triaging skills through repeated scenario-based drills. This is an opportunity to evaluate the response process in terms of communicating accurate information to field colleagues as well as noting if appropriate protective measures were taken. After the drill, nursing documentation recorded at the event may be reviewed and guidelines developed for future trainings.

The use of simulators for training can be expensive and labor intensive, however, the value that it brings to emergency response activities is considerable.

**SUMMARY**

PHNs have been promoting health in communities for well over a century. The population-based focus of public health practice has provided many initiatives that improve health and reduce the spread of infectious disease. Following the anthrax attacks of 2001, emergency preparedness and response for biological, chemical, and radiological events have been added to the mission of public health. With their broad-based clinical knowledge, disease surveillance and management skills, and familiarity with community resources, the PHN is a critical member of the emergency response team. Their assessment skills make them obvious leaders in a prehospital setting. By developing experience working within a multidisciplinary setting and obtaining appropriate training for disaster and bioterrorist events, the PHN’s transition to a diverse emergency response team is assured.

**STUDY QUESTIONS**

1. What are the three guiding principles of public health nursing practice?
2. Discuss how public health nursing has had an impact on your community.
3. Describe how the three tenets of public health nursing are consistent with disaster response activities.
4. There is a confirmed outbreak of pneumonic plague. What will PHN responders do to protect the community?
5. Describe ways in which your agency/institution can become an active part of disaster planning in your community.
6. Identify sources for public health competencies for emergency preparedness.
7. Identify the roles that a PHN could take as part of a multidisciplinary disaster response team.
8. How might your agency/institution use simulation to improve their disaster response? How could you personally benefit from simulation training?

**REFERENCES**


Columbia University School of Nursing Center for Health Policy. (2002). Bioterrorism and emergency readiness competencies for all public health workers. Atlanta: Centers for Disease Control and Prevention.


Every time the traveler boards an aircraft and safely arrives at the chosen destination, the ability of the pilot is rarely questioned. In fact, the skills that the average consumer has come to take for granted are honed and updated on a regular basis through use of an air flight simulation system. Medical schools first began using patient simulators for the training of anesthesia residents, and many schools of nursing have begun incorporating their use into all facets of curriculum. Efforts are under way to try to determine the effectiveness of simulation experiences through the establishment of quantitative elements that will measure the efficacy of simulators in the development of nursing competencies.

Public health nurses have a long history of conducting mass immunization clinics. These operations are developed based on the assessment of the communities they serve and in keeping with the goal of public health nursing. Public health’s mission is to promote physical and mental health while preventing injury, disease, and disability. After the tragic events of 9/11, public health added a new dimension to that charge: terrorism preparedness and emergency response. The Centers for Disease Control and Prevention classified critical biological and chemical agents and integrated fact sheets on all classifications on its Web site (www.cdc.gov/bioterrorism). In addition, the Columbia University School of Nursing published “Core Competencies for Public Health Workers,” which assisted the public health workforce to build those competencies that are defined as “applied skills and knowledge that enable people to perform work” (Columbia University School of Nursing).

If we know what the competencies are, then how can the public health nurse demonstrate his or her readiness to apply their skills in an emergency response scenario? Typically, the medical and nursing communities have voiced their willingness to step up to the plate in a response effort. However, Health Affairs has reported that although there is a willingness to do so—80% of those surveyed—or an identified knowledge and skills gap voiced by those surveyed revealing that only 20% feel that they have the necessary skills to be effective (Health Affairs, September–October 2003) in an all-hazards event.

The CDC funded Burlington County College (BCC) as a Center for Public Health Preparedness (CPHP), a specialty center to develop emergency response education and training programs designed to build competencies of the public health workforce through the use of simulation. Public health nurses are the largest segment in that workforce in New Jersey and immediate steps were taken to engage the county and municipal health department nurses in simulated, real-time all-hazards scenarios. Recognizing that the focus of the simulation sessions should be on those categorized agents that are high risk, low frequency, each public health agency is asked to identify a training need unique to the area in which they are located. Counties who count several petrochemical plants in their district invariably train within a chemical release scenario. Health departments in a county with a nuclear power plant, choose radiological release as the scenario foundation. All nursing divisions also have the opportunity to work with patient simulators who have been programmed to exhibit symptoms associated with Category A biologicals: smallpox, tularemia, plague, anthrax, botulism, and viral hemorrhagic fevers. Without simulation, where would nurses ever get the opportunity to deliver care to smallpox patients or the victims of a sarin attack?

The simulation lab at BCC has 14 simulators in two (2) sites. The main lab is set up with six (6) simulators in a field hospital setting designed so that the learner is immersed in a crowded, busy setting that would duplicate the noise level (complete with a competing sound track) and cramped conditions that would encounter during a real event. One (1) corner is a virtual ER containing one (1) simulator. However, the ER equipment there can easily moved to any of the other stations. There is one (1) infant simulator in a pediatric crib and an additional adult simulator in a home setting, complete with TV and remote control. Health departments are invited to visit the lab and discuss their specific needs. A date is set for the training and nurses have the opportunity to sharpen their assessment skills in a triage setting. Repeat sessions are scheduled to keep the skills current. Emergency room nurses and physicians have also been the beneficiaries of simulation training for disasters. Although considered “first receivers,” their connection with the prehospital responder, most particularly the public health nurse, is an essential part of maintaining a smooth transition to acute care from the field. Recognizing that it is not feasible to shut...
down an ER for a day’s training, the CPHP can provide training on-site delivering up to five (5) simulators to an agency. This ensures training totally customizable to the audience. It also enables more workers to train at one time within a multidisciplinary team framework.

Perhaps the best way to train in a multidisciplinary setting is to use simulation in a field drill. In such surroundings, all emergency responders can begin to learn about and appreciate the skills of their fellow team members. Some field drills that have included simulation have drawn on fire, police, emergency medical services personnel, emergency management officials, corporate and small business leaders, and school and elected officials. In the center of this stands the public health nurse, whose growing triaging skills serve all responders well.

The application of simulation to a disaster event can be as simple as using the simulators to drill evacuation procedures at a long-term care (LTC) facility. With hurricane season on us, several LTC organizations will begin to work with their staff to do just that. By programming the simulators to be elderly with chronic conditions and adding a nasal O₂ mask, staff will be able to evaluate the effectiveness of their evacuation plan. Or perhaps the placement of patient simulators within a hospital itself and then drilling an accidental radiological release from the X-ray department will assist all acute care departments to measure the effectiveness of their procedures while assuring patient safety.

Simulation technology is also an effective tool in the education of non-clinical responders. A multiplayer system allows multidisciplinary and interagency personnel to create unlimited scenarios and rehearse threat detection and response techniques over a network. Using gaming software, realistic terrains and environments such as specific cities, shopping malls, hospitals, restaurants, or amusement parks, to name a few possibilities, will allow police, exercise planners and elected officials to plan, create, and run training exercises in a safe, non-threatening environment. Incident command and communication skills are tested effectively. The high fidelity of the systems used in this effort also allows for specific, customizable scenario building.

Because public health has often been the last to be funded, the use of technology for the building of skills has come late. The use of simulation training for public health nurses is a nonthreatening way to achieve the skill level that the first responder community has come to expect from these colleagues. Working within this team framework also assures that the role of the public health nurse will not be overlooked.
Disaster Recovery: Creating Sustainable Disaster-Resistant Communities
Tener Goodwin Veenema

In the aftermath of a disaster, the evidence of death, injury, and devastation can overwhelm both victims and responders. The evidence of destruction and the inevitable life changes that the disaster has caused become rapidly apparent. The disaster continuum plays out—leaving its victims and responders in its wake. Yet the disaster response is not over—in fact, the final recovery and evaluative phases of the disaster continuum are just beginning. And in all probability, the role of the nurse is never more important than during recovery. Nursing, with roots firmly planted in health promotion and wellness and the provision of holistic health care, now needs to address holistic disaster recovery with the goals being to assist individuals and communities to recover and create a more sustainable future.

How do nurses embark on holistic disaster recovery and creating a more sustainable future for communities? How do we help communities that have been impacted by disasters? We start by accepting our professional mandate as a profession to be prepared. We continue to share our knowledge and experiences with each other through professional conferences, the establishment of disaster nursing task forces, and in the literature. We write and speak of the lessons that we have learned and strategies for avoiding future mistakes. We applaud the efforts of those valiant nurses who have responded to their communities in times of need. We seek and accept leadership positions in disaster planning, response, and recovery initiatives. We need to clearly understand the concept of sustainability and what that means in terms of community planning and building codes, environmental health and safety, and promoting a sense of harmony and togetherness. The disaster recovery process is multifaceted and involves numerous steps and the inclusion of many individuals and organizations. As Hurricane Katrina has so aptly demonstrated, the disaster recovery process is long, cumbersome, and often painful. It encompasses adaptive responses to unexpected and untoward events, advocacy planning to ensure the future safety of populations, and policy and legislative adjustments. It mandates extensive investigation and exploration of what went right and what went wrong. It demands an evaluation of every agency’s response.

Disaster recovery is a social process that encompasses (a) planning for future events, (b) public policy development, and (c) social learning. This mandates the establishment of organizational relationships and intergovernmental linkages—and the processes for collaboration and coordination that enhance recovery efforts. Nurses need to understand how the disaster recovery process can be used to maintain and enhance the quality of life. We need to design recovery strategies for enhancing quality of life, pursue new strategies for improving the quality of life, and institute systems for the ongoing monitoring of the quality of life.

Nurses need to understand and become active in policymaking at both the federal and state levels. Familiarity with the Disaster Mitigation Act; the concepts of negotiation, regionalism, and paternalism on the part of the federal government in regard to disaster recovery; and the role of leadership and charisma are important components of policymaking. The importance of using strategies that protect the quality of the environment, address rebuilding economic vitality in a community, and include protections for social and intergenerational equity are critical to achieving sustainable improvements.

Nurses need to understand how the funding of the disaster recovery process is supposed to occur and what federal disaster recovery programs exist (and how they are evolving). Public assistance will be available for repairing hazard-prone infrastructure, although the process for obtaining this assistance is also changing. Funds for disaster recovery have traditionally been available through the Hazard Mitigation Grant Program, the Housing and Urban Development initiative funds, the Uniform Relocation Act, temporary housing assistance, and the Small Business Administration. Historically, debate has existed around the success of these federal programs.
and whether or not they have created more vulnerable communities. Discussion remains as to whether or not at-risk families should be relocated, and what the government’s role (in terms of long-term commitment) to the disaster recovery process should be. Who should pay for what and for how long? What is the role of the federal government versus that of the states? When should disaster areas seek congressional aid? What areas should be rebuilt? What if the risk of the hazard persists? What are individuals’ understanding of risk? What are the expectations of the public and of the media? What type of social learning needs to take place for communities to better position themselves for mitigation and recovery? How do we create a less vulnerable society? How do we protect the quality of our environment in order to sustain life on our planet? What is the role for academia in disaster response and recovery?

These are difficult questions at best, yet the foundation for successful disaster recovery and the creation of disaster-resistant sustainable communities lies within them. As a nation, we must not succumb to “the apathy factor” as Dr. Erik Auf der Heide has described, but force ourselves to plan for the unexpected, prepare for the unlikely, and to establish sustainable community partnerships with effective avenues of communication. These discussions will most likely take place at the highest levels of our government—and no one is better prepared to contribute to this discussion than a nurse.
Appendix I

Internet Resources on Disaster Preparedness, Emergency Care, and Bioterrorism

AMERICAN BURN ASSOCIATION:
http://www.ameriburn.org/

AMERICAN COLLEGE OF RADIOLOGY:
http://www.acr.org/

AMERICAN COUNSELING ASSOCIATION:
http://www.counseling.org

AMERICAN HOSPITAL ASSOCIATION:
http://www.aha.org/aha/index.jsp

AMERICAN NURSES ASSOCIATION:
http://www.ana.org

AMERICAN PSYCHIATRIC ASSOCIATION:
http://www.psych.org

AMERICAN PSYCHOLOGICAL ASSOCIATION’S DISASTER RESPONSE NETWORK:
http://www.apa.org/practice

AMERICAN PUBLIC HEALTH ASSOCIATION:
http://www.apha.org

AMERICAN RED CROSS:
http://www.redcross.org

ANIMAL MANAGEMENT IN DISASTERS:
http://www.animaldisasters.com

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE, MEDICAL RADIOBIOLOGY TEAM:
http://www.afrri.usuhs.mil/

CANADIAN CENTER FOR EMERGENCY PREPAREDNESS:
http://www.ccep.ca

CENTER FOR CIVILIAN BIODEFENSE STUDIES, JOHNS HOPKINS UNIVERSITY:
http://www.hopkins-biodefense.org

CENTER FOR DISASTER MANAGEMENT:
http://www.cerdim.boun.edu.tr/

CENTER FOR EARTHQUAKE RESEARCH AND INFORMATION AT THE UNIVERSITY OF MEMPHIS:
http://www.ceri.memphis.edu

CENTER FOR MENTAL HEALTH SERVICES:
http://www.mentalhealth.samhsa.gov/cmhs/

CENTER FOR RESEARCH ON THE EPIDEMIOLOGY OF DISASTERS:
http://www.cred.be

CENTERS FOR DISEASE CONTROL AND PREVENTION:
http://www.bt.cdc.gov

CENTERS FOR DISEASE CONTROL AND PREVENTION, BIOTERRORISM PREPAREDNESS & RESPONSE:
http://www.bt.cdc.gov

CENTERS FOR DISEASE CONTROL AND PREVENTION, CHEMICAL TREATMENT:
http://www.cdc.gov/nceh/demil/articles/initialtreat.htm

CENTERS FOR DISEASE CONTROL AND PREVENTION, HEALTH ALERT NETWORK:
http://www.phppo.cdc.gov/han

CENTERS FOR DISEASE CONTROL AND PREVENTION NATIONAL IMMUNIZATION PROGRAM:
http://www.cdc.gov/nip/

CENTER FOR NONPROLIFERATION STUDIES:
http://www.cns.miis.edu/

CENTER FOR NONPROLIFERATION STUDIES—CHEMICAL & BIOLOGICAL WEAPONS RESOURCE PAGE:
http://cns.miis.edu/research/cbw/cbierror.htm

DEFENSE TECHNICAL INFORMATION CENTER:
http://www.dtic.mil

DEPARTMENT OF DEFENSE, DEPARTMENT OF THE ARMY, DIRECTOR OF MILITARY SUPPORT:
http://www.globalsecurity.org/military/agency/army/doms.htm

603
DEPARTMENT OF DEFENSE, BIOLOGICAL, CHEMICAL MEDICAL REFERENCE SITE:

DEPARTMENT OF DEFENSE, OFFICE OF COUNTERPROLIFERATION AND CHEMICAL/BIOLOGICAL DEFENSE:
http://www.acq.osd.mil/cp/

DEPARTMENT OF HEALTH AND HUMAN SERVICES (DHHS), OFFICE OF EMERGENCY PREPAREDNESS (OEP):
http://www.hhs.gov/ophep

DEPARTMENT OF HEALTH AND HUMAN SERVICES (DHHS), OEP, NATIONAL DISASTER MEDICAL SYSTEM:
http://www.oeppndms.dhhs.gov

DEPARTMENT OF HOMELAND SECURITY:
http://www.dhs.gov/dhspublic/

DEPARTMENT OF JUSTICE, OFFICE OF STATE AND LOCAL DOMESTIC PREPAREDNESS SUPPORT:
http://www.ojp.usdoj.gov/osldsps

DISASTER CENTER:
http://www.disastercenter.com

DISASTER MEDICINE AND MENTAL HEALTH:
http://www.mentalhealth.samhsa.gov/cmhs/EmrgencyServices

DISASTER RESEARCH CENTER, UNIVERSITY OF DELAWARE:
http://www.udel.edu/DRC

DISASTER RESPONSE: PRINCIPLES OF PREPARATION AND COORDINATION (ON-LINE DISASTER MANAGEMENT TEXT)
http://orgmail2.coe-dmha.org/dr/flash.htm

EARTHQUAKE ENGINEERING RESEARCH LIBRARY, BERKELEY (National Information Service for Earthquake Engineering):
http://nise.berkeley.edu

EARTHQUAKE SAFETY:
http://www.geohaz.org/

EFFECTIVE DISASTER WARNINGS:
http://www.nwaa.gov

EMERGENCY INFORMATION INFRASTRUCTURE PARTNERSHIP:
http://www.emforum.org

EMERGENCY NET, EMERGENCY RESPONSE AND RESEARCH INSTITUTE:
http://www.emergency.com

EMERGENCY NURSES ASSOCIATION:
http://www.ena.org

ENVIRONMENTAL PROTECTION AGENCY, CHEMICAL EMERGENCY PREPAREDNESS AND PREVENTION OFFICE:
http://www.epa.gov/swercepp
http://www.epa.gov/ceppo

ENVIRONMENTAL PROTECTION AGENCY, SAFE WATER:
http://www.epa.gov/safewater

FEDERAL BUREAU OF INVESTIGATION:
http://www.fbi.gov/

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA):
http://www.fema.gov

FEDERAL EMERGENCY MANAGEMENT AGENCY’S HIGHER EDUCATION PROJECT:
http://training.fema.gov/emisweb/edu/

FEDERATION OF AMERICAN SCIENTISTS:
http://fas.org/nuke/intro/cw/

FIRST RESPONDERS.COM
http://wmfirstresponders.com/

FLOOD INSURANCE MANUAL, THE FEDERAL EMERGENCY MANAGEMENT AGENCY:
http://www.fema.gov/nfip/manual10_05.shtm

FOOD FOR THE HUNGRY: WORLD CRISIS NETWORK
http://www.fh.org/

GLOBAL CHILDREN’S ORGANIZATION
http://www.globalchild.org/

GLOBAL EMERGENCY MANAGEMENT SYSTEM:
http://www.globalchild.org/

GLOBAL EMERGING INFECTIONS SURVEILLANCE AND RESPONSE SYSTEM, DEPARTMENT OF DEFENSE:
http://www.geis.fip.osd.mil/

GREEN CROSS:
http://www.greencross.org/

HEALTH INFORMATION NETWORK FOR ADVANCED PLANNING (HINAP):
http://www.emonline.net/fex/04/ne19-2.html

HEALTH PHYSICS SOCIETY:
http://www.hps.org

HENRY L. STIMSON CENTER, CHEMICAL AND BIOLOGICAL WEAPONS NONPROLIFERATION PROJECT:
http://www.stimson.org/home.cfm

HOMELAND SECURITY—OFFICE FOR DOMESTIC PREPAREDNESS:
http://www.oip.usdoj.gov/odp/training_ndpc.htm

HOSPITAL EMERGENCY INCIDENT COMMAND SYSTEM (HEICS III):
http://www.heics.com
INTERNATIONAL ASSOCIATION OF EMERGENCY MANAGERS:
http://www.iaem.com

INTERNATIONAL ATOMIC ENERGY AGENCY:
www.iaea.org

INTERNATIONAL COUNCIL ON RADIATION PROTECTION (ICRP):
www.icrp.org

INTERNATIONAL CRITICAL INCIDENT STRESS FOUNDATION (ICISF):
http://www.icsf.org

INTERNATIONAL FEDERATION OF THE RED CROSS (IFRC):
http://www.ifrc.org

INTERNATIONAL RESCUE COMMITTEE:
http://www.ifrc.org

INTERNATIONAL SOCIETY OF TRAUMATIC STRESS STUDIES (ISTS):
http://www.ists.org

INTERNATIONAL SOCIETIES ASSOCIATION, RESEARCH COMMITTEE ON DISASTERS:
http://www.ucm.es/info/isa/rc39.htm

INTERNET DISASTER INFORMATION NETWORK:
http://www.historical.disaster.net/

JOINT COMMISSION:
http://www.jointcommission.org/

MEDECINS SANS FRONTIERES:
http://www.msf.org/

NATIONAL ACADEMIES OF SCIENCE, INSTITUTE OF MEDICINE:
http://www.iom.edu

NATIONAL ASSOCIATION OF COUNTRY AND CITY HEALTH OFFICIALS (NACCHO):
http://www.naccho.org/

NATIONAL CENTER FOR INJURY PREVENTION AND CONTROL:
http://cdc.gov/injury/

NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS:
http://www.ncrpon

NATIONAL DISASTER MEDICAL SYSTEM:
http://ndms.dhhs.gov

NATIONAL EARTHQUAKE INFORMATION CENTER:
http://earthquake.usgs.gov/regional/nea

NATIONAL EMERGENCY MANAGEMENT ASSOCIATION:
http://www.nemaweb.org/index.cfm

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH:
http://www.cdc.gov/niosh/homepage.html

NATIONAL INSTITUTES OF HEALTH (NIH):
http://www.nih.gov

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA):
http://www.noaa.gov

NATIONAL ORGANIZATION FOR VICTIM ASSISTANCE (NOVA):
http://www.novaco.org

NATIONAL RESPONSE CENTER:
http://www.nrc.uscg.mil/nrchp.html

NATIONAL RESPONSE TEAM, HAZMAT & CHEMICAL SPILLS:
http://www.nrt.org

NATIONAL VOLUNTARY ORGANIZATIONS ACTIVE IN DISASTER (NOAD):
http://www.novoad.org

NATIONAL WEATHER SERVICE:
http://www.nws.noaa.gov

NATURAL HAZARDS CENTER, UNIVERSITY OF COLORADO:
http://www.colorado.edu/hazards

NATIONAL ORGANIZATION FOR VICTIM ASSISTANCE (NOVA):
http://www.trynova.org

NATIONAL VOLUNTARY ORGANIZATIONS ACTIVE IN DISASTER (NOAD):
http://www.novoad.org

NATIONAL WEATHER SERVICE:
http://www.nws.noaa.gov

NATIONAL INSTITUTES OF HEALTH:
http://www.nih.gov

NATIONAL ORGANIZATION FOR VICTIM ASSISTANCE (NOVA):
http://www.novaco.org

NATIONAL VOLUNTARY ORGANIZATIONS ACTIVE IN DISASTER (NOAD):
http://www.novoad.org

PAN-AMERICAN HEALTH ORGANIZATION (PAHO):
http://www.paho.org

PAN-AMERICAN HEALTH ORGANIZATION (PAHO):
http://www.paho.org

PUBLIC HEALTH PRACTICE PROGRAM OFFICE:
http://www.phppo.cdc.gov/index.asp

RADIATION EMERGENCY ASSISTANCE CENTER/ TRAINING SITE (REAC/TS):
http://www.oreas.gov/reacts/

REGIONAL DISASTER INFORMATION CENTER—LATIN AMERICA AND THE CARIBBEAN (CRID):
http://www.cridd.or.cr/CRID/ing/sistema_informacion_desastres_ing.html

SIGMA THETA TAU ON-LINE JOURNAL OF KNOWLEDGE SYNTHESIS FOR NURSING:
http://stti.iupui.edu/library/okd/journals/homepage.html

SOUTHERN CALIFORNIA EARTHQUAKE CENTER:
http://www.scec.org

TERRORISM RESEARCH CENTER:
http://www.terrorism.com/

UNITED NATIONS HIGH COMMISSIONER FOR REFUGEES (UNHCR):
http://www.unhcr.org/cgi-bin/tcxis/vtx/home
UNITED STATES ARMY CENTER FOR HEALTH PROMOTION & PREVENTIVE MEDICINE:

UNITED STATES ARMY CHEMICAL SCHOOL:
http://www.wood.army.mil/usacmils

UNITED STATES ARMY MEDICAL COMMAND:
http://www.armymedicine.army.mil/

UNITED STATES ARMY MEDICAL RESEARCH AND MATERIAL COMMAND:

UNITED STATES ARMY MEDICAL RESEARCH INSTITUTE OF CHEMICAL DEFENSE:
http://chemdef.apgea.army.mil

UNITED STATES ARMY MEDICAL RESEARCH INSTITUTE OF INFECTIOUS DISEASES (USAMRIID):
http://www.usamriid.army.mil

UNITED STATES ARMY NATIONAL GUARD BUREAU:
http://www.ngb.army.mil

UNITED STATES ARMY SOLDIER AND BIOLOGICAL CHEMICAL COMMAND (SBCCOM):
http://dlis.dla.mil/Army/sbccom.asp

UNITED STATES CENSUS BUREAU:
http://www.census.gov

UNITED STATES GEOLOGICAL SURVEY (USGS):
http://www.usgs.gov

UNITED STATES GEOLOGICAL SURVEY VOLCANO HAZARDS PROGRAM:
http://volcanoes.usgs.gov
http://volcanoes.usgs.gov/educators.html

UNIVERSITY OF ALABAMA AT BIRMINGHAM CENTER FOR DISASTER PREPAREDNESS:
http://main.uab.edu/show.asp?durk=19254

UNIVERSITY OF WISCONSIN DISASTER MANAGEMENT CENTER:
http://dmc.engr.wisc.edu/

USAID—DISASTER ASSISTANCE:
http://www.usaid.gov/our_work/humanitarian_assistance/disaster_assistance/

WORLD HEALTH ORGANIZATION (WHO):
http://www.who.org
Appendix II

Glossary of Terms Commonly Used in Disaster Preparedness and Response

advanced life support – A medical procedure performed by paramedics that includes the advanced diagnosis and protocol-driven treatment of a patient in the field.

aftershocks – A sequence of smaller earthquakes that follow larger magnitude earthquakes; aftershocks may be felt for many months after an earthquake and can exacerbate damage; also a type of ground failure.

alarm procedure – A means of alerting concerned parties to a disaster; various optical and acoustical means of alarm are possible including flags, lights, sirens, radio, and telephone.

analysis-epidemiologic measures – Indicators such as descriptive statistics, specific disease and/or death rates, secular trends, and tests for sensitivity and validity.

assessments – The evaluation and interpretation of short- and long-term measurements to provide a basis for decision making and to enhance public health officials’ ability to monitor disaster situations.

assets – A term used for all resources required, including human, to adequately respond to a disaster.

avalanche – The sudden slide of a huge mass of snow and ice, usually carrying with it earth, rocks, trees, and other debris.

basic life support – Noninvasive measures used to treat unstable patients, such as extraction of airway obstructions, cardio-pulmonary resuscitation, care of wounds and hemorrhages, and immobilization of fractures.

becquerel (Bq) – A unit of nuclear activity (for example, 1 Bq represents the amount of radioactive substance that disintegrates in 1 second); this unit replaces the curie.

bioterrorism – The unlawful release of biologic agents or toxins with the intent to intimidate or coerce a government or civilian population to further political or social objectives; humans, animals, and plants are often targets.

branch – An organizational level that has functional or geographic responsibility for major parts of the ICS or incident operations (the incident commander may establish geographic branches to resolve span-of-control issues, or functional branches to manage specific functions [e.g., law enforcement, fire, and emergency medical]; a branch is managed by the Branch Director).

case – One (unit) documented incidence of disease.

case definition – Standardized criteria for deciding whether a person has a particular disease or health-related condition; often used in investigations and for comparing potential cases; case definitions help decide which disaster-specific conditions should be monitored with emergency information surveillance systems.

case management – The collaborative process that assesses, plans, implements, coordinates, monitors, and evaluates the options and services required to meet an individual’s health needs.

casualty – Any person suffering physical and/or psychological damage that leads to death, injury, or material loss.

casualty clearing station – A collecting point for victims that is located in the immediate vicinity of a disaster site where triage and medical treatment can be provided.

central holding area – A location where ambulances leave from to pick up patients from the casualty clearing station, or deliver patients to neighboring hospitals according to a victim distribution plan.

community profile – The characteristics of the local environment that are prone to a chemical or nuclear accident (these characteristics can include population density; age distribution; number of roadways, railways, and waterways; type of buildings; and local relief agencies).

comprehensive emergency management – A broad style of emergency management, encompassing prevention, preparedness, response, and recovery.
concept – A view or idea we hold about something, ranging from something highly concrete to something highly abstract.

consequence management – An emergency management function that includes measures to protect public health and safety, restore essential government services, and provide emergency relief to governments in the event of terrorism. (Consequence management responses are managed by FEMA and use protocols established under the National Response Plan. Consequence management efforts can also include support missions as described in other federal operations plans, such as predictive modeling, protective action recommendations, and mass decontamination.)

contamination – An accidental release of hazardous chemicals or nuclear materials that pollute the environment and place humans at risk.

decommissioning – A systematic exchange of information among principal participants in order to carry out a unified response in the event of an emergency.

decontamination – The removal of hazardous chemicals or nuclear substances from the skin and/or mucous membranes by showering or washing the affected area with water or by rinsing with a sterile solution.

disaster – Any event, typically occurring suddenly, that causes damage, ecological disruption, loss of human life, deterioration of health and health services, and which exceeds the capacity of the affected community on a scale sufficient to require outside assistance. These events can be caused by nature, equipment malfunction, human error, or biological hazards and disease (e.g., earthquake, flood, fire, hurricane, cyclone, typhoon, significant storms, volcanic eruptions, spills, air crashes, drought, epidemic, food shortages, civil strife).

disaster continuum or emergency management cycle – The life cycle of a disaster or emergency.

disaster epidemiology – The study of disaster-related deaths, illnesses, and injuries in humans; also includes the study of the factors and determinants that affect death, illness, and injury following a disaster. (Methodology involves identifying and comparing risk factors among disaster victims to those who were left unharmed. Epidemiologic investigations provide public health professionals with information on the probable public health consequences of disasters.)

Disaster Field Office (DFO) – The office established in or near the disaster area that supports federal and state response as well as recovery operations. The Disaster Field Office houses the Federal Coordinating Officer (FCO), the Emergency Response Team (ERT), the State Coordinating Officer (SCO), and support staff.

disaster informatics – The theoretical and practical operation of processing information and communicating in a disaster situation.

disaster-prone – The level of risk that is related to the hazard or the immediate cause of a disaster, which is determined by analyzing the history of past events as well as new conditions that may increase the risk of a disaster taking place.

disaster severity scale – A scale that classifies disasters by the following parameters: the radius of the disaster site, the number of dead, the number of wounded, the average severity of the injuries sustained, the impact time, and the rescue time.

disaster vulnerability – A measure of the ability of a community to absorb the effects of a severe disaster and to recover; vulnerability varies with each disaster, depending on the disaster’s impact on the affected population or group.

dispatch communications system – A system used to assign ambulance personnel and other first responders.

division – The organizational level that has responsibility for operations within a defined geographic area (the division level is the organizational level between single tasks, resources, task forces, or strike teams and the branch level).

disaster – Any natural or man-made situation that results in severe injury, harm, or loss of humans or property.

Emergency Management Agency (EMA) – Also referred to as the Office of Emergency Preparedness (OEP); the EMA, under the authority of the governor’s office, coordinates the efforts of the state’s health department, housing and social service agencies, and public safety agencies (e.g., state police) during an emergency or disaster; the EMA also coordinates federal resources made available to the states, such as the National Guard, the Centers for Disease Control (e.g., EIS officers), and the Public Health Service (e.g., Agency for Toxic Substances Disease Registry (ATSDR)).

Emergency Medical Services (EMS) System – The coordination of the prehospital system (e.g., public access, dispatch, EMTs/and medics, ambulance services) and
the in-hospital system (e.g., emergency departments, hospitals, and other definitive care facilities and personnel) to provide emergency medical care.

**Emergency Medical Technicians (EMTs) and Paramedics (EMT-Ps)** – Trained emergency medical respondents (both paramedics and EMTs are trained to diagnose and treat most common medical emergencies in the field and to provide medical treatment while en route to the hospital; paramedics are more highly trained than EMTs).

**emergency operations center (EOC)** – The location where department heads, government officials, and volunteer agencies coordinate the response to an emergency.

**emergency public information** – Information disseminated to the public in anticipation of an emergency that continues for the duration of the emergency; emergency public information directs actions and gives instructions.

**emergency response team** – A team of federal personnel and support staff that is deployed by FEMA during a major disaster or emergency; the duty of the team is to assist the FCO in carrying out his or her responsibilities under the Stafford Act; team members consist of representatives from each federal department or agency that has been assigned primary responsibility for an emergency support function as well as key members of the FCO’s staff.

**emergency support function (ESF)** – A functional area of response activity established to coordinate the delivery of federal assistance during the response phase of an emergency. (ESF’s mission is to save lives, protect property, preserve public health, and maintain public safety; ESF represents the type of federal assistance most needed by states overwhelmed by the impact of a catastrophic event on local and state resources.)

**Enhanced Fujita scale** – Updated scale using a set of wind estimates (not measurements) based on damage occurring from a tornado.

**ESF 6 Mass Care** – Mass Care includes sheltering and feeding victims of disaster, emergency first aid, family reunification, and the distribution of emergency relief supplies; the American Red Cross (ARC) is designated by the Federal Response Plan (NRF) as the primary agency responsible for ESF Mass Care.

**ESF 8 Health and Medical** – Led by the United States Public Health Service’s Office of Emergency Preparedness, ESF 8 Health and Medical serves as the basis for federal response to the health needs of disaster victims.

**epidemic** – The occurrence of any known or suspected contagion that occurs in clear excess of normal expectancy (a threatened epidemic occurs when the circumstances are such that a disease may reasonably be anticipated to occur in excess of normal expectancy).

**evacuation** – An organized removal of civilians from a dangerous or potentially dangerous area.

**evaluation** – A detailed review of a disaster relief program designed to determine whether program objectives were met, to assess the program’s impact on the community, and to generate lessons learned for the design of future projects (evaluations are most often conducted at the completion of important milestones, or at the end of a specified period).

**evaluation research** – The application of scientific methods to assess the effectiveness of programs, services, or organizations established to improve a patient’s health or prevent illness.

**exposure surveillance** – To look for exposure to risk (in a disaster setting, exposure may be based on the physical or environmental properties of the disaster event; also known as a risk factor variable, predictor variable, or independent variable).

**exposure variable** – A characteristic of interest; also known as risk factor or predictor variable.

**Famine Early Warning System** – A system established by the United States Agency for International Development to monitor a number of factors that are predictive of famine including climate, availability of food, and nutrition-related morbidity.

**Federal Coordinating Officer (FCO)** – The person appointed by FEMA following a presidential declaration of a severe disaster or of an emergency to coordinate federal assistance. (The FCO initiates immediate action to assure that federal assistance is provided in accordance with the disaster declaration, any applicable laws or regulations, and the FEMA-state agreement. The FCO is also the senior federal official appointed in accordance with the provisions of Public Law No. 93-288, as amended [the Stafford Act], to coordinate the overall consequence management response and recovery activities. The FCO represents the president as provided by Section 303 of the Stafford Act by coordinating the administration of federal relief activities in the designated disaster area. Additionally, the FCO is delegated responsibilities and performs those for the FEMA Director as outlined in Executive Order 12148 and those responsibilities delegated to the FEMA Regional Director in the Code of Federal Regulations, Title 44, Part 205.)

**Federal On-Scene Commander (OSC)** – The official designated upon the activation of the Joint Operations Center that ensures appropriate coordination of the United States government’s overall response with federal, state, and local authorities; the OSC maintains this role until the United States Attorney General transfers the Lead Federal Agency (LFA) role to FEMA.

**first responder** – Local police, fire, and emergency medical personnel who arrive first on the scene of an incident and take action to save lives, protect property, and meet basic human needs.

**Functional Model of Public Health Response in Disasters** – A model for identifying what disaster-related...
activities are the responsibility of public health officials; this model also identifies the interface between the core components of professional public health training and emergency management functions, as well as the relationship between the framework of activities typically conducted by the emergency management community and public health practice.

**Fujita scale** – A scale used to measure the strength of tornadoes.

**golden hour** – A principle that states ABC unstable victims must be stabilized within 1 hour following injury to reduce the risk of death.

**group** – The organizational level that has responsibility for a specified functional assignment in an emergency or disaster (e.g., perimeter control, evacuation, fire suppression, etc.; a group is managed by a Group Supervisor).

**hazard** – The probability that a disaster will occur (hazards can be caused by a natural phenomenon [e.g., earthquake, tropical cyclone], by failure of man-made energy sources [e.g., nuclear reactor, industrial explosion], or by an uncontrolled human activity [e.g., conflict, overgrazing]).

**hazard identification/analysis** – The process of determining what events are likely to occur in a specified region or environment (e.g., earthquakes, floods, industrial accidents).

**hazard surveillance** – An assessment of the occurrence, distribution, and secular trends relating to different levels of hazards (e.g., toxic chemical agents, physical agents, biomechanical stressors, and biologic agents) that are responsible for disease and injury.

**impact phase** – A phase during a disaster when emergency management activities focus on warning and preparedness.

**incident action plan (IAP)** – A written document, developed by the incident commander or the planning section of the ICS, that details which actions will be conducted by the ICS in response to an incident. IAPs are developed for specific time periods, often referred to as operational periods, and are based on the specific needs of an incident. The incident commander is responsible for the oversight and implementation of the IAP.

**Incident Command System (ICS)** – The model for the command, control, and coordination of a response to an emergency; provides the means to coordinate the efforts of individual agencies.

**integrated communications** – A system that uses a common communications plan, standard operating procedures, clear text, common frequencies, and common terminology.

**integrated recovery programs (IRPs)** – Versatile recovery programs that respond to a variety of community needs. IRPs often coordinate recovery activities and stimulate economic rehabilitation by working with various sectors of the community. For example, IRPs may include work schemes to repair community facilities that enable disaster victims to access cash and replace their lost possessions.

**intensity** – A Roman numerical index from I to XII that describes the physical effects of an earthquake to a specific area. (These values are subjective. Intensity is a measurement of the nature and spatial extent of the distribution of damage. The most commonly used scale is the 12-point Modified Mercalli Intensity [MMI]. An earthquake has many intensities [perceived effects], but only one magnitude [force]. The MMI does not indicate an earthquake’s magnitude.)

**international assistance** – Assistance provided by one or more governments or voluntary organizations to a country in need, usually for development or for an emergency.

**Joint Information Center (JIC)** – A center located at the scene of an emergency established to coordinate federal public information; it is also the central point of contact for all news media; public information officials from participating state and local agencies often collocate here.

**Joint Information Center (JIC)** – A center located at the scene of an emergency established to coordinate federal public information; it is also the central point of contact for all news media; public information officials from participating state and local agencies often collocate here.

**Joint Operations Center (JOC)** – The JOC acts as the focal point for the management and direction of on-site activities, coordination and establishment of state requirements and priorities, as well as the coordination of the federal response, JOCs are established by the Lead Federal Agency (LFA) and are under the operational control of the federal on-scene coordinator.

**landslide** – A massive or rapid descent of damage-causing soil and rock (landslides are the most common and widespread type of ground failure and may include falls, topples, slides, spreads, and flows of soil and/or rock on unstable slopes).

**latrines** – A pit designed to capture and contain excreta; most often trenches with multiple platforms across them, or solitary pits surrounded by a structure.

**LD50** – The amount of a substance (the lethal dose) that results in the death of 50% of the subjects who are exposed to it.

**lead agency** – The federal department or agency that is assigned the lead responsibility under U.S. law for the management and coordination of the federal response in a specific functional area (lead agencies support the Lead Federal Agency (LFA) during all phases of the response).

**Lead Federal Agency (LFA)** – The agency designed by the president to lead and coordinate the federal response. (The type of emergency determines which agency becomes the LFA. In general, the LFA establishes operational procedures to assemble and work with the cooperating agencies to provide the LFA with support. These agencies support the LFA in carrying out the president’s policy by furnishing the LFA with an initial assessment of the situation, developing action plans, monitoring and updating operational priorities, and by ensuring that each agency exercises its authority within
the boundaries of the law. Specific responsibilities of an
LFA vary according to each agency’s statutory author-
ity.)
liaison – An agency official who works with individual
agencies or agency officials to coordinate interagency
communications.
liquefaction – Primarily occurs in young, shallow,
loosely compacted, water-saturated sand and gravel de-
posits that are subjected to ground shaking; it results in
a temporary loss of load-bearing strength.
local government – Any country, city, village, town,
district, political subdivision of any state, Indian tribe or
authorized tribal organization, or Alaskan native village
or organization, including rural communities, unincor-
porated towns and villages, or any other public entity.
loss – A range of adverse consequences that can impact
communities and individuals (e.g., damage, loss of eco-
nomic value, loss of function, loss of natural resources,
loss of ecological systems, environmental impact, health
deterioration, mortality, morbidity).
magnitude – A numerical quantity invented by Charles
F. Richter that determines the size and scope of an earth-
quake by using a measure called a Richter. (The mag-
nitude of an earthquake is the total amount of energy
released after adjusting for differences in epicentral dis-
tance and focal depth. Magnitude is determined on the
basis of instrumental records, whereas intensity is de-
termined by subjective observations of an earthquake’s
damage. Moderate earthquakes have magnitudes of 5.5
to 6.9; larger earthquakes have magnitudes of 7.0 to
7.9; and strong earthquakes have magnitudes of 8.0
and greater. The energy of an earthquake increases ex-
ponentially with magnitude. For example, a magnitude
6.0 earthquake releases 31.5 times more energy than a
magnitude 5.0 earthquake or approximately 1,000 times
more energy than a magnitude 4.0 earthquake.)
man-made or human-generated disasters; complex
emergencies – Technological events that are caused by
humans and occur in human settlements (for example,
fire, chemical spills and explosions, and armed conflict).
Maslow’s Theory of Human Motivation and Hierar-
chy of Basic Needs – Proposes a hierarchical structure
for human needs, from physiological drives to needs for
safety, belonging, love, esteem, and self-actualization at
the top of the pyramid.
maximum contaminant level (MCL) – The maximum
permissible level of a contaminant in water in a public
water system. The MCL is established by the Environ-
mental Protection Agency (EPA). MCLs are defined in
the Safe Drinking Water Act as the level that may be
achieved with the use of the best available technology,
treatment techniques, and other means that EPA finds
are available after taking cost into consideration.
measures of biological effects – A gauge of health
in humans that indicates the impact of a disaster (ex-
amples include laboratory typing of organisms where
infectious disease outbreaks occur, biochemical testing
of exposures to toxic chemicals to assess exposure lev-
els, and anthropometric measurements [e.g., height-to-
weight ratio] that indicate the type and degree of mal-
nutrition in famine situations).
measures of physical effects to indicate magnitude –
An assessment of environmental conditions whose
levels are negatively impacted because of a disaster (ex-
amples include the height of river above flood stage, the
level of pollutants in air after a forest fire, and the level
of toxic chemicals in drinking water or sediment).
measuring environmental hazards – Assessing the oc-
currence, distribution, and the secular trends that affect
the level of hazards (e.g., toxic culture agents, physi-
cal agents, biomechanical stressors, biologic agents) re-
sponsible for disease and injury.
medical coordination – The coordination between
health care providers during the transition from the pre-
hospital to the hospital phase of patient care; simplifica-
tion and standardization of materials and methods are
a prerequisite.
mitigation – Measures taken to reduce the harmful ef-
fects of a disaster by attempting to limit the disaster’s
impact on human health and economic infrastructure.
Modified Mercalli Scale – A scale that indicates the
intensity of an earthquake by assessing the degree of
damage on a particular location.
monitoring – A process of evaluating the performance
of response and recovery programs by measuring a pro-
gram’s outcomes against stated objectives (monitoring
is used to identify bottlenecks and obstacles that cause
delays or programmatic shortfalls that require assess-
ment).
mortality data – Information about the number of
deaths used to assess the magnitude of a disaster, evalu-
ate the effectiveness of disaster preparedness, evaluate
the adequacy of warning systems, and to aid contin-
gency planning by identifying high-risk groups.
na-tech (natural-technological) disasters – Natural dis-
asters that create technological emergencies, such as ur-
ban fires that result from seismic motion, or chemical
spills that result from floods.
National Response Plan (NRP) – The plan that coordi-
nates federal resources in disaster situations. (The NRP
is designed to address the consequences of any disas-
ter or emergency situation in which there is need for
federal assistance under the authorities of the Robert T.
Stafford Disaster Relief and Emergency Assistance Act,
42 U.S.C. 5121 et seq. The NRP is also the federal gov-
ernment’s plan of action when assisting affected states
and local jurisdictions in the event of a severe disaster or
emergency. The plan consists of 12 emergency support
functions [ESFs].)
natural disasters – Natural phenomena with acute on-
set and profound effects (e.g., earthquakes, floods, cy-
clones, tornadoes).
on-scene coordinator (OSC) – The federal official pre-designated by the EPA and United States Coast Guard to coordinate and direct response and removals of oil or hazardous materials under the National Oil and Hazardous Substances Pollution Contingency Plan.

outcome surveillance – To look for a health outcome or health event of interest, usually illness, injury, or death; also known as the response variable, dependent variable, or effect variable (for example, the American Red Cross [ARC]/Centers for Disease Control and Prevention’s Health Impact Surveillance System records mortality in disaster events in which ARC has served).

outcome variable – A health event, usually encompassing illness, injury, or death; also known as a response variable.

overt release – An announced release of a biological agent, by terrorists or others; this type of release allows for treatment before the onset of disease.

phases of the emergency planning model – The model is composed of five phases, each corresponding to a type of activity involved in preparing for and responding to a disaster; the phases include planning (preparedness), mitigation, response, recovery, and evaluation.

planning – To work cooperatively with others in advance of a disaster in order to initiate prevention and preparedness activities.

postdisaster surveillance – Observations conducted by health authorities after a disaster in order to monitor health events, detect sudden changes in disease occurrence, follow long-term trends of specific diseases, identify changes in agents and host factors for the diseases of interest, and detect changes in health practices for treating disease.

postimpact phase – The period of time after a disaster event; often associated with the activities of response and recovery.

pre-impact phase – The period of time before a disaster strikes; often associated with mitigation and prevention activities.

preparedness – All measures and policies taken before an event occurs that allow for prevention, mitigation, and readiness. (Preparedness includes designing warning systems, planning for evacuation and relocation, storing food and water, building temporary shelter, devising management strategies, and holding disaster drills and exercises. Contingency planning is also included in preparedness as well as planning for postimpact response and recovery.)

prevention – Primary, secondary, and tertiary efforts that help avert an emergency; these activities are commonly referred to as “mitigation” in the emergency management model (for example, prevention activities include cloud seeding to stimulate rain in a fire; in public health terms, prevention refers to actions that prevent the onset or deterioration of disease, disability, and injury).

primary prevention – Preventing the occurrence of death, injury, or illness in a disaster (e.g., evacuation of a community in a flood-prone area, sensitizing warning systems for tornadoes and severe storms).

public access system – An emergency telephone system by which the public notifies authorities of a medical emergency; accessed by dialing 911.

public health surveillance – The systematic collection, analysis, and interpretation of the health data that are used to plan, implement, and evaluate public health programs; also used to determine the need for public health action.

public information officer – The official at headquarters or in the field responsible for preparing, coordinating, and disseminating public information; he/she relies on the cooperation of federal, state, and local agencies.

radiation – Energy emitted by atoms that are unstable—radiation with enough energy to create ion pairs in matter.

radioactive contamination – The presence of radiation-emitting substances (radioactive materials) in a place where it is not desired.

radio bands – A collection of neighboring radio frequencies; frequencies are allocated on different bands—a radio designed to work on one band will not work on another band.

rapid needs assessment – A collection of techniques (i.e., epidemiological, statistical, anthropological) designed to provide information about an affected community’s needs following a disaster.

readiness – Links preparedness to relief; an assessment of readiness reflects the current capacity and capabilities of the organizations involved in relief activities.

recovery – Actions of responders, government, and the victims that help return an affected community to normal by stimulating community cohesiveness and government involvement. (One type of recovery involves repairing infrastructure, damaged buildings, and critical facilities. The recovery period falls between the onset of the emergency and the reconstruction period.)

recovery plan – A plan to restore areas affected by disaster; developed on a state-by-state basis with assistance from responding federal agencies.

Red Cross (also known as the American Red Cross, or the International Red Cross) – A comprehensive designation used for all or one of the components of the International Red Cross and Red Crescent Movement, a worldwide organization active in humanitarian work. (This organization has three components: The International Committee of the Red Cross [ICRC], which acts primarily as a neutral intermediary during armed conflict, and includes the Guardian of the Geneva Conventions, an advocate for the protection of war victims; the League of the Red Cross and Red Crescent Societies [LRCS], an international federation of the National
Societies, active in nonconflict disasters and natural calamities; and the National Red Cross or Red Crescent Society, a worldwide relief organization specific to individual countries.)

Regional Operations Center (ROC) – Temporary operations facility used in the coordination of federal response and recovery activities; located at the FEMA Regional Office (or at the Federal Regional Center) and led by the FEMA Regional Director or Deputy Regional Director until the Disaster Field Office becomes operational.

rehabilitation or reconstruction – A long-term development project that follows a disaster or emergency that reconstructs a community’s infrastructure to preexisting levels; is often associated with an opportunity to improve a community rather than to simply “reconstruct” a preexisting system.

relief – Action focused on saving lives. (Relief activities often include search and rescue missions, first aid, and restoration of emergency communications and transportation systems. Relief also includes attention to the immediate care of survivors by providing food, clothing, medical treatment, and emotional care.)

report format – The instrument on which surveillance data are reported.

reporting unit for surveillance – The data source that provides information for the surveillance system. (Reporting units often include hospitals, clinics, health posts, and mobile health units. Epidemiologists select reporting units after they define “what a case is” because the source of data is dependent on that definition.)

representativeness – The accuracy of the data when measuring the occurrence of a health event over time and its distribution by person and place.

resource management – A management style that maximizes the use of and control over assets; this management style reduces the need for unnecessary communications, provides for strict accountability, and ensures the safety of personnel.

response – The phase in a disaster when relief, recovery, and rehabilitation occur; also includes the delivery of services, the management of activities and programs designed to address the immediate and short-term effects of an emergency or disaster.

Richter scale – A scale that indicates the magnitude of an earthquake by providing a measure of the total energy released from the source of the quake; the source of an earthquake is the segment of the fault that has slipped.

risk assessment – A systematic process that determines the likelihood of adverse health effects to a population after exposure to a hazard; health consequences may depend on the type of hazard and damage to infrastructure, loss of economic value, loss of function, loss of natural resources, loss of ecological systems, and environmental impacts and deterioration of health, mortality, and morbidity. (The major components of a risk assessment include a hazard identification analysis and a vulnerability analysis that answer the following questions: What are the hazards that could affect a community? What can happen as a result of those hazards? How likely is each of the possible outcomes? When the possible outcomes occur, what are the likely consequences and losses? Risk assessment is a fundamental planning tool for disaster management, especially during prevention and mitigation activities.)

risk as a function of hazard and vulnerability – A relationship that is frequently illustrated with the following formula, although the association is not strictly arithmetic: Risk equals Hazard times Vulnerability.

risk indicator – Descriptor that denotes risks that may cause a disaster.

risk management – The process of deciding which action to take when a risk assessment indicates that a danger of loss exists. (Risk management includes a range of actions [e.g., prevention, mitigation, preparedness, recovery] that are designed to mitigate an increasing risk of natural and technological hazards, decrease a risk to existing levels, and plan ways to respond to natural and technological hazards as well as catastrophic events.)

Saffir-Simpson scale – A scale used to measure strength of hurricanes.

secondary prevention – Mitigates the health consequences of disasters. (Examples include the use of carbon monoxide detectors when operating gasoline-powered generators after the loss of electric power, employing appropriate occupant behavior in multi-story structures during earthquakes, and building “safe rooms” in dwellings located in tornado-prone areas. Secondary prevention may be instituted when disasters are imminent.)

size-up/assessment – To identify a problem and assess the potential consequences. (Initially, a size-up is the responsibility of the first officer to arrive at the scene of an emergency. Size-ups continue throughout the response phase and continuously update the status of the incident, evaluate the hazards present, determine the size of the affected area as well as whether the area can be isolated. A size-up also determines if a staging area will be needed and where it should be located to allow for the best flow of personnel and equipment.)

span of control – The number of individuals managed by a single supervisor (the manageable span of control for one supervisor ranges from between three to seven individuals, with five as optimum).

staging area – An area where resources are kept while awaiting assignment.

state coordinating officer – An official designated by the governor of an affected state upon the declaration of a major disaster or emergency to coordinate state and local disaster assistance efforts with those of the federal government and to act in cooperation with the FCO to administer disaster recovery efforts.
Appendix II

**stockpile** – An area or storehouse where medicine and other supplies are kept in the event of an emergency.

**stress** – Physical, mental, or emotional strain or tension.

**strike team** – A group of resources of the same size and type (e.g., five patrol units, three drug K-9 teams).

**Supply Management Program (SUMA)** – A computer system that sorts and classifies supplies in order to prepare inventories of relief supplies that are sent to disaster-stricken countries (developed by the Pan American Health Organization).

**surveillance** – The ongoing and systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice; systems are designed to disseminate data in a timely manner and often include both data collection and disease monitoring.

**table-top exercise** – Method of evaluation of a disaster preparedness plan.

**task force** – A combination of single resources that is assembled for a particular operational need with common communications and one leader.

**technological hazard** – A potential threat to human welfare caused by technological factors (e.g., chemical release, nuclear accident, dam failure; earthquakes and other natural hazards can trigger technological hazards as well).

**tertiary prevention** – The minimization of the effects of disease and disability among those with preexisting health conditions. (Tertiary prevention shields persons with health conditions from negative health effects relating to a disaster. Examples of tertiary prevention include protecting persons with respiratory illnesses and those prone to respiratory conditions from the haze and smoke that originates from forest fires, and sheltering elderly who are prone to heat illnesses during episodes of extreme ambient temperatures.)

**theory** – A set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena.

**timeliness** – How quickly information or surveillance data can be made available.

**top-down** – A command function that is established by the first officer to arrive on the scene, who then becomes the incident commander.

**toxicological disaster** – A serious environmental pollutant that causes illness by a massive, accidental escape of toxic substances into the air, soil, or water; these disasters affect humans, animals, and plants.

**toxin** – A substance capable of causing a harmful effect.

**treatment technique (TT)** – An enforceable procedure or level of technological performance that public water systems must follow to ensure control of a water contaminant. (When there is no reliable method that is economically and technically feasible to measure contaminants at particularly low concentrations, a TT is set rather than a maximum contaminant level [MCL]. An example of a TT rule is the surface water treatment rule, which includes disinfection and filtration.)

**unity of command** – A hierarchical methodology that states that each person within an organization should report to only one superior.

**victim distribution** – A victim distribution plan defines the transport distribution of victims among neighboring hospitals according to their hospital treatment capacity; these plans often avoid taking victims to the nearest hospital because walking victims will overcrowd hospitals closest to the disaster site.

**voluntary agency (VOLAG)** – A nonprofit, nongovernmental, private association maintained and supported by voluntary contributions that provides assistance in emergencies and disasters.

**vulnerability** – The susceptibility of a population to a specific type of event; it is also associated with the degree of possible or potential loss from a risk that results from a hazard at a given intensity. (The factors that influence vulnerability include demographics, the age and resilience of the environment, technology, social differentiation, and diversity as well as regional and global economics politics.)

**vulnerability analysis** – The assessment of an exposed population’s susceptibility to the adverse health effects of a particular hazard.

**warning and forecasting** – Monitoring events to determine the time, location, and severity of a disaster.

**weapons of mass destruction (WMD)** – Any device, material, or substance used in a manner, in a quantity or type, or under circumstances evidencing an intent to cause death or serious injury to persons or significant damage to property.
Appendix III

Bioterrorism and Emergency Readiness: Competencies for All Public Health Workers

PUBLIC HEALTH COMMUNICABLE DISEASE STAFF

Occupations in which employees collect, investigate, describe, and analyze the distribution and determinants of disease, disability, and other health outcomes, and develop the means for their prevention and control; investigate, describes, and analyzes the efficacy of programs and interventions, advising local health departments and the health care community on outbreak investigations, immunization data, disease identification, reporting, and prevention. Includes individuals specifically trained as epidemiologists and those trained in other disciplines (e.g., medicine, nursing, environmental health, veterinary medicine) who are employed as epidemiologists under job titles such as nurse epidemiologist.

I. PREPAREDNESS AND PLANNING

Core Competency 1

Describe the public health role in emergency response in a range of emergencies that might arise (e.g., This department provides surveillance, investigation and public information in disease outbreaks and collaborates with other agencies in biological, environmental, and weather emergencies.)

Core Competency 2

Describe the chain of command in emergency response. Maintain regular communication with emergency response partners (includes maintaining a current directory of partners and identifying appropriate methods for contact in emergencies).

Core Competency 3

Identify and locate the agency emergency response plan (or the pertinent portion of the plan). Generate a public health bioterrorism (BT) response plan for epidemiology and surveillance personnel that is integrated with the emergency response plan for the agency by applying the following competencies:

- Define modifications to the agency’s internal command notification and coordination structure that are required for BT response.
- Establish protocols for handling and distribution of the National Pharmaceutical Stockpile.
- Maintain written plans for 24/7 availability of specific staff and specialists required during a BT event.
- Design BT-specific protocols for enhanced surveillance, including activating additional personnel (e.g., infection control practitioners, public health nurses, epidemiologists, and data entry clerks from other institutions, jurisdictions, and/or agencies).
- Generate plans to conduct risk assessments in public health emergencies.
- Establish written policies and procedures for rapid specimen identification and electronic reporting of results.
- Establish emergency communications roles and responsibilities for BT response.
- Establish data collection protocols that systematically monitor community health indicators (e.g., aberrations in utilization trends or syndromic surveillance).
- Ensure a system is established and functioning that provides rapid rule-out testing, referral,
Appendix III

Identification, confirmation, and characterization of biological threat agents, including rapid reporting of results, during a BT event.

■ Conduct workforce BT preparedness programs in epidemiology and surveillance. Identify specific resources needed for BT response to crucial biologic agents (Category A, B, C).
■ Use risk assessment of potential biological, chemical, or radiological hazards in the community to determine roles and responsibilities of those involved in public health BT response.

Core Competency 4

Describe one’s functional role(s) in emergency response and demonstrate one’s role(s) in regular drills.

Identify one’s functional role in the agency’s BT response plan.

Demonstrate readiness to apply professional skills to a range of emergency situations during regular drills (e.g., access, use, and interpret surveillance data; access and use lab resources; access and use science-based investigation and risk assessment protocols; identify and use appropriate personal protective equipment).

Core Competency 5

Demonstrate correct use of all communication equipment used for emergency communication (phone, fax, radio, etc.).

Core Competency 6

Describe communication role(s) in emergency response:
■ within the agency, using established communication systems
■ with the media
■ with the general public
■ with family, neighbors (personal)

Disseminate notifiable disease information and reporting requirements and procedures to health care providers on a periodic basis.

Core Competency 7

Identify limits to own knowledge, skill, and authority, and identify key system resources for referring matters that exceed these limits.

Core Competency 8

Recognize unusual events that might indicate an emergency and describe appropriate action (e.g., communicate clearly within the chain of command). Participate in continuing education to maintain up-to-date knowledge in areas relevant to emergency response (e.g., emerging infectious diseases, hazardous materials, diagnostic tests, etc.).

II. RESPONSE AND MITIGATION

Implement your individual BT response functional role.

Core Competency 9

Apply creative problem solving and flexible thinking to unusual challenges within one’s functional responsibilities and evaluate effectiveness of all actions taken. Apply algorithms that trigger further epidemiological investigation. Identify the indicators, signs, and symptoms for exposure to critical biologic agents (Category A, B, C) or to nuclear or chemical agents. Activate enhanced active surveillance protocols to track the scope of the exposure or outbreak. Request implementation of the public health emergency response plan. Collect timely patient-based data and health care utilization data on critical biological agents (Category A, B, C). Identify persons potentially exposed to a specific BT agent in need of public health and/or medical intervention. Demonstrate proper safety and personal protection equipment procedures. Use established communication systems for coordination among the response community during a BT event, including those for privileged information. Contribute to the development of accurate event-specific science-based risk communication to the public, the media, health care providers, and response community in a BT event.

III. Recovery and Evaluation

Define algorithms that trigger further epidemiological investigation. Apply appropriate science-based public health measures to ensure continued population protection appropriate to the biological threat involved, including follow-up of those exposed, vaccinated, or quarantined.
Federal Emergency Management Agency: Emergency Response Action Steps

Appendix IV

The first 48 hours can make the difference.

DISASTER ALERT: IF YOU HAVE ADVANCED WARNING:

■ People come first. Provide assistance. Note needs of people with disabilities.
■ Move or secure vital records/high priority items if it can be done safely.
■ Screw plywood over windows or use tape to reduce shattering.
   (Please note: Taping windows to prevent flying glass is not a recommended practice.)
■ Verify master switch shut-off (water, gas, electricity) by trained staff.
■ Move items away from windows and below-ground storage into water-resistant areas.
■ For flooding, move items to higher floors.
■ In a hurricane, avoid areas under roof.
■ Wrap shelves, cabinets, other storage units in heavy plastic sealed with waterproof tape.
■ Move outdoor objects indoors or secure.
■ Take with you lists of staff, institutional/public officials, insurance and financial data, inventory, emergency plan, and supplies.
■ Appoint a staff contact to give instructions on returning to work.

SAFETY FIRST!

■ Remain calm, reassuring. Alert staff to potential hazards.
■ Look for loose or downed power lines. Avoid area. Report problems to local utility.
■ Look for electrical system damage: sparks, broken/frayed wires, smell of burning insulation. Turn off electricity at main switch if you can without risk.
■ Shut off water.
■ If you smell gas or hear blowing or hissing, open a window and immediately leave the building. Turn off gas at main valve if trained to do so. Call gas company at once.
■ DO NOT REENTER THE BUILDING until declared safe by security or emergency management officials.

GETTING STARTED OFF SITE

■ Gather staff off site to assign tasks and review salvage priorities. Create a team big enough for the work.
■ Establish a Command Center with office equipment (computers, photocopier) and communications tools (walkie-talkies, cellular phones).
■ Create a secure salvage area with locks, fans, tables, shelves, plastic sheeting, drying materials, and clean water.
■ Notify emergency officials of the extent of damage. Contact peer institutions or professional groups for help.
■ Appoint a media liaison to report conditions and need for help/volunteers. You may have to limit access to collections.
■ Verify financial resources—amount and terms of insurance, government assistance, potential outside funding.
■ Contact service providers for generator, freezer, drying or freeze-drying services, and refrigerated trucking.
■ Arrange for repairs to security system.
STABILIZE THE BUILDING AND ENVIRONMENT

- Some building contents may be contaminated. Do not enter without current tetanus shots, protective gloves/clothing, hard hat and NIOSH-approved respiratory mask.
- Identify and repair structural hazards. Brace shelves. Remove debris from floor.
- Reduce temperature and relative humidity at once to prevent mold outbreak. Ideal targets are less than 70°F/45% RH.
- If warm outside, use coldest air conditioning setting; cover broken windows with plastic.
- In cool, low-humidity weather open windows, use circulating fans. If mold is already present, do not circulate air.
- Do not turn on heat unless required for human comfort.
- Remove standing water and empty items containing water; remove wet carpets and furnishings.
- If everything is soaked, use commercial dehumidification except in historic buildings.
- Purchase needed supplies.

DOCUMENTATION

- Once it is safe to enter the building, make a preliminary tour of all affected areas. Wear protective clothing.
- Do not move objects or collections without documenting their condition.
- Use a Polaroid-type camera or video camera to record conditions of collections and structure. Make sure images clearly record damage. Supplement with better quality photos when necessary.
- Make notes and voice recordings to accompany photographs.
- Assign staff to keep written records of contacts with insurance agents and other investigators, and staff decisions on retrieval and salvage.
- Make visual, written, and voice records for each step of salvage procedures.

RETRIEVAL AND PROTECTION

- Leave undamaged items in place if the environment is stable and area secure. If not, move them to a secure, environmentally controlled area.
- If no part of the building is dry, protect all objects with loose plastic sheeting.
- When moving collections, give priority to undamaged items and those on loan. Separate undamaged from damaged items.
- Until salvage begins, maintain each group in the same condition you found it; that is, keep wet items wet, dry items dry, and damp items damp.
- Retrieve all pieces of broken objects and label them.
- Check items daily for mold. If mold is found, handle objects with extreme care and isolate them.

DAMAGE ASSESSMENT

- Notify insurance representative or risk manager. You may need an on-site evaluation before taking action.
- Make a rough estimate of the type of materials affected and the extent and nature of damage. A detailed evaluation can slow recovery now.
- Look for threats to worker safety or collections. Determine status of security systems.
- Look for evidence of mold. Note how long the materials have been wet and the current inside temperature and relative humidity.
- See Documentation section. Documenting the damage is essential for insurance and will help you with recovery.

SALVAGE PRIORITIES

Establish salvage priorities by groups of materials, not item by item. A library might use subject areas or call numbers; an archive, record groups; and a museum, material groupings. Focus first protection efforts and salvage work on:

- Vital institutional information; employee and accounting records, accession lists, shelflist, and database backups.
- Items on loan from individuals or other institutions.
- Collections that are unique, most used, most vital for research, most representative of subject areas, least replaceable, or most valuable.
- Items most prone to continued damage if untreated.
- Materials most likely to be successfully salvaged.

HISTORIC BUILDINGS: GENERAL TIPS

- Contact architectural conservators, historic preservation agencies, FEMA, and/or structural engineers before cleanup, especially for buildings on the National Register of Historic Places.
Follow the Secretary of the Interior’s Standards for Treatment of Historic Properties (pp. 17–59).

- Remove standing water from basement and crawl spaces. Contact a structural engineer before pumping water; pumping can collapse foundation when groundwater is high.
- Remove flood-soaked insulation, wallboard, and non-historic wall coverings. Support loose plaster with plywood and wood “T” braces.
- Clean historic elements first. Use nonabrasive household cleansers.

- If you treat nonhistoric features, do not harm historic elements.
- Inventory found items, loose decorative elements, furnishings, and collections. Save for reuse or as restoration models.
- Air dry with good ventilation. Never use systems that pump in super-dry air.

## Anthrax Summary

<table>
<thead>
<tr>
<th>Clinical Recognition</th>
<th>Diagnosis and Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ETIOLOGIC AGENT</strong></td>
<td>Bacillus anthracis, a spore-forming bacterium found in soil, transmitted via infected sheep, cattle, goats, or animal products. Can also be purified and aerosolized.</td>
</tr>
<tr>
<td><strong>PRODROME</strong></td>
<td>Similar to influenza: fever, malaise, fatigue, chills, myalgia</td>
</tr>
<tr>
<td><strong>INHALATIONAL ANTHRAX</strong></td>
<td>Cough, chest pain, dyspnea</td>
</tr>
<tr>
<td><strong>GASTROINTESTINAL ANTHRAX</strong></td>
<td>Nausea, bloody diarrhea, abdominal pain</td>
</tr>
<tr>
<td><strong>CUTANEOUS ANTHRAX</strong></td>
<td>Painless, necrotic ulcers with black base and edema</td>
</tr>
<tr>
<td><strong>ONSET</strong></td>
<td>Abrupt</td>
</tr>
<tr>
<td><strong>DURATION</strong></td>
<td>Days</td>
</tr>
<tr>
<td><strong>INCUBATION</strong></td>
<td>1 to 7 days</td>
</tr>
<tr>
<td><strong>SYNDROMES</strong></td>
<td>Influenza, Pulmonary, Meningitis, Septicemia, Pleural Effusions, Meningitis, Mediastinitis, Respiratory Distress, Septic Shock, Cytostasis, Elevated WBC, Edema</td>
</tr>
<tr>
<td><strong>DISTRIBUTION</strong></td>
<td>Aerosol</td>
</tr>
<tr>
<td><strong>LETHALITY</strong></td>
<td>High (80%–90%) for inhalational form</td>
</tr>
<tr>
<td><strong>DIAGNOSTIC SAMPLES</strong></td>
<td>Blood, ulcer fluid</td>
</tr>
<tr>
<td><strong>DIFFERENTIAL DIAGNOSIS</strong></td>
<td>Tularemia, plague, diphtheria</td>
</tr>
<tr>
<td><strong>ISOLATION/DECON PRECAUTIONS</strong></td>
<td>Contact isolation</td>
</tr>
<tr>
<td><strong>VACCINE</strong></td>
<td>Available, but confined to military and certain laboratory personnel.</td>
</tr>
<tr>
<td><strong>POSTEXPOSURE PROPHYLAXIS</strong></td>
<td>Ciprofloxacin or doxycycline, 60–180 d course, ± anthrax vaccine</td>
</tr>
</tbody>
</table>
| **THERAPY** | Ciprofloxacin 400 mg IV q 8–12h (Peds: 20–30mg/kg/d IV bid dosing up to 1 g)  
**OR**  
Doxycycline 200 mg IV (1 dose) then 100 mg IV q 8–12h — 4 wk. (Peds: 2.5mg/kg IV q 12h)  
**PLUS**  
One or two additional antimicrobials: gentamicin, clindamycin, rifampin, vancomycin, penicillin, ampicillin, chloramphenicol, imipenem, or clarithromycin |
| **FOR MASS CASUALTY SETTINGS** | Ciprofloxacin or doxycycline may be used. Therapy should continue for 60 d. |
# Appendix VI

## Botulism Summary

### Clinical Recognition

<table>
<thead>
<tr>
<th>Etiologic Agent</th>
<th>Clostridium botulinum, a spore-forming bacterium found in soil and contaminated food. Produces botulinum toxin, an extremely powerful neuroparalytic agent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prodrome</td>
<td>Abdominal cramps, nausea, vomiting, possibly diarrhea</td>
</tr>
<tr>
<td>Neurologic Symptoms</td>
<td>Double vision, blurred vision, drooping eyelids, slurred speech, difficulty swallowing, dry mouth, muscle weakness</td>
</tr>
<tr>
<td>Other Symptoms</td>
<td>Pulmonary Dyspea</td>
</tr>
<tr>
<td></td>
<td>CNS Cranial nerve deficits are universal Descending symmetric paralysis</td>
</tr>
<tr>
<td></td>
<td>Gastrointestinal Constipation (later in course)</td>
</tr>
<tr>
<td>Other Forms of Botulism</td>
<td>Infantile Botulism—Ingestion of botulism spores, often in honey, produces flaccid paralysis, poor feeding and suck reflexes, “floppy baby” syndrome. Wound Botulism—Contamination of wounds with C. botulinum spores can produce systemic symptoms.</td>
</tr>
</tbody>
</table>

### Diagnosis and Treatment

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Foodborne, wound contaminant, aerosol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethality</td>
<td>Mild (about 5% die from respiratory failure), Fatigue and shortness of breath may last for years in survivors.</td>
</tr>
<tr>
<td>Diagnostic Samples</td>
<td>Stool, gastric aspirate, vomitus, suspect food samples</td>
</tr>
<tr>
<td>Differential Diagnosis</td>
<td>Diphtheria, encephalitis, poliomyelitis, Guillain-Barré syndrome, congenital neuromuscular and myopathies, myasthenia gravis</td>
</tr>
<tr>
<td>Isolation/Decont Precautions</td>
<td>Extensive precautions for laboratory personnel</td>
</tr>
<tr>
<td>Vaccine</td>
<td>Botulinum toxoid vaccine available but restricted in use to military and laboratory personnel</td>
</tr>
<tr>
<td>Postexposure Prophylaxis</td>
<td>None</td>
</tr>
<tr>
<td>Therapy</td>
<td>Ventilatory support (often for weeks) Trivalent botulinum antitoxin Enemas and cathartics</td>
</tr>
</tbody>
</table>

## Distribution

- Foodborne
- Wound contaminant
- Aerosol

## Lethality

Mild (about 5% die from respiratory failure), Fatigue and shortness of breath may last for years in survivors.

## Diagnostic Samples

- Stool
- Gastric aspirate
- Vomitus
- Suspect food samples

## Differential Diagnosis

- Diphtheria
- Encephalitis
- Poliomyelitis
- Guillain-Barré syndrome
- Congenital neuromuscular and myopathies
- Myasthenia gravis

## Isolation/Decont Precautions

Extensive precautions for laboratory personnel

## Vaccine

Botulinum toxoid vaccine available but restricted in use to military and laboratory personnel

## Postexposure Prophylaxis

None

## Therapy

- Ventilatory support (often for weeks)
- Trivalent botulinum antitoxin
- Enemas and cathartics

## Onset

Acute

## Duration

Weeks to months

## Incubation

12–72 hours
# Appendix VII

## Plague Summary

<table>
<thead>
<tr>
<th>Clinical Recognition</th>
<th>Diagnosis and Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Etiologic Agent</strong></td>
<td>Yersinia pestis, a gram-negative bacterium carried by fleas and infected rodents</td>
</tr>
<tr>
<td><strong>Prodrome</strong> (for Pneumonic Form)</td>
<td>Fever, cough, and dyspnea; bloody, watery sputum; nausea, vomiting, abdominal pain, diarrhea</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Bubonic Plague</strong></td>
<td>Painful, fluctuant swellings (buboes) in groin, axillae, and cervical areas; fever, bacteremia</td>
</tr>
<tr>
<td><strong>Pneumonic Plague</strong></td>
<td>Chest pain, dyspnea, hemoptysis, sepsis, multiple organ failure</td>
</tr>
<tr>
<td><strong>Septicemic Plague</strong></td>
<td>Fever, bacteremia, sepsis, leading to multiple organ failure</td>
</tr>
<tr>
<td><strong>Onset</strong></td>
<td>Abrupt</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Days</td>
</tr>
<tr>
<td><strong>Incubation</strong></td>
<td>1–6 days, with 2–4 days for an intentional attack</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Bite of infected flea, droplet spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethality</td>
<td>High (100%) for pneumonic form if not treated in first 24 hours</td>
</tr>
<tr>
<td>Diagnostic Samples</td>
<td>Blood, sputum, bubo aspirate cultures</td>
</tr>
<tr>
<td>Differential Diagnosis</td>
<td>Tularemia, anthrax, diphtheria, pneumonia, DIC</td>
</tr>
<tr>
<td>Isolation/Decontamination precautions</td>
<td>Respiratory droplet precautions</td>
</tr>
<tr>
<td>Vaccine</td>
<td>Not currently available. Previous vaccine did not protect against pneumonic form.</td>
</tr>
<tr>
<td>Postexposure Prophylaxis</td>
<td>Ciprofloxacin or Doxycycline</td>
</tr>
<tr>
<td>Therapy</td>
<td>Streptomycin, 1 g IM twice daily OR Gentamicin, 5 mg/kg IM or IV once daily or 2 mg/kg loading dose followed by 1.7 mg/kg IM or IV three times daily. For mass casualty settings, Ciprofloxacin or Doxycycline may be used.</td>
</tr>
</tbody>
</table>
Appendix VIII

Smallpox Summary

<table>
<thead>
<tr>
<th>Clinical Recognition</th>
<th>Diagnosis and Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Etiologic Agent</strong></td>
<td>Smallpox virus, an orthopoxvirus declared eliminated by WHO in 1980. Stockpiles still exist for research purposes.</td>
</tr>
<tr>
<td><strong>Prodrome</strong></td>
<td>High fever, fatigue, and headache, abdominal pain</td>
</tr>
<tr>
<td><strong>Rash</strong></td>
<td>Characteristic rash, most prominent on the face, arms, and legs, follows in 2–3 days. Lesions evolve at same rate, unlike varicella.</td>
</tr>
<tr>
<td><strong>Other Symptoms</strong></td>
<td>Influenza-like</td>
</tr>
<tr>
<td></td>
<td>Malaise, fever, headache, vomiting, cough, abdominal pain</td>
</tr>
<tr>
<td></td>
<td>Pulmonary</td>
</tr>
<tr>
<td></td>
<td>Bronchitis</td>
</tr>
<tr>
<td></td>
<td>Pulmonary edema</td>
</tr>
<tr>
<td></td>
<td>CNS</td>
</tr>
<tr>
<td></td>
<td>Delirium</td>
</tr>
<tr>
<td></td>
<td>Encephalitis</td>
</tr>
<tr>
<td><strong>Onset</strong></td>
<td>Abrupt</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>3–4 weeks</td>
</tr>
<tr>
<td><strong>Incubation</strong></td>
<td>7–17 days (mean 12 days)</td>
</tr>
<tr>
<td><strong>DISTRIBUTION</strong></td>
<td>Aerosol</td>
</tr>
<tr>
<td><strong>Lethality</strong></td>
<td>Moderate (20%–40% in unvaccinated)</td>
</tr>
<tr>
<td><strong>Diagnostic Samples</strong></td>
<td>Pharyngeal swab, scab matter, nasal swab, serum</td>
</tr>
<tr>
<td><strong>Differential Diagnosis</strong></td>
<td>Varicella, erythema multiform, contact dermatitis</td>
</tr>
<tr>
<td><strong>Isolation/Decontamination Precautions</strong></td>
<td>Negative pressure isolation room with HEPA-filtration</td>
</tr>
<tr>
<td></td>
<td>Glove, gown, masks, and face shields</td>
</tr>
<tr>
<td></td>
<td>Clean environments with bleach solution</td>
</tr>
<tr>
<td><strong>Vaccine</strong></td>
<td>Available but currently restricted in use to military and laboratory personnel. Plans to vaccinate U.S. health care workers are pending. Vaccinia Immune Globulin (VIG) 0.6 mL/kg IM may be given for complications of vaccine.</td>
</tr>
<tr>
<td><strong>Postexposure Prophylaxis</strong></td>
<td>Smallpox vaccine within 4 days of exposure</td>
</tr>
<tr>
<td><strong>Therapy</strong></td>
<td>Supportive therapy with intravenous fluids, antibiotics for secondary bacterial infections</td>
</tr>
<tr>
<td></td>
<td>Cidofovir (pediatric dosage is not established) possibly effective</td>
</tr>
</tbody>
</table>
## Tularemia Summary

<table>
<thead>
<tr>
<th>CLINICAL RECOGNITION</th>
<th>DIAGNOSIS AND TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ETIOLOGIC AGENT</strong></td>
<td><em>Francisella tularensis</em>, an extremely infectious gram-negative bacterium found in soil and carried by small mammals such as rabbits, squirrels, and mice</td>
</tr>
<tr>
<td><strong>PRODROME</strong></td>
<td>Fever, headache, chills, rigor, and myalgias (often with low back pain)</td>
</tr>
<tr>
<td><strong>SYMPTOMS</strong></td>
<td>Pulmonary: Dry cough, chest pain or tightness without overt signs of pneumonia</td>
</tr>
<tr>
<td></td>
<td>Cutaneous: Ulcers at site of inoculation, regional lymphadenopathy</td>
</tr>
<tr>
<td><strong>ONSET</strong></td>
<td>Abrupt</td>
</tr>
<tr>
<td><strong>DURATION</strong></td>
<td>Weeks</td>
</tr>
<tr>
<td><strong>INCUBATION</strong></td>
<td>3–4 days, range: 1–14 days</td>
</tr>
<tr>
<td><strong>DISTRIBUTION</strong></td>
<td>Infection can occur through breaks in skin, by inhalation or gastrointestinal routes</td>
</tr>
<tr>
<td><strong>LETHALITY</strong></td>
<td>Low (1% if treated, 5%–15% if untreated)</td>
</tr>
<tr>
<td><strong>DIAGNOSTIC SAMPLES</strong></td>
<td>Sputum, exudates, biopsy specimens, blood cultures</td>
</tr>
<tr>
<td><strong>DIFFERENTIAL DIAGNOSIS</strong></td>
<td>Plague, diphtheria, psittacosis, Q fever, and other tickborne diseases</td>
</tr>
<tr>
<td><strong>ISOLATION/DECONTAMINATION PRECAUTIONS</strong></td>
<td>Standard precautions</td>
</tr>
<tr>
<td></td>
<td>Routine laboratory samples should be handled under biosafety level 2 conditions</td>
</tr>
<tr>
<td><strong>VACCINE</strong></td>
<td>Available for laboratory personnel who work with <em>F. tularensis</em></td>
</tr>
<tr>
<td><strong>POSTEXPOSURE PROPHYLAXIS</strong></td>
<td>Ciprofloxacin or Doxycycline</td>
</tr>
<tr>
<td><strong>THERAPY</strong></td>
<td>Streptomycin, 1 g IM twice daily</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Gentamicin, 5 mg/kg IM or IV once daily</td>
</tr>
<tr>
<td></td>
<td>For mass casualty settings, Ciprofloxacin or Doxycycline may be used.</td>
</tr>
</tbody>
</table>
## Viral Hemorrhagic Fevers Summary

<table>
<thead>
<tr>
<th>Etiologic Agent</th>
<th>Distribution and Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A group of highly infectious viruses that lead to a potentially lethal disease syndrome characterized by fever, malaise, vomiting, mucosal and gastrointestinal bleeding, edema, and hypotension, including Ebola, Marburg, Lassa fever, and the South American arenaviruses.</td>
<td>Contact with infected rodents or their excreta. Vectors for Ebola and Marburg are unknown.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prodrome</th>
<th>Lethality</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fever, headache, fatigue, abdominal pain, myalgias, and prostration.</td>
<td>High (80%–90%) for Ebola-Zaire, 50%–60% for Ebola-Sudan, variable for other VHF.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Differential Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal: Hematemesis, bloody diarrhea, generalized mucous membrane hemorrhage.</td>
<td>Malaria, DIC, typhoid fever, meningococcemia, salmonella, shigellosis, idiopathic and thrombotic thrombocytopenic purpura, leukemia.</td>
</tr>
<tr>
<td>Cutaneous: Rash, may be macular, petechial, or ecchymotic. Jaundice seen in Rift Valley fever and yellow fever.</td>
<td></td>
</tr>
<tr>
<td>Cardiovascular: Shock, circulatory collapse</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Onset</th>
<th>Diagnosis and Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>abrupt</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Isolation/Decontamination Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>days</td>
<td>Stringent barrier nursing</td>
</tr>
<tr>
<td></td>
<td>HEPA filter masks or respirators</td>
</tr>
<tr>
<td></td>
<td>Mask, gown, gloves</td>
</tr>
<tr>
<td></td>
<td>Leg and shoe coverings</td>
</tr>
<tr>
<td></td>
<td>Restricted access to patient</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incubation</th>
<th>Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–21 days, depending on the specific virus</td>
<td>Not currently available, except for Lassa fever. Other vaccines are under development.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Postexposure Prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribavirin for Lassa fever and possibly other arenavirus infections. Supportive therapy for other VHF infections. Passive therapy with convalescent plasma offers unclear benefit.</td>
<td>None</td>
</tr>
</tbody>
</table>

Differential diagnosis includes malaria, DIC, typhoid fever, meningococcemia, salmonella, shigellosis, idiopathic and thrombotic thrombocytopenic purpura, leukemia.
# Appendix XI

## Biological Weapon (BW) Agent Lab Identification

### BW Agents: Vaccine, Therapeutics, and Prophylaxis

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>VACCINE</th>
<th>CHEMOTHERAPY (Rx)</th>
<th>CHEMO-PROPHYLAXIS (Px)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthrax*</td>
<td>Bioport vaccine (licensed) 0.5 mL SC @ 0, 2, 4 wk, 6, 12, 18 mo; then annual boosters**</td>
<td>Ciprofloxacin 400 mg IV q 8–12 h**</td>
<td>Ciprofloxacin 500 mg PO bid times 4 wk. If unvaccinated, begin initial doses of vaccine.****</td>
<td>Potential alternates for Rx: gentamicin, erythromycin, and chloramphenicol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Doxycycline 200 mg IV, then 100 mg IV q 8–12 h</td>
<td>Doxycycline 100 mg PO bid times 4 wk plus vaccination</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Penicillin 2 million units IV q 2 h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholera*****</td>
<td>Wyeth-Ayerst Vaccine 2 doses 0.5 mL IM or SC @ 0, 7–30 days, then boosters 0-6 months</td>
<td>Tetracycline 500 mg q 6 h times 3 d</td>
<td>Tetracycline 500 mg once, or 100 mg q 12 h times 3 d</td>
<td>PON for sensitive organisms only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ciprofloxacin 500 mg q 6 h times 3 d</td>
<td>Ciprofloxacin 500 mg q 6 h times 3 d</td>
<td>Vaccine not recommended for routine protection in endemic areas (50% efficacy, short term). Alternates for Rx: erythromycin, trimethoprim and sulfamethoxazole, and furazolidone Quinolones for tetra/doxy resistant strains</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Norfloxacin 400 mg q 12 h times 3 d</td>
<td>Norfloxacin 400 mg q 12 h times 3 d</td>
<td></td>
</tr>
<tr>
<td>Q Fever*****</td>
<td>IND 610-inactivated whole cell vaccine given as single 0.5mL s.c. injection</td>
<td>Tetracycline 500 mg PO q 6 h times 5–7</td>
<td>Tetracycline start 8–12 d post-exposure times 5 d</td>
<td>Currently testing vaccine to determine the necessity of skin testing prior to use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Doxycycline 100 mg PO q 12 h times 5–7 d</td>
<td>Doxycycline start 8–12 d post-exposure times 5 d</td>
<td></td>
</tr>
</tbody>
</table>

* Potential alternates for Rx: gentamicin, erythromycin, and chloramphenicol.

** Tetracycline start 8–12 d post-exposure times 5 d.

*** Tetracycline 500 mg PO q 6 h times 3 d.

**** Tetracycline 500 mg PO q 6 h times 3 d.

***** Tetracycline 500 mg PO q 6 h times 3 d.

****** Tetracycline 500 mg PO q 6 h times 3 d.
## BW Agents: Vaccine, Therapeutics, and Prophylaxis (continued)

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>VACCINE</th>
<th>CHEMOTHERAPY (Rx)</th>
<th>CHEMO-PROPHYLAXIS (Px)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glanders†††</td>
<td>No vaccine available</td>
<td>Antibiotic regimens vary depending on localization and severity of disease; refer to text.</td>
<td>Postexposure prophylaxis may be tried with TMP-SMX.</td>
<td>No large therapeutic human trials have been conducted owing to the rarity of naturally occurring disease.</td>
</tr>
</tbody>
</table>
### BW Agents: Vaccine, Therapeutics, and Prophylaxis (continued)

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>VACCINE</th>
<th>CHEMOTHERAPY (Rx)</th>
<th>CHEMO-PROPHYLAXIS (Px)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEE inactivated</td>
<td>0.5 mL SC at 0, 7, and 28 d</td>
<td>Immunogenic. Multiple immunizations are required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AHF Candid #1 vaccine</td>
<td>Ribavirin (CCHF/arenaviruses) 30 mg/kg IV Q 6 h times 4 d 7.5 mg/kg IV q 8 h times 6 d***</td>
<td>NA</td>
<td>Aggressive supportive care and management of hypotension very important</td>
<td></td>
</tr>
<tr>
<td>RVF inactivated vaccine</td>
<td>Passive antibody for AHF, BHV, Lassa fever, and CCHF***</td>
<td>Vaccinia immune globulin 0.6 mL/kg IM (within 3 d of exposure, best within 24 h)**</td>
<td>Pre- and postexposure vaccination recommended if greater than 3 years since last vaccine. Skin test for hypersensitivity before equine antitoxin administration.</td>
<td></td>
</tr>
<tr>
<td>WYeth calf lymph</td>
<td>No current Rx other than supportive; cidofovir (effective in vitro); animal studies ongoing</td>
<td>Vaccinia immune globulin 0.6 mL/kg IM (within 3 d of exposure, best within 24 h)**</td>
<td>Pre- and postexposure vaccination recommended if greater than 3 years since last vaccine. Skin test for hypersensitivity before equine antitoxin administration.</td>
<td></td>
</tr>
<tr>
<td>DOD pentavalent toxoid</td>
<td>DOD heptavalent equine despeciated antitoxin for serotypes A-G (IND): 1 vial (10 mL) ***</td>
<td>CDC intraventricular antitoxin for serotypes A, B, E (licensed)</td>
<td>Skin test for hypersensitivity before equine antitoxin administration.</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus Enterotoxin B</td>
<td>No vaccine available</td>
<td>Ventilatory support for inhalation exposure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ricin ******</td>
<td>No vaccine available</td>
<td>Inhalation: supportive therapy G-I; gastric lavage, superactivated charcoal, cathartics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-2 Mycotoxin</td>
<td>No vaccine available</td>
<td>Decontamination of clothing and skin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = Category A agent  
** = Vaccine  
*** = Category A Rx  
**** = Chemoprophylaxis Category A  
***** = Category B agent
## Category A BW Agents: Vaccine, Therapeutics, and Prophylaxis

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>VACCINE</th>
<th>CHEMOTHERAPY (Rx)</th>
<th>CHEMO-PROPHYLAXIS (Px)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viral Hemorrhagic Fevers</td>
<td>AHF Candid #1 vaccine (x-protection for BHF) (IND)</td>
<td>Ribavirin (CDHF/arenaviruses) 30 mg/kg IV initial dose 15 mg/kg IV q 6 h times 4 d 7.5 mg/kg IV q 8 h times 6 d</td>
<td>NA</td>
<td>Aggressive supportive care and management of hypotension very important.</td>
</tr>
<tr>
<td>Viral Hemorrhagic Fevers</td>
<td>AHF Candid #1 vaccine (x-protection for BHF) (IND)</td>
<td>Ribavirin (CDHF/arenaviruses) 30 mg/kg IV initial dose 15 mg/kg IV q 6 h times 4 d 7.5 mg/kg IV q 8 h times 6 d</td>
<td>NA</td>
<td>Aggressive supportive care and management of hypotension very important.</td>
</tr>
<tr>
<td>RVF inactivated vaccine</td>
<td>Ribavirin (CDHF/arenaviruses) 30 mg/kg IV initial dose 15 mg/kg IV q 6 h times 4 d 7.5 mg/kg IV q 8 h times 6 d RVF inactivated vaccine (IND)</td>
<td>Passive antibody for AHF, BHF, Lassa fever, and CDHF</td>
<td>NA</td>
<td>Passive antibody for AHF, BHF, Lassa fever, and CDHF</td>
</tr>
</tbody>
</table>
Appendix XII

Patient Isolation Precautions

STANDARD PRECAUTIONS
Wash hands after patient contact.
Wear gloves when touching blood, body fluids, secretions, excretions, and contaminated items.
Wear a mask and eye protection, or a face shield, during procedures likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.
Handle used patient-care equipment and linen in a manner that prevents the transfer of microorganisms to people or equipment. Use care when handling sharps and use a mouthpiece or other ventilation device as an alternative to mouth-to-mouth resuscitation when practical.

Standard precautions are employed in the care of ALL patients.

AIRBORNE PRECAUTIONS
Standard Precautions plus:
Place the patient in a private room that has monitored negative air pressure, a minimum of six air changes per hour, and appropriate filtration of air before it is discharged from the room.
Wear respiratory protection when entering the room.
Limit movement and transport of the patient. Place a mask on the patient if they need to be moved.

Conventional diseases requiring airborne precautions: measles, varicella, pulmonary tuberculosis.
Biothreat diseases requiring airborne precautions: smallpox.

CONVENTIONAL DISEASES
measles, varicella, pulmonary tuberculosis.
Biothreat diseases requiring airborne precautions: smallpox.

DROPLET PRECAUTIONS
Standard Precautions plus:
Place the patient in a private room or cohort them with someone with the same infection. If not feasible, maintain at least 3 feet between patients.
Wear a mask when working within 3 feet of the patient.
Limit movement and transport of the patient. Place a mask on the patient if they need to be moved.

Conventional diseases requiring droplet precautions: invasive haemophilus influenzae and meningococcal disease, drug-resistant pneumococcal disease, diphtheria, pertussis, mycoplasma, GABHS, influenza, mumps, rubella, parvovirus.
Biothreat diseases requiring droplet precautions: pneumonic plague.

CONTACT PRECAUTIONS
Standard Precautions plus:
Place the patient in a private room or cohort them with someone with the same infection if possible.
Wear gloves when entering the room. Change gloves after contact with infective material.
Wear a gown when entering the room if contact with patient is anticipated or if the patient has diarrhea, a colostomy, or wound drainage not covered by a dressing.
Limit the movement or transport of the patient from the room.
Ensure that patient-care items, bedside equipment, and frequently touched surfaces receive daily cleaning.
Dedicate use of noncritical patient-care equipment (such as stethoscopes) to a single patient, or co-hort of patients with the same pathogen. If not feasible, adequate disinfection between patients is necessary.

Conventional diseases requiring contact precautions: MSRA, VRE, Clostridium difficile, RSV, parainfluenza, enteroviruses, enteric infections in the incontinent host, skin infections (SSSS, HSV, impetigo, lice, scabies), hemorrhagic conjunctivitis.

Biothreat diseases requiring contact precautions: viral hemorrhagic fevers.

Creating a Personal Disaster Plan

One of the most important steps you can take in preparing for emergencies is to develop a household disaster plan.

1. Learn about the natural disasters that could occur in your community from your local emergency management office or American Red Cross chapter. Learn whether hazardous materials are produced, stored or transported near your area. Learn about possible consequences of deliberate acts of terror. Ask how to prepare for each potential emergency and how to respond.

2. Consider becoming an American Red Cross disaster nurse.

3. Talk with employers and school officials about their emergency response plans.

4. Talk with each member of your household about potential emergencies and how to respond to each. Talk about what you would need to do in an evacuation.

5. Plan how your household would stay in contact if you were separated. Identify two meeting places: the first should be near your home—in case of fire, perhaps a tree or a telephone pole; the second should be away from your neighborhood in case you cannot return home.

6. Pick a friend or relative who lives out of the area for household members to call to say they are okay.

7. Draw a floor plan of your home. Mark two escape routes from each room.

8. Post emergency telephone numbers by telephones. Teach children how and when to call 911.

9. Make sure everyone in your household knows how and when to shut off water, gas, and electricity at the main switches. Consult with your local utilities if you have questions.

10. Stay up to date with all of your certifications (e.g., CPR, ACLS, PALS, TNCC).

11. Reduce the economic impact of disaster on your property and your household’s health and financial well-being.

12. Review property insurance policies before disaster strikes—make sure policies are current and be certain they meet your needs (type of coverage, amount of coverage, and hazard covered—flood, earthquake).

13. Protect your household’s financial well-being before a disaster strikes—review life insurance policies and consider saving money in an “emergency” savings account that could be used in any crisis. It is advisable to keep a small amount of cash or traveler’s checks at home in a safe place where you can quickly gain access to it in case of an evacuation.

14. Be certain that health insurance policies are current and meet the needs of your household.

15. Consider ways to help neighbors who may need special assistance, such as the hearing impaired, elderly, or the disabled.

16. Make arrangements for pets. Pets are not allowed in public shelters. Service animals for those who depend on them are allowed.

17. Do not rely on the Internet or cell phone for communication. Both may be unavailable during a disaster. Have a personal communications backup plan.

EMERGENCY PLANNING FOR PEOPLE WITH SPECIAL NEEDS

If you or someone in your family has a disability or special need, you may have to take additional steps to protect yourself and your household in an emergency. If you know of friends or neighbors with special needs, help them with these extra precautions. Examples include:

- Hearing impaired may need to make special arrangements to receive a warning.


■ Mobility impaired may need assistance in getting to a shelter.
■ Households with a single working parent may need help from others both in planning for disasters and during an emergency.
■ Non-English-speaking people may need assistance planning for and responding to emergencies. Community and cultural groups may be able to help keep these populations informed.
■ People without vehicles may need to make arrangements for transportation.
■ People with special dietary needs should have an adequate emergency food supply.

1. Find out about special assistance that may be available in your community. Register with the office of emergency services or fire department for assistance, so needed help can be provided quickly in an emergency.

2. Create a network of neighbors, relatives, friends, and co-workers to aid you in an emergency. Discuss your needs and make sure they know how to operate necessary equipment.

3. Discuss your needs with your employer.

4. If you are mobility impaired and live or work in a high-rise building, have an escape chair.

5. If you live in an apartment building, ask the management to mark accessible exits clearly and to make arrangements to help you evacuate the building.

6. Keep extra wheelchair batteries, oxygen, catheters, medication, food for guide or hearing-ear dogs, or other items you might need. Also, keep a list of the type and serial numbers of medical devices you need.

7. Those who are not disabled should learn who in their neighborhood or building is disabled so that they may assist them during emergencies.

8. If you are a caregiver for a person with special needs, make sure you have a plan to communicate if an emergency occurs.

**DISASTER SUPPLY KITS**

You and your family may need to survive on your own for 3 days or more. This means having your own water, food, and emergency supplies. Try using backpacks or duffel bags to keep the supplies together.

Assembling the supplies you might need following a disaster is an important part of your disaster plan. You should prepare emergency supplies for the following situations:

■ A disaster supply kit with essential food, water, and supplies for at least 3 days—this kit should be kept in a designated place and be ready to “grab and go” in case you have to leave your home quickly because of a disaster, such as a flash flood or major chemical emergency. Make sure all household members know where the kit is kept.

■ Consider having additional supplies for sheltering or home confinement for up to 2 weeks.

■ You should also have a disaster supply kit at work. This should be in one container, ready to “grab and go” in case you have to evacuate the building.

■ A car kit of emergency supplies, including food and water, to keep stored in your car at all times. This kit would also include flares, jumper cables, and seasonal supplies.

The following checklists will help you assemble disaster supply kits that meet the needs of your household. The basic items that should be in a disaster supply kit are water, food, first-aid supplies, tools and emergency supplies, clothing and bedding, and specialty items. You will need to change the stored water and food supplies every 6 months, so be sure to write the date you stored it on all containers. You should also re-think your needs every year and update your kit as your household changes. Keep items in airtight plastic bags and put your entire disaster supply kit in one or two easy-to-carry containers such as an unused trash can, camping backpack, or duffel bag.

**Water: The Absolute Necessity**

1. Stocking water reserves should be a top priority. Drinking water in emergency situations should not be rationed. Therefore, it is critical to store adequate amounts of water for your household.

■ Because you will also need water for sanitary purposes and, possibly, for cooking, you should store at least 1 gallon of water per person per day.

2. Store water in thoroughly washed plastic, fiberglass, or enamel-lined metal containers. Don’t use containers that can break, such as glass bottles. Never use a container that has held toxic substances. Sound plastic containers, such as soft drink bottles, are best. You can also purchase food-grade plastic buckets or drums.

■ Containers for water should be rinsed with a diluted bleach solution (one part bleach to ten parts water) before use. Previously used bottles or other containers may be contaminated with microbes or chemicals. Do not rely on untested devices for decontaminating water.
If your water is treated commercially by a water utility, you do not need to treat water before storing it. Additional treatments of treated public water will not increase storage life.

If you have a well or public water that has not been treated, follow the treatment instructions provided by your public health service or water provider.

If you suspect that your well may be contaminated, contact your local or state health department or agriculture extension agent for specific advice.

Seal your water containers tightly, label them and store them in a cool, dark place.

It is important to change stored water every 6 months.

For water purification for immediate or near-term use, please read the "Shelter" chapter of this guide.

Food: Preparing an Emergency Supply

1. If activity is reduced, healthy people can survive on half their usual food intake for an extended period or without any food for many days. Food, unlike water, may be rationed safely, except for children and pregnant women.

2. You don’t need to go out and buy unfamiliar foods to prepare an emergency food supply. You can use the canned foods, dry mixes and other staples on your cupboard shelves. Canned foods do not require cooking, water or special preparation. Be sure to include a manual can opener.

3. Keep canned foods in a dry place where the temperature is fairly cool. To protect boxed foods from pests and to extend their shelf life, store the food in tightly closed plastic or metal containers.

4. Replace items in your food supply every 6 months. Throw out any canned good that becomes swollen, dented, or corroded. Use foods before they go bad, and replace them with fresh supplies. Date each food item with a marker. Place new items at the back of the storage area and older ones in front.

5. Food items that you might consider including in your disaster supply kit include: ready-to-eat meats, fruits, and vegetables; canned or boxed juices, milk, and soup; high-energy foods like peanut butter, jelly, low-sodium crackers, granola bars, and trail mix; vitamins; foods for infants or persons on special diets; cookies, hard candy; instant coffee, cereals, and powdered milk.

First Aid Supplies

Assemble a first aid kit for your home and for each vehicle:

- The basics for your first aid kit should include:
  - First-aid manual
  - Sterile adhesive bandages in assorted sizes
  - Assorted sizes of safety pins
  - Cleansing agents (isopropyl alcohol, hydrogen peroxide, soap, germicide)
  - Antibiotic ointment
  - Latex gloves (2 pairs)
  - Petroleum jelly
  - 2-inch and 4-inch sterile gauze pads (4–6 each size)
  - Triangular bandages (3)
  - 2-inch and 3-inch sterile roller bandages (3 rolls each)
  - Cotton balls
  - Scissors
  - Tweezers
  - Needle
  - Moistened towelettes
  - Antiseptic
  - Thermometer
  - Tongue depressor blades (2)
  - Tube of petroleum jelly or other lubricant
  - Sunscreen

- It may be difficult to obtain prescription medications during a disaster because stores may be closed or supplies may be limited. Ask your physician or pharmacist about storing prescription medications. Be sure they are stored to meet instructions on the label and be mindful of expiration dates—be sure to keep your stored medication up to date.

- Extra pair of prescription glasses or contact lens.

- Have the following nonprescription drugs in your disaster supply kit:
  - Aspirin and nonaspirin pain reliever
  - Antidiarrhea medication
  - Antacid (for stomach upset)
  - Syrup of ipecac (use to induce vomiting if advised by the poison control center)
  - Laxative
  - Vitamins.

Tools and Emergency Supplies

It will be important to assemble these items in a disaster supply kit in case you have to leave your home quickly. Even if you don’t have to leave your home, if you lose power it will be easier to have these items already assembled and in one place.

- Tools and other items:
  - A portable, battery-powered radio or television and extra batteries (also have a NOAA weather radio, if appropriate for your area)
  - Flashlight and extra batteries
  - Signal flare
Creating a Personal Disaster Plan

Matches in a waterproof container (or waterproof matches)
- Shut-off wrench, pliers, shovel, and other tools
- Duct tape and scissors
- Plastic sheeting
- Whistle
- Small canister, A-B-C-type fire extinguisher
- Tube tent
- Compass
- Work gloves
- Paper, pens, and pencils
- Needles and thread
- Battery-operated travel alarm clock

Kitchen items:
- Manual can opener
- Mess kits or paper cups, plates, and plastic utensils
- All-purpose knife
- Household liquid bleach to treat drinking water
- Sugar, salt, pepper
- Aluminum foil and plastic wrap
- Re-sealing plastic bags
- If food must be cooked, small cooking stove and a can of cooking fuel

Sanitation and hygiene items:
- Washcloth and towel
- Towelettes, soap, hand sanitizer, liquid detergent
- Toothpaste, toothbrushes, shampoo, deodorants, comb and brush, razor, shaving cream, lip balm, sunscreen, insect repellent, contact lens solutions, mirror, feminine supplies
- Heavy-duty plastic garbage bags and ties—for personal sanitation uses—and toilet paper
- Disinfectant and household chlorine bleach

Household documents and contact numbers:
- Personal identification, cash (including change) or traveler’s checks, and a credit card
- Copies of important documents: birth certificate, marriage certificate, driver’s license, social security cards, passport, wills, deeds, inventory of household goods, insurance papers, immunizations records, blank and credit card account numbers, stocks and bonds. Be sure to store these in a watertight container.
- Emergency contact list and phone numbers
- Map of the area and phone numbers of place you could go
- An extra set of car keys and house keys.

Clothes and Bedding

One complete change of clothing and footwear for each household member. Shoes should be sturdy work shoes or boots. Rain gear, hat and gloves, extra socks, extra underwear, thermal underwear, sunglasses.

Blankets or a sleeping bag for each household member, pillows.

Specialty Items

Remember to consider the needs of infants, elderly persons, disabled persons, and pets and to include entertainment and comfort items for children.

- For baby
- For the elderly
- For pets
- Entertainment: books, games, quiet toys, and stuffed animals.

It is important for you to be ready, wherever you may be when disaster strikes. With the checklists above, you can now put together an appropriate disaster supply kit for your household:

- A disaster supply kit kept in the home with supplies for at least 3 days.
- Although it is unlikely that food supplies would be cut off for as long as 2 weeks, consider storing additional water, food, clothing, bedding, and other supplies to expand your supply kit to last up to 2 weeks.
- A workplace disaster supply kit. It is important to store a personal supply of water and food at work; you will not be able to rely on water fountains or coolers. Women who wear high-heels should be sure to have comfortable flat shoes at their workplace in case an evacuation requires walking long distances.
- A car disaster supply kit. Keep a smaller disaster supply kit in the trunk of your car. If you become stranded or are not able to return home, having these items will help you be more comfortable until help arrives. Add items for severe winter weather during months when heavy snow or icy roads are possible—salt, sand, shovels, and extra winter clothing, including hats and gloves.

REFERENCE

Abdominal compartment syndrome, 248
Abdominal injuries, blast trauma, 244, 248–249
ABLS secondary survey, 243
Acceptance, of disaster plans, 2, 14, 140
Accountability issues, 570, 572, 579–582
ACLS secondary survey, 243
Active Learning Network for Accountability and Performance (ALNAP), 579–580
Active surveillance, 391
Acute stress disorder (ASD), 254, 258–259
Adolescents
case of, 87, 249
in complex emergencies, 279
decomcontamination of, 353
mustard gas exposure, 290, 293
physiologic considerations
malignant thyroid cancer, 277
musculoskeletal, 281
pulmonary, 281, 283
psychosocial considerations, 283
PTSD in, 86, 264, 265
radiation injuries in, 277
socioeconomic status of, 351
stress reactions in, 86, 263, 273–274, 298
Advanced Burn Life Support (ABLS), 223
Advanced life support (ALS), 52, 605
Advance warning systems, 9–10, 13
Afghanistan war, 3, 278–279, 562
Aldrin, 355
Agency for Healthcare Research and Quality (AHRQ), hospital standards of care, 150, 218
Agent-specific approach, 8–9
Add relief organizations, growth of, 575
AIDS. See HIV/AIDS
Air pollutants, 355–356
Airway/breathing/circulation, burn injuries, 225
Alarm procedure, 605
Aminoglycosides, 408
Aminophylline, 3, 30–31
Amitriptyline, 3, 4–5
Ambulance diversion, 53
American Academy of Child & Adolescent Psychiatry, 93, 267
American Academy of Dermatology, 327
American Academy of Family Medicine, 62
American Academy of Emergency Medicine, 62
American Academy of Pediatrics, 93, 267
American Burn Association (ABA)
burn MCI defined, 221, 232
burn referral criteria, 236
disaster plan, 232–236
triage policy, 224
Web site, 605
American College of Radiology, 601
American Counseling Association, 601
American Hospital Association, 601
American Hospital Association: Disaster Readiness, 157
American Nurses Association, 601
American Psychiatric Association, 93, 601
American Psychological Association’s Disaster Response Network, 601
American Public Health Association, 601
American Red Cross
ADFAA services, 70
Armed Forces and, 68
case studies, 76–78
Congressional charter of, 68
don disaster nursing, 206, 207
disaster nursing in, 71–72
disaster partners, 69
disasters, historical, 70–71
disaster services policy statement, 75
emotional recovery, phases of, 85
in fire disasters, 228
fundamental principles of, 67
history of, 68–69
in mental health care, 70, 72, 256
mission of, 68
and the NRP, 69–70
overview, 66–69, 681
personnel, preferred, 257
in rapid assessment data collection, 183
shelter nursing, 72–74
Web site, 157, 207, 601
American Sign Language (ASL), 356
Anthrax
antibiotics, supply of, 53
biopartectoral issues, 407
case study, 379–386
casualty ratio from, 367
c Holmes radiograph of, 410
in children, 277, 290–293
classification/toxicology, 405–406

Index
Index

Anthrax (cont.)
delivery of, 375, 376
epidemiology, 405
history of, 404–405
information dissemination on, 130
lab identification of, 624, 627
news media reporting of, 319–320, 125–126
pathogenesis, 406–407
PHNs in, 590
photograph, 411
as psychological weapon, 82–83, 364, 368
public health implications, 407–408
recognition of, 424, 426–428, 434
summary, 618
treatment, 408
triage, 163
vaccination/PEP, 408

Anthrax vaccine adsorbed (AVA), 292

Antipersonnel land mines, 279

Anxiety, 258, 269

Apathy factor, 138

Aral Sea pesticide spill, 355

Arenaviruses, 415, 417

Armed Forces Radiology Research Institute, Medical Radiology Team, 601

Arsine poisoning, 490–493

Ascariasis, 282

Assertive Community Treatment (ACT) teams, 88

Assessment competency, 549

Assessment of health/medical needs, 40

Assessments, 605, 611

Assets, 605

ATCN secondary survey, 243

ATLS secondary survey, 243

Atropine, 294, 488

Aum Shinrikyo, 366, 369, 371, 378–379, 403

Autonomous Pathogen Detection System, 429

Avacuncha, 605

Averting Israel's Blood, 377–378

Avian influenza (H5N1)
antigenic shifts in, 442
in children, 276–277, 293
described, 439–440
information resources, 461
planning for, 290–295
classification of, 4–5
covet releases defined, 606
defined, 430, 605
delivery of, 375
government role in public health, 104
infectious agents, release of, 105
infected, 228
infectious diseases (IDIs), infectious disease outbreaks
Internet resources, 605, 606
legal issues, 100
and licensing requirements, 109–110
LRN structure for, 435
news media reporting of, 124–126
overview, 365–367
patient surges, 60
PHNs, roles of, 593
planning for, 16, 103
provision of adequate care, 111–112
standards of care, altered, 218
surveillance systems, 392–393
recognize growth in, 375
risks of, 369–370
screening/testing, 108–109
smallpox (See Smallpox)

Aviation Disaster Family Assistance Act of 1996, 70

Avian influenza (H5N1)

Avocet (Olecranorhynchus), 605

Aviation Disaster Family Assistance Act of 1996, 70

Bacillus anthracis. See Anthrax

Bali burn disaster, 230

Bam earthquake (2004), 275

Barton, Clara, 69, 70

Basic life support (BLS), 52, 605

Beegleid (Bkg), 605

Befalithr, 289

Benenate, 356

Benzamidepinos, 514

Benavente, post-disaster, 82, 91

Beta radiation, 522

Beverage contamination, 574

Bhopal disaster (1984), 276, 353–354, 372

Bhujal (Bhujal, 1984), 276

Bibliography of essential resources in disaster care (STT), 267

BIDS system, 392, 396

Bioevent defined, 163

Biological agents
Category A (See also specific agents)
classification of, 404, 593
overview, 404–405, 418
Category B, 404, 428, 593
Category C, 404, 593
defined, 367

Biological Incident Annex, 32, 33

Biosecurity Level precautions
anthrax, 407
botulism, 410
plague, 411
smallpox, 414–415
tularemia, 413

viral hemorrhagic fevers, 417–418

Biosecurity, 396, 429

Bioterrorism
agents
lab identification of, 624–628
typical, 373–376
anthrax (See Anthrax)

botulism (See Botulism)

challenges, 364, 370, 377

children
effects on, 274, 280
treatment of, 280–285

classification of, 4–5
covet releases defined, 606
defined, 403, 605
delivery of, 375
government role in public health, 104
infectious agents, release of, 105

infected, 228
infected diseases (IDIs), infectious disease outbreaks
Internet resources, 605, 606
legal issues, 100
and licensing requirements, 109–110
LRN structure for, 435
news media reporting of, 124–126
overview, 365–367
patient surges, 60
PHNs, roles of, 593
planning for, 16, 103
provision of adequate care, 111–112
standards of care, altered, 218
surveillance systems, 392–393
recognize growth in, 375
risks of, 369–370
screening/testing, 108–109

smallpox (See Smallpox)

rational for, 367–369

recognition of

bioterrorists, 396, 429
clinicians in, 424–425
education in, 425
epidemiological patterns in, 394, 425–426
laboratory detection, 428–429
overview, 564, 423
syndromic approach to, 426–428
research on, 561, 562
resource allocation, 103–111
risks of, 369–370
screening/testing, 108–109

smallpox (See Smallpox)

standards of care, altered, 218
surveillance systems, 392–393

treatment for disease, 108
triage in, 56, 163

Bioterrorism Preparedness and Response Act of 2002, 547

Bioterrorism Training and Curriculum Development Program, 547

Bio/Hatch, 434
Bipolar disorder, 88
Blast injuries
abdominal/pelvic, 244, 248–249
brain injuries, 244, 245
cervical spine/neck, 244, 246
chest, 244, 246–248
DISASTER algorithm, 250–251
education, CDC on, 240
effects on children, 278
event management, 250
explosives, classification of, 240–241
extremity, 244, 249–250
head injuries, 244, 246
maxillofacial, 244, 246
mechanism/classification, 241–242
mental health care, 250
musculoskeletal, 244, 249–250
overview, 238–240
pelvic, 244, 248–249
perineum/rectum/vagina, 244, 248
spinal cord, 244, 249
treatment of
EDs, 52
fluid resuscitation, 247–250
physical examination, 242–245
triage, 238, 251
Blast lung, 246, 247
Blast waves, 240–242, 246
Blind people, 314–315
Blister agents (vesicants), 372, 484, 488–490, 507, 508
Blizzard/heavy snowfall, 328.
See also Winter/ice storms
Blunt injuries
abdominal/pelvic, 248
cardiac, 247
head, 245
overview, 238, 241, 242
Botulinum antitoxin, 410
Botulism
as biological weapon, 375, 377
biosafety issues, 410
CDC classification of, 404
in children, 293
classification/etiology, 409
clinical presentation/diagnosis, 409
detection of, 399
epidemiology, 409
history, 408–409
in infants, 409, 410
lab identification of, 626, 628
pathogenesis, 409
public health implications, 410
rations for, 369
recognition of, 426, 427
summary, 619
treatment, 410
vaccination/PEP, 410
wound, 409
Botulinum Immune Globulin (BIG), 410
Bovine Spongiform Encephalopathy (BSE), 190
Braille literacy, 315
Brain injuries, blast trauma, 244, 245
Branch defined, 608
Brown recluse spider bite, 407
Brown–Sequard Syndrome, 249
Brucellosis, 625
Bunyavirus, 415, 417
Burn disasters
beds, tracking, 223
case studies, 230–236
DMATs, 223, 224
earthquakes, 274
electrical injuries, 228
evaluation, 229
injury, pathophysiology, 224
mental health care, 229
mitigation, 222–223
NDMS, 222, 233–234
overview, 220–222
planning for, 222, 235–236
recovery, 228–229
response
ABA plan, 233
overview, 223–224
pain control, 227
patient management, 224–227
triage, 224, 232–233
transportation issues, 222, 227–228, 230, 235
Burns
ABA referral criteria, 236
classification, 227–228
in children, 224–226
in elderly people, 224
pain control, 227
primary survey, 224–227
radiation, 228
secondary survey, 227
size estimation, 225–226
vs. radiation burns, 531
wound care, 227
Burn Specialty Teams (BSTs), 223, 234
BZ (3-quinuclidinyl benzilate), 372
Campylobacteriosis, 190
Canadian Center for Emergency Preparedness, 601
Cancer, from radiation exposure, 528
Capacity to respond, 13.
See also Response
capital resources, availability of, 58
carbon monoxide, 49
Cardiac pacing, 52
Cardiac tamponade, 247
case defined, 608
case definition, 605
case management, 605
case studies
ABA disaster plan, 232–236
air pollution, 316
anthrax, 379–380
Avenging Israel’s Blood, 377–378
Atal Sea, 355
Association of Rehabilitation Nurses, 321–323
Aum Shinrikyo, 378–379
Avenger Israel’s Blood, 377–378
Bali burn disaster, 227
Bhagwan Shree Rajneesh, 367, 369, 378
Bhopal disaster, 278, 335–334
child anxiety, 269
countries, children’s health/disaster preparedness, 306–307
Brisance, 240
Brownfields, 356–357
Brown re挑战 spider bite, 407
Brown-Sequard Syndromes, 249
Brucellosis, 625
Bunyavirus, 415, 417
Burn disasters
beds, tracking, 223
case studies, 230–236
DMATs, 223, 224
earthquakes, 274
electrical injuries, 228
evaluation, 229
injury, pathophysiology, 224
mental health care, 229
mitigation, 222–223
NDMS, 222, 233–234
overview, 220–222
planning for, 222, 235–236
recovery, 228–229
response
ABA plan, 233
overview, 223–224
pain control, 227
patient management, 224–227
triage, 224, 232–233
transportation issues, 222, 227–228, 230, 235
Burns
ABA referral criteria, 236
classification, 227–228
in children, 224–226
in elderly people, 224
pain control, 227
primary survey, 224–227
radiation, 228
secondary survey, 227
size estimation, 225–226
vs. radiation burns, 531
wound care, 227
Burn Specialty Teams (BSTs), 223, 234
BZ (3-quinuclidinyl benzilate), 372
Campylobacteriosis, 190
Canadian Center for Emergency Preparedness, 601
Cancer, from radiation exposure, 528
Capacity to respond, 13.
See also Response
capital resources, availability of, 58
carbon monoxide, 49
Cardiac pacing, 52
Cardiac tamponade, 247
case defined, 608
case definition, 605
case management, 605
case studies
ABA disaster plan, 232–236
air pollution, 316
anthrax, 379–380
Avenging Israel’s Blood, 377–378
Atal Sea, 355
Association of Rehabilitation Nurses, 321–323
Aum Shinrikyo, 378–379
Avenger Israel’s Blood, 377–378
Bali burn disaster, 227
Bhagwan Shree Rajneesh, 367, 369, 378
Bhopal disaster, 278, 335–334
child anxiety, 269
countries, children’s health/disaster preparedness, 306–307
Index

Case studies (cont.)
coccidioidomycosis, 342
communication, 133–134
decommissioning, 518–519
dergoes/dergo iron, 200
Ecoxn Valdez, 354–355
FEMA, 20–21
Georgia woodsmen, 541
HAZMAT surveillance, 500
heat waves, 342–343
high-risk, high-vulnerability patients, 319
HIPPA, 47–49
Hurricane Andrew (1992), 341
Hurricane Katrina (2005), 95–96, 201–202, 356, 360–362
Hurricane Rita (2005), 356, 360
infectious disease outbreaks, 115–116
Laboratory Response Network, 434–435
LDREP, 555–556
mass casualty incidents, 214–218
mental health services, 9/11, 269–271
mumps, 456
National Student Nurses’ Association (NSNA), 21–23
Northeastern Border Health Initiative, 398–399
PHN education, 598–599
PPV equipment, 455
pregnancy and radiation exposure, 541
public health functions, essential, 197–198 (See also Public health)
Red Cross, 76–78
schools in mental health care, 97
secondary traumatization, 98–99
sheltering in place, 501–502
smallpox, 115–116
Station nightclub fire, 230–231
Three Mile Island, 542
trachoma, 199
WHO, 198
winter/ice storms, 343–344, 346–348
WMD, 385–386 (See also Weapons of mass destruction (WMD))
Casualties
catastrophic, 162–163
defined, 605
estimation of, 251
Casualty clearing station, 605
Catastrophic Incident Annex, 32–33
CB terrorism. See Bioterrorism, Chemical terrorism
Ceftriaxone, 408
Center for Civilian Biodefense Studies, Johns Hopkins University, 601
Center for Disaster Management, 157, 601
Center for Earthquake Research and Information at the University of Memphis, 601
Central Cord Syndrome, 249
Central holding areas, 605
Cephalosporins, 408
Cerebral perfusion pressure (CPP), 245
Cerebrovascular syndrome, 526
Central nervous system injury, 248
Centers for Disease Control and Prevention (CDC)
and anthrax infection criteria, 405
on blast injury education, 249
decommissioning information, 510
Emergency Response Hotline, 482
risk communication courses by, 124
surveillance resources, 196
Web sites, 157, 207, 460, 601
Chemical agents defined, 367: See also Hazardous materials (HAZMAT), specific agents
Chemical burns, 227–228
Chemical Manufacturers Association hot line, 510
Chemical poisoning, 188
Chemical spills, 276, 353–354
Chemical terrorism
antidotes, 486
blood agents, 371–372, 484, 490–493, 507, 508
challenges, 364, 370, 374
in children, 277, 279, 280, 283–285
classification of, 486
cyanide (See Cyanides)
decommissioning for, 507
delivery of, 370–371
detection of, 364, 423, 484–486
effects of, 373
Internet resources, 601, 602, 604
LRN structure for, 435
lung irritants, 372, 373, 484, 493–495, 507, 508
nerve agents (See Nerve agents)
orovirus, 365–367, 370, 483
pesticides, 355, 372–373
PHN, roles of, 594
psychonacaptants, 372
as psychological weapon, 82–83, 364, 367
rational for, 367–369
risks for, 369–370
triage, 56, 169, 172–175
vesicants (blister agents), 372, 484, 488–490, 507, 508
Chem pack, 486
Chernobyl meltdown, 54, 524
Child injuries, blast trauma, 244, 246–248
Child care facilities, disaster planning in, 297
Children
adolescents (See Adolescents)
anthrax in, 277, 291–293
avian influenza (H5N1) in, 276–277, 293
bioterrorism effects on, 274, 280
treatment of, 280–285
blast injuries and, 278
burn injuries in, 224–226
case of emergency department, 285–287
impatient, 287
overview, 6–87, 90–91, 97, 283
prehospital, 284–285
primary survey, 285
radiation, 288–290
in refugee camps, 287–288
secondary survey, 285
in shelters, 287
structural collapse, 284
trauma, 288–289
in terrorist attacks, 285
in terrorists, 284
case studies
anxiety in, 269
health/disaster preparedness, 306–307
chemical terrorism in, 277, 279, 280–295
community disaster planning for, 296–298
death, 295–296
decontamination of, 512–513
depression in, 263, 264
earthquakes, effects on, 274–275, 281
ethical issues, 295
fire education for, 222
foodborne infections in, 189
infectious disease outbreaks in, 278, 284, 288
injury/illness patterns in, 272, 274–279
JumpSTART system, 168–169
legal issues, 295
maintenance fluids for, 226
mental health care of, 256
mustard gas, effects on, 279–282, 293–295
nerve agents, 293, 294
penetrating injuries in, 277, 278
physiologic considerations
  cardiovascular, 280
  cognitive, 281
  genetic, 281–282
  immunologic, 282
  integumentary, 280–281
  musculoskeletal, 281
  nutrition, 281
  overview, 279
  pulmonary, 279–280
preschool, 85–86
psychiatric disorders in, 263, 266
psychiatric sequelae in, 82, 85–86, 273–274, 283
PTSD in, 86, 226, 279
radiation
care of, 286–290
effects on, 277, 280, 282
in refugee camps, 287–288
school-aged, 86–87
special needs, 283, 285, 298
  tachypnea in, 280
and terrorism, 277–278
transportation issues, 283–287, 290, 297
  treatment for disease, 108
  for exposure, 272
  malathion/Sevin exposure, 294
  radiation exposure, 289–290
  triage, 283–285
  urine output, normal, 248
  war, effects on, 278–279
Clostridium botulinum. See Botulism
Chlorambucil, 412, 413
Chloramphenicol, 412, 413
Chlorbenzylidemalononitrile (CS), 495
Chlorobenzylidenemalononitrile (CS), 495
Choking agents, 372, 373, 484, 493–495, 507, 508
Cholera, 190, 275, 278, 283–285
Chromosome competency, 550–551
Chronic care system, 59
Chronic obstructive pulmonary disease in, 222
Citizen Corps, 58
Civil commitment issues, 107
Civil liability, 102
Civil war, effects on, 278–279
Clinically significant issues, 107
Clindamycin, 408
Clindamycin, 408
Cocaine, 408
Coccioidiomycosis, 342
Cognitive behavioral therapy, 254, 259, 265
Cognitive disabilities, accommodation of, 37–38
Cold disasters, effects on children, 275–276
Cold wave, environmental effects of, 132
Collaboration, benefits of, 44, 350
Command post identification, 14
Commission on Collegiate Nursing Education (CCNE), 552
Communication
case study, 133–134
CDC risk communication courses, 124
in disaster management, 139, 140, 152, 158–162
in disaster planning, 9–10, 13, 60
emergency risk communication principles, 122–125
importance of, 118
information, alternate formats of, 314–315
integrated defined, 608
the Internet in, 219, 125–126, 130
issues in, 59–60
limited English proficiency, 312
mass gatherings, 207, 217–212
MSEHPA, 103
nursing competency, 550
and patient distribution, 57
radio/TV/print press, 125–126
Red Cross in, 68
reporter access guidelines, 127–129
surveillance and, 395
Communities
disaster planning in, 222, 296–298
disaster-resistant, 601–602
disaster's effects on, 181
natural disasters, impact of, 327
profiles of, 605
Red Cross in, 70
stress reactions in, 80, 83–84, 90–92
surveillance by, 395–396
urgent care centers in, 52
Community hospitals, available staff in, 52
Community needs assessment, 14
Compartment syndrome, 250
Complex emergences
defined, 609
effects on children, 279, 281, 288
Complex emergency defined, 4
Complicated bereavement, 263
Complicated bereavement, 263
Comprehensive emergency management, 605
Concept defined, 605
Confidentiality issues, 105–106
Congressional Charter of 1905, 68
Consequences management, 605–606
Contamination
consumer products, 374
defined, 606
food, prevention of, 191–193
radioactive defined, 608
of water sources, 185, 373–374, 376–378
Contingency planning, 139, 207, 408
Contracts, employment, 112
Convergent volunteerism, 58
Coronaviruses, 325
Coordination issues, 59–60, 606
Core Knowledge competency, 350–351
Covert releases defined, 606
Crisis intervention, 259–260
Critical Incident Stress Management (CISM), 261–262
Critical thinking skills, 44, 549
Crowd Controllers job description, 477
Crown fire defined, 337
Crush injuries, in children, 274–275, 284
Cryptosporidiosis, 377
Culex mosquitoes, 444, 449
Cultural competence in health care workers, 312
Cultural/ethnic subgroups, stress reactions in, 88–89
Cyanides
Bhopal disaster (1984), 276
delivery of, 370
described, 371–372
detection of, 491
patient assessment, 492
as weapon, 120, 364
Cyanogen chloride, 491
Cyclones, 328, 330–332
Damage assessment, planning for, 14–15
Damage patterns, in disasters, 54
Data collection, 182–183
DDT, 355
Deaf people, 315–316
Debriefing, psychological, 261–262
Decontamination of adolescents, 513
ambulatory patient prioritization, 515
case studies, 518–519
for chemical warfare agents, 507
of children, 512–513
defined, 606
in EDs, 510–511
HAZMAT, 61–62
mass casualty (See Mass casualty decontamination)
mustard gas protocol, 497–500
nonambulatory procedures, 514
overview, 584–586
PEP, 14, 17, 507–509
procedures, 509–513
radiation, 530–534
respirators, 509
sarin protocol, 61, 507
seizures, 514
Defense Technical Information Center, 602
Defibrillation, 52
Demobilization, 261
Department of Homeland Security described, 104
NIMS revision by, 59
in NRP, 24, 33
Web sites, 44, 602
Department of Justice, 602
Department of State, 34
Depression in children, 263, 264
defined, 91, 258
in the disillusionment phase, 85
in first responders, 89
identification methods, 262
as normal stress reaction, 7, 81, 82
in special needs people, 88
in trauma counselors, 90
treatment of, 259, 263, 265
Desertification, 332
Detonation, 240
Developmental disabilities, accommodation of, 317–318
Diphtheria, 247
Diphtherin, 355
Dirty bombs, 228, 529, 531
Disaster aid programs, 20–21
Disaster Center, 602
Disaster Continuum, 602
Disaster disease surveillance/containment, 43, 183, 395–396
Disaster Field Office (DFO), 606
Disaster informatics, 606
Disaster management (See Management)
Disaster Medical Assistance Teams (DMATs), 37–38
Disaster Mortuary Operational Response Teams (DMORTs), 38
Disaster planning (See Planning)
Disasters declaration of, 5–6
definition, 5–6
external vs. internal, 5, 15–16
Disaster-prone defined, 602
Disaster Research Center, University of Delaware, 602
Disaster response (See Response)
Disaster Response: Principles of Preparation and Coordination, 157–158
Disaster vulnerability defined, 606
Diseases communicable, 16, 31–33
Disease surveillance systems, 43, 183, 395–396
Disease, communicable, 16, 31–33
Disillusionment phase, 85
Dislocation stress, 82
Disorientation, 258
Displacement, 258
Dispatchers, EMS, 51, 52
Disruption of normal living, 82

642
Index
<table>
<thead>
<tr>
<th>Index</th>
<th>643</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributive justice, 110</td>
<td>as EHS component, 51, 52, 56–57</td>
</tr>
<tr>
<td>Division defined, 608</td>
<td>entry/exit blocks in, 53, 55, 58</td>
</tr>
<tr>
<td>Dog guides, 316</td>
<td>evacuation of, 513–514</td>
</tr>
<tr>
<td>Domestic Preparedness Chem/Bio Helpline, 510</td>
<td>HAZMAT procedures, 495–496, 506</td>
</tr>
<tr>
<td>Domestic Readiness Group (DRG), 32</td>
<td>patients</td>
</tr>
<tr>
<td>The Dougly Center, 267</td>
<td>inflow planning, 60–62</td>
</tr>
<tr>
<td>Doxycycline, 291–293, 408, 412, 413</td>
<td>overview, 52–53</td>
</tr>
<tr>
<td>D.R. Congo, 3</td>
<td>radiation decontamination, 533–534</td>
</tr>
<tr>
<td>Drills, conducting, 15</td>
<td>radiation exposure treatment, children, 289–290</td>
</tr>
<tr>
<td>Droughts, 5, 328, 332</td>
<td>satellite, 52, 58, 61</td>
</tr>
<tr>
<td>DUMBBELLS, 487</td>
<td>triage systems in, 166</td>
</tr>
<tr>
<td>Dunant, Henri, 68–69, 575</td>
<td>volume, post-disaster, 58</td>
</tr>
<tr>
<td>Dysentery, 288, 375</td>
<td>Emergency health services (EHS) system</td>
</tr>
<tr>
<td>Earthquake Engineering: Research Library, Berkeley, 602</td>
<td>concepts, disaster-associated, 53–54</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>emergency departments as EHS component, 51, 52, 56–57</td>
</tr>
<tr>
<td>classification of, 4, 5</td>
<td>entry/exit blocks in, 53, 55</td>
</tr>
<tr>
<td>effects on children, 274–275, 281</td>
<td>financial pressures on, 53</td>
</tr>
<tr>
<td>environmental effects of, 328</td>
<td>nursing shortages in, 53</td>
</tr>
<tr>
<td>Internet resources, 602, 605</td>
<td>operation of, 52–53</td>
</tr>
<tr>
<td>magnitude defined, 609</td>
<td>overview, 50–52</td>
</tr>
<tr>
<td>overview, 352–353</td>
<td>patient access to, 56–58</td>
</tr>
<tr>
<td>power outages during, 55–56</td>
<td>resources, critical, 54–56</td>
</tr>
<tr>
<td>public health, effects on, 180</td>
<td>response, challenges to communication/coordination issues, 59–60</td>
</tr>
<tr>
<td>staff availability during, 58</td>
<td>overview, 50, 52–53, 57</td>
</tr>
<tr>
<td>triage, 284</td>
<td>patient surges, 60–62</td>
</tr>
<tr>
<td>Ebola virus, 376, 406, 415–417</td>
<td>resource availability, 57–59</td>
</tr>
<tr>
<td>Education</td>
<td>system evaluation, 57</td>
</tr>
<tr>
<td>in attack recognition, 430</td>
<td>transportation issues, 51–58</td>
</tr>
<tr>
<td>competencies</td>
<td>Emergency Information Infrastructure Partnership, 602</td>
</tr>
<tr>
<td>defined, 548</td>
<td>Emergency Management Agency (EMA), 606</td>
</tr>
<tr>
<td>entry-level nurses, 549–551</td>
<td>Emergency management cycle described, 7, 8, 31, 606</td>
</tr>
<tr>
<td>general, all-nurse, 548–549</td>
<td>Emergency Medical Paramedics (EMT-Ps), 606–607</td>
</tr>
<tr>
<td>implementation of, 351–352</td>
<td>Emergency Medical Services (EMS) system, 27, 606</td>
</tr>
<tr>
<td>public health preparedness, 593</td>
<td>Emergency Medical Technicians (EMTs), 606–607</td>
</tr>
<tr>
<td>cultural (See Cultural competence)</td>
<td>Emergency Nurses Association (ENA), 157, 246–247, 386, 602</td>
</tr>
<tr>
<td>in disaster preparedness, 547</td>
<td>Emergency operations center (EOC), 606, 608</td>
</tr>
<tr>
<td>in disaster relief nursing, 572</td>
<td>Emergency Planning and Community Right-to-Know Act (EPCRA), 353</td>
</tr>
<tr>
<td>in EID recognition, 450–455</td>
<td>Emergency public information, 607</td>
</tr>
<tr>
<td>goals of, 544, 547, 548, 552</td>
<td>Emergency responders and the news media, 126, 130–131</td>
</tr>
<tr>
<td>immunization and prophylactic treatment regimes, 458, 466, 469</td>
<td>Emergency response team, 607</td>
</tr>
<tr>
<td>INCiMCE goals, 544, 546, 548, 549</td>
<td>Emergency risk communication principles, 122–125</td>
</tr>
<tr>
<td>Leadership in Health Care Systems in Disaster Response and</td>
<td>Emergency support function (ESF) 6, 69–70, 607</td>
</tr>
<tr>
<td>Emergency Preparedness Program (LDREP), 355–356</td>
<td>Emergency support function (ESF) 8</td>
</tr>
<tr>
<td>overview, 24, 43–44, 544–547</td>
<td>activation of, 32</td>
</tr>
<tr>
<td>of PHNs, 590, 595–596, 598–599</td>
<td>coordination of, in NRMP, 33, 34, 70</td>
</tr>
<tr>
<td>SNS, 462</td>
<td>overview, 24, 28, 607</td>
</tr>
<tr>
<td>standards in, 547</td>
<td>Emergency support function (ESF) 10, 353</td>
</tr>
<tr>
<td>Effective Disaster Warnings, 602</td>
<td>Emergency support function (ESF) 1–15, 29–30, 32, 607</td>
</tr>
<tr>
<td>EIDs. See Emerging infectious diseases (EIDs)</td>
<td>Emergency defined, 105, 106</td>
</tr>
<tr>
<td>Elderly people</td>
<td>Emerging Infectious Programs (EIP), 392, 602</td>
</tr>
<tr>
<td>accommodation of, 314</td>
<td>Emerging infectious diseases (EIDs)</td>
</tr>
<tr>
<td>burned injuries in, 224</td>
<td>burden of, 438</td>
</tr>
<tr>
<td>case studies, 319</td>
<td>classification of, 439</td>
</tr>
<tr>
<td>disability in, 313</td>
<td>education and, 450–453</td>
</tr>
<tr>
<td>foodborne infections in, 189</td>
<td>factors contributing to, 438–439</td>
</tr>
<tr>
<td>poverty statistics of, 311</td>
<td>history, 437–438</td>
</tr>
<tr>
<td>stress reactions in, 88, 313</td>
<td>overview, 437</td>
</tr>
<tr>
<td>triage of, 171</td>
<td>Emotional recovery, phases of, 85</td>
</tr>
<tr>
<td>Electrical injuries, 228</td>
<td>Employment at will, 111–112</td>
</tr>
<tr>
<td>Emergency declaration, 20</td>
<td>Empowerment, 181</td>
</tr>
<tr>
<td>Emergency defined, 606</td>
<td>EMS job description, 477</td>
</tr>
<tr>
<td>Emergency departments (EDs)</td>
<td>EMTALA, 62, 295</td>
</tr>
<tr>
<td>blast injury treatment, 52</td>
<td>Enhanced-blast explosive devices, 240</td>
</tr>
<tr>
<td>children, case of, 285–287</td>
<td>Enteroheamorrhagie E. coli, 190</td>
</tr>
<tr>
<td>daily triage, 165</td>
<td>Environmental disaster defined, 350–352</td>
</tr>
</tbody>
</table>
Index

facial, 246
laryngeal, 246
pelvic, 248
rib, 246–247
spinal, 249

Francisella tularensis. See Tularemia

Frostbite, 210, 336
Frostnip, 210

Fujita Scale, 334, 608

Functional Model of Public Health Response in Disasters, 607–608

Functional needs-based perspective, 308

G agents, 487
Gamma radiation, 522
Gastrointestinal syndrome, 525–526, 535
Generalized anxiety disorder, 82, 85
Gentamicin, 292, 412, 413
Geographic Information Systems (GIS), 564, 581
Georeferencing, 392, 393, 396
GIS (Geographic Information Systems), 564, 581
Glasgow Coma Scale, 207

Global acute malnutrition (GAM), 281
Global Children’s Association, 602
Global Emergency Management System, 602
Global Emerging Infections Surveillance and Response System, DoD, 602

Global issues in relief nursing aid relief organizations, growth of, 575
ethical issues in, 572, 576–579
grand theory application, 584–585
Internet resources, 602
metaparadigm application, 583–584
overview, 570–572, 585
personal safety issues, 570, 572, 582
quality assurance, 570, 572, 579–582
scale, 572–575
translator vs. interpreter, 577
workforce development, 576

Global Outbreak Alert and Response Network (GOARN), 392, 461
Glossary of terms, 605–612
Goldilocks hour defined, 608
Good Samaritan laws, 110, 111

Google Earth system, 581
Groin Cross, 602
Greeters job description, 475
Grief, traumatic, 263
Grieving, facilitation of, 80, 91
Ground fire defined, 337
Groundwater, 185
Group defined, 608
Group treatment, 265

Guide for All-Hazards Emergency Operations Planning, 9
Gulf War (1991), 282, 297

Halabja, Iraq (1988), 370
Hanzra virus, 376
Hayes, Brainzoung v., 128

Hazardous materials (HAZMAT) case studies, 500, 518–519
classification of, 486
defined, 483, 565
disaster planning, 17, 52
ED procedures, 495–496, 506
evergreen response, 485

overview, 485–488, 496
patient decontamination, 61–62, 373
PPE in, 17, 507–509
surveillance systems, 508
training levels, 485
transportation issues, 17, 174, 352, 354, 505
treatment/identification of, 497
triage, 169, 172–175

Hazardous Substances Emergency Events Surveillance (HSEES) system, 590

Hazards defined, 5, 608
environmental, measuring, 630
identification of, 11, 12, 608
mitigation of, 21
surveillance, 608
technological defined, 612

Health Alert Network, 395
Health care facilities in disaster classification, 5
in EMS response, 55

health care workers
cultural competence in, 312, 570, 571, 577
high-risk, 463–464
psychiatric sequelae in, 89–90

Health indicator data in recognition, 426

Health information disclosure, 105–106
Health Insurance Portability and Accountability Act of 1996 (HIPPA), 47–49, 106

Health/medical equipment and supplies, 40
Health Physics Society, 602
Health promotion, 178, 181–182, 195
Health services, Red Cross, 71–72
Health surveillance, 40

Heat cramps, 209, 330
Heat exhaustion, 209, 330
Heat index (HI) defined, 329, 330
Heat rash, 209
Heat stroke, 209–210, 329–330
Heat syncope, 209, 330
Heat waves case studies, 342–343
effects on children, 275–276
environmental effects of, 328
overview, 329–330
Helmholtz infections, 282

Hematopoietic syndrome, 524–527
Hepatic injuries, 248
Hepatitis A, 189
Heroin phase, 85
High-order explosives, 248–249
High-risk, high vulnerability. See Special needs populations
HIV/AIDS

and avian influenza, 440
ethical issues in, 113
infected people, accommodation of, 318
statistics, global, 575
Honey and botulism, 409
Honeymoon phase, 85
Hormesis, 528
Hospital Emergency Incident Command System (HEICS), 140, 144, 147–148, 602
Hospital Incident Command System (HICS), 140, 145–150, 157
Hospitals
decontamination in, 510–511
in disaster classification, 5
in disaster management, 143–145
in disaster planning, 13, 138, 298
in disasters common, 142
effects of, 35–36, 138–139
emergency rooms (See Emergency departments (EDs))
decontamination in, 510–511
HST/P–5 criteria, 27–28
Human-generated disasters, 4
Humanitarian Charter, 183–184
Human rights, maintaining, 570, 572, 578
Hurricane Andrew (1992), 5, 15, 287, 313, 317, 341
Hurricane Charley (2004), 329
Hurricane Floyd (1999), 275, 311
Hurricane Frances (2004), 329
Hurricane Georges (1998), 329, 340
Hurricane Gilbert (1988), 281–282
Hurricane Hugo (1989), 86, 275, 329
Hurricane Ivan (2004), 329
Hurricane Jeanne (2004), 329
Hurricane Katrina (2005)
case studies, 95–96, 201–202, 356, 360–362
communicating technology for sensory impaired, 316 as disaster, 54, 352–353
effects on children, 275
family reunification, 31
FEMA response to, 6, 104–105
flooding described, 10, 11
FEMA, 39
HIV/AIDS-infected people, accommodation of, 318
in hospitals, 15, 18
human resources requests, 58
information dissemination by news media, 126
infants
botulism in, 409, 410
care of, 86
public health, effects on, 180
Red Cross in, 70
resource shortages following, 56
shelters, public health in, 205–206
public health, effects on, 180, 356
Red Cross in, 70
Hurricanes
classification of, 4, 54
effects on children, 275
overview, 330–332
psychiatric sequelae in, 82
human resources requests, 58
improved explosive devices (IEDs), 240, 242
incidents of National Significance declaration, 27
Infants
botulism in, 409, 410
care of, 86
Index
physiologic considerations
integumentary, 280–281
pulmonary, 280
stress reactions in, 85
Infection
control issues, biological agents, 402
prevention of, 390
Infectious disease outbreaks. See also Emerging infectious diseases (EIDs); Epidemics
case studies, 115–216, 342
in children, 278, 284, 288
disaster response by health workers, 312–313
disease occurrence, measuring, 390
earthquakes and, 333
emerging (See Emerging infectious diseases (EIDs))
notifiable diseases, 392, 396
occurrence, timing of, 178
patient surges, 60
psychiatric sequelae in, 82–83
quarantine/isolation/civil commitment, 106–107
reporting of, 105
risk factors, 182
transmission modes, 390
treatment for, 108
triage, 163
Influenza pandemic
effects on children, 276
effects of, 276
example NRP implementation, 31–33
information portal, 461
provision of adequate care, 111–112
surveillance, 391, 396
in hospital care, 40
Injury assessment, MCIs, 215
INMARSAT, 581
Insecticide spraying, 276
Integrated communications defined, 608
Integrated recovery programs (IRPs), 608
Intellectual disabilities, accommodation of, 317–318
Intensity defined, 608
International assistance defined, 609
International Association of Emergency Managers, 608
International Atomic Energy Agency, 603
International Coordination Annex, 33
International Council on Radiation Protection (ICRP), 603
International Critical Incident Stress Foundation (ICISF), 608
International Federation of the Red Cross, 603
International Nursing Coalition for Mass Casualty Education (INCMCE)
goals, 544, 546, 548, 549
Web sites, 608
International Nursing Coalition for Mass Casualty Incidents (INCMCE)
web sites, 390
in mass communication, 118, 125–126, 130
resources, 401–404
Internet Disaster Information Network, 157, 609
Interpreter vs. translator, 577
Intracerebral hemorrhage (ICH), 245
Intracranial pressure (ICP), 245
Intubation, 52
Investigation procedures
disease outbreaks, 429
of foodborne illness, 190–191
Iraq War, 3, 4, 6, 279, 562
Irradiator attacks, 536
IS-100, 45
IS-200, 45
IS-700, 45
IS-800, 45
Isolation issues, 106–107, 109
Jacobson v. Massachusetts, 107
Job action sheets, 145, 146
Joint Commission, 603
Joint Commission on Accreditation of Healthcare Organizations (JCAHO), 16, 157, 352
Joint Field Office (JFO), 32
Joint Information Center (JIC), 609
Joint Operations Center (JOC), 609
Jonesboro School shooting (1998), 278
Jump/SART system of triage, 168–172, 284
Kyasam Forest disease, 416, 417
KySS campaign, 87, 93
Laboratory Response Network, 428–429, 434–435
Landslide defined, 609
Laryngeal fracture, 246
Lassa virus, 415, 416, 418
Latrines defined, 609
LD50 dose, 525, 532, 609
Lead agency defined, 609
Leadership
communication by, 118 (See also Communication; News media)
identification of, 14
opportunities in, 25–26, 42
roles of, 146
styles in, 140–141
Leadership in Health Care Systems in Disaster Response and Emergency Preparedness Program (LDREP), 555–556
Lead Federal Agency (LFA), 609
Legal issues in disaster response
children, 295
disabled persons, 314
health information disclosure, 105–106
licensing, professional, 109–110
malpractice liability, 111
overview, 100–102
privacy issues, 105–109
provision of adequate care, 111–112
quarantine/isolation/civil commitment, 106–107, 109
resource allocation, 110–111
screening/testing, 108–109
treatment for disease, 108
vs. ethical, 102–103
Leininger’s Transcultural Health Model, 584
Levermore, 374, 408–490, 495
Liability issues, 110, 111–112
Liaison defined, 609
Liaison Officer, 149, 153
Licensing, professional, 109–110
Lightning, 328, 335
Limited English proficiency (LEP), 312
Linear, no-threshold (LNT) model, 528
Liquidation defined, 609
Listeriosis, 190
Local government defined, 609
Local governments in public health regulation, 102, 104, 107
Location in disaster classification, 5
Logistics Section Chief, 149, 155
Index

Loss defined, 609
Love Canal, 353, 357
Low-order explosives, 240, 241
Lung irritants, 372, 373, 484, 493–495, 507, 508
Mace, 495
Madrid bombing, 58
Magnitude defined, 609
Major disasters, 20–21
Malaria, 194, 444–447, 450, 451
Malathion/sevin exposure treatment, children, 294
Malpractice claims, 38
Management
communication in, 139, 150, 572, 581–582
evaluation in, 140, 141, 156
in hospitals, 143–145
Internet resources, 603
leadership
roles of, 146
styles in, 140–141
mental health care, 83–84, 262
mitigation in, 21, 140, 141, 143
overview, 136–138, 156
phases of, 7, 137, 138, 140–143
planning and, 136, 137
recovery in, 140, 141, 150, 156
response in, 140, 141, 144
risk assessment in, 140–143
Mitigation
burn disasters, 222–223
defined, 7, 610
in disaster management, 21, 140, 141, 143
earthquakes, 333
prevention and, 13
of staffing issues, 143
tornadoes, 334–335
wildfires, 339
winter storms, 337
staffing issues, 212
transportation issues, 211
type issues, 208
Mass media. See News media; specific media types
Maxillofacial injuries, blast trauma, 244, 246
Maximum contaminant level (MCL) defined, 609
Measles, 282, 288
Measures of biological effects defined, 609
Measures of physical effects to indicate magnitude defined, 609–610
Measuring environmental hazards defined, 610
Management of property, 103
Man-made disasters, 4
Mark-I kits, 294
Maslow’s hierarchy of needs, 181–182, 609
Massachusetts, Jacobson v., 107
Massachusetts, Prince v., 108
Mass casualty decontamination
ambulatory patient prioritization, 515
nonambulatory procedures, 514
overview, 504–506, 515–516
PPE, 14, 17, 507–509
procedures, 509–513
respirators, 509
supportive care, 514
triage, 174
Mass casualty incident (MCI) burns (See Burn disasters)
case studies, 216–218
causality, estimation of, 211
communication/coordination issues, 60
defined, 54
EMS resources, critical, 55–56
Internet resources, 603
nursing practice, fundamentals of, 206–208
planning issues, 204
standards of care, altered, 218
triage, 163
Mass gatherings
aid stations placement, 221
alcohol/drug use, 20
communication issues, 207, 211–212
crowd characteristics, 209
crowd mood, 209–211
documentation, 212
duration issues, 206–209
nursing fundamentals, 206–208, 212
overview, 204–206
planning for, 207–208
site layout, 211
staffing issues, 212
transportation issues, 211
type issues, 208
Meat media. See News media; specific media types
Maxillofacial injuries, blast trauma, 244, 246
Maximum contaminant level (MCL) defined, 609
Measles, 282, 288
Measures of biological effects defined, 609
Measures of physical effects to indicate magnitude defined, 609–610
Measuring environmental hazards defined, 610
Management of property, 103
Man-made disasters, 4
Medical disaster defined, 4
Medical Disaster Response (MDR) project, 169, 171
Medical Gatekeeper job description, 470, 475
Medical Priority Dispatch System (MPDS), 51
Medical Reserve Corps (MRC), 38–39, 45
Medical Screeners job description, 475, 477
Medical/Technical Specialists, 149
MED-1 project, 52
Mental disabilities, accommodation of, 317–318
Mental health care. See also Psychosocial effects
American Red Cross in, 70, 72, 256
blast injuries, 250
burn disasters, 229
of children, 256
CHSM, 261–262
complicated bereavement, 263
first aid, 259–263
of first responders, 255–256
government agencies for, 41
importance of, 80, 254
Internet resources, 601, 602
management of, 83–84, 262
Oklahoma City bombing, 256, 260, 262
psychiatric disorders, diagnosis of, 262–263
Red Cross, 70, 72, 256
referrals, 258
resources assessment, 83–84, 255–258
response principles, 257
response team, 256
schools in, 90–91
social support networks, 260–261
of volunteers, 256
Mental health workers, 80, 90
Mental illness
diagnosis of, 262–263
stress reactions in, 88
Methicillin-resistant Staphylococcus aureus (MRSA), 275
Methylene chloride, 356
Methyl isocyanate, 372. See also Bhopal disaster (1984)
Methylprednisolone, 249
Metropolitan Medical Response System (MMRS) program, 55, 296,
385
Midwest Floods (1993), 329
Mild traumatic brain injury (MTBI), 245
Mitigation
burn disasters, 222–223
defined, 7, 610
in disaster management, 21, 140, 141, 143
earthquakes, 333
prevention and, 13
of staffing issues, 143
tornadoes, 334–335
wildfires, 339
winter storms, 337
Northridge Earthquake (1994), 15, 329, 342
North Shore Long Island Jewish Health System (NSLIJHS) decontamination protocol, 518–519
Nuclear Regulatory Commission, 603
Nuclear terrorism, 532, 535–537
North Shore Long Island Jewish Health System (NSLIJHS) decontamination protocol, 518–519
Nuclear Regulatory Commission, 603
Nuclear terrorism, 532, 535–537
Nurse Clinic Manager job description, 470
Nurse Practitioner job description, 470
Nurses
  disaster management, opportunities/challenges in, 42–44
  education of, 24, 43–44
  health information disclosures, 105–106
  and information disclosure, 106
  law, effects on, 102
  leadership opportunities for, 25–26, 42
  psychiatric sequelae in, 89–90
  public health (See Public health nurse (PHN))
  Red Cross, 71–72
  roles
    in disaster planning, 2, 4, 8, 17, 340, 545–546
    in disaster recovery, 601–602
    in disaster response, 42, 183, 206, 546, 575–576
  public health, 183
  shortages, 53, 58
  volunteer opportunities, 35–40
Nursing homes, service maintenance in, 59
Oak Ridge National Laboratory, REAC/TS center, 532
Office of Emergency Management (OEM), 139
Office of Public Health Emergency Preparedness, DHHS, 18, 105
Office of the Chief Nurse, 71
Oil spills, 354–355
Oklahoma City bombing
  effects on children, 277
  EHS, patient access to, 56–58
  information dissemination by news media, 126, 127
  mental health care, 256, 260, 262
  news coverage of, 121
  psychosocial effects of, 86, 90, 91
  as WMD, 166
  Older adults, stress reactions in, 88
  Omik hemorrhagic fever, 416, 417
  On-scene coordinator (OSCC), 610
  Operations Section Chief, 149
  Osetlamavir (Tamiflu), 293
  OSHA, 603
Outbreak management, planning for, 16
Outcomes Model for Health Care Research, 560
Outcomes surveillance defined, 610
Outbreak management, planning for, 16
Outcomes Model for Health Care Research, 560
Outcome variable defined, 610
Overt release defined, 610
Pain control, burn injuries, 227
Pan American Flight 103, 131
Pan-American Health Organization (PAHO), 603
Pan-American Health Organization (PAHO), 603
Pandemic example NRP implementation, 31–33
Pathogens as biological weapon, 375
Parkland formula, 225
Passive surveillance, 391
Patients
  assessment of, 492, 550
  burn disasters
    management of, 224–227
    transportation issues, 222, 227–228, 280, 235
decommissioning procedures, 509–513
discharge of, 52–53
  in EDs, 52–53
  EHS access, 56–58
  evacuation of, 40
  isolation precautions, 629–630
  RPM classification of, 168
  surge in, 60–62
  tracking of, 11
  triage/distribution
    in disaster planning, 10, 11, 57
    overtriage of, 56
    reverse triage, 56
Pentax overpressure, 240–241
Pelvic injuries, blast trauma, 244, 248–249
Penetrating injuries
  chest/heart, 247
  in children, 277, 278
  head, 245
  overview, 238, 241, 242
  spinal cord, 249
  9/11 Pentagon attack, 56, 126
Penetrate calcium trisodium (CaDTPA), 290
Penetrate zinc trisodium (Zn-DTPA), 290
PEP. (See Postexposure prophylaxis (PEP))
Perthiflorine, 556
Potassium/rectum/vagina injuries, blast trauma, 244, 248
Personal hygiene issues, 194
Personal protective equipment (PPE)
  in hazardous materials disasters, 17, 507–509
  identification of, 14
  respirators, 109
  Personal safety issues, 570, 572, 582, 681–684
  Pets/animals, 275
  Pesticides, 355, 372–373
  Pharmacological administration of, 52
  as critical EMS resource, 55–56
  and disease reporting, 105
  stockpiling of, 53
  Pharmacy Manager job description, 470
  Phase of the emergency planning model defined, 610
Phenol oxime, 488–490, 493, 494, 497
Phosphate poisoning, 491, 493
Physician in Chief job description, 470
Physician in charge job description, 470
Physician practices as EMS provider, 52
Physiological needs defined, 181
Plague
  biohazard issues, 411
  CDC classification of, 404
  classification/ontology, 411
  clinical presentation/diagnosis, 411
  development as weapon, 376
  epidemiology, 418–421
  history, 410
  hosts, 413
  lab identification of, 625, 627
  pathogenesis, 411
  public health implications, 411
  recognition of, 427, 428
  summary, 620
  treatment, 412
  vaccination/PEP, 412
  Planning
    ALS/BLS response, local, 52
    avian influenza (H5N1), 198, 442
    benefits of, 2
    bioterrorism, 16, 109
    burn disasters, 222, 235–236
    challenges to, 9–11
    child care facilities, 297
    child-specific, 296–300
INDEX
communication/coordination issues, 9–10, 13, 60
core activities, 13–15
defined, 610
evaluation of, 15
federal assistance in, 14
HAZMAT, 17, 52
in hospitals, 13, 138, 298
human resources, 55, 58
max gatherings, 207–208
mental health care resource assessment, 83–84, 255–258
mental health workers in, 80
MSEHPA, 103
news media in, 10, 15
NSNA resolution, 22
nurses roles in, 2, 4, 8, 17, 140, 545–546
overview, 2, 7–8
personal, 631–634
resources distribution in, 9
in schools, 297–298
situations requiring, 15–17
special needs populations, 320–323
transportation issues, 9–12, 14
types of, 8–9
Planning Section Chief, 149
Plasmodium falciparum, 445
Plasmodium malaria, 445
Plasmodium ovale, 445
Plasmodium vivax, 445
Pneumothorax, 247
Point of distribution plans, 593–594
Poor people
countries, disaster impacts on, 573–575
medical needs of, 310–311
statistical profile, 311
Population exposure model, 83
Population exposures
accommodation of, 14
behavior prediction in planning, 13
disaster’s effects on, 7, 13
high risk, vaccination estimates, 464
PTSD risk, 82, 86–90
special needs (See Special needs populations)
Portable water/waste water, 41
Postdisaster surveillance defined, 610
Posterior Cord Syndrome, 249
Postexposure prophylaxis (PEP)
anthrax, 408
botulism, 410
plague, 412
smallpox, 415
tularemia, 413
viral hemorrhagic fevers, 418
Postimpact phase defined, 610
Posttraumatic stress disorder (PTSD)
in children, 86, 264, 279
debriefing and, 261–262
diagnosis of, 258–259, 263–264, 317
identification methods, 262
as natural stress reaction, 81, 82
resources, online, 93, 267
risk factors affecting, 254, 258
populations, 82, 88–90
management, 264–266
Potassium iodide, 289–290, 297, 532
Pradlozime, 294, 488
Pregnancy
immunization/prophylaxis for, 468, 469
and radiation exposure, 528–529, 541
shelter issues, 202
Preimpact phase defined, 610
Preparedness defined, 7, 610
Preschool children, stress reactions in, 85–86
Presidential major disaster declaration, 20
Prevention measures
defined, 7, 610
food contamination, 191–193
hazardous materials, 17
infection, 190
overview, 13
primary defined, 610
secondary, 611–612
tertiary defined, 612
Primary prevention defined, 610
Primary survey, burn injuries, 224–227
Prince v. Massachusetts, 108
Print press as platform, 125–126
Privacy issues, 105–109
Privacy Rule, 47–49
Private military firms (PMFs), 582
Private Sector Coordination Annex, 33
Prodromal syndrome, 524, 531, 535
Professional Role Development competency, 551
Project BioShield, 452–453
Prophylaxis
postexposure (See Postexposure prophylaxis (PEP))
tularemia, 287
Tularemia, 292
Prophylaxis clinics. See Immunization/prophylaxis clinics
Protected Health Information (PHI), 47
Protection of persons, 103. See also Personal safety issues
Protein-energy malnutrition, 281
Provision of adequate care, 111–112
Prussian blue, 290, 542
Psittacosis, 376
Psychiatric disorders, diagnosis of, 262–263
Psychoneuroparassitias, 372, 386–387
Psychological debriefing, 261–262
Psychosis, 258
Psychosocial effects. See also Mental health care; Stress reactions
of 9/11, 82, 87–91, 98–99, 256, 283
adolescents, 283
in children, 82, 85–86, 273–274, 283
first responders, 82, 89, 98–99
health care workers, 89–90
hurricanes, 82
infectious disease outbreaks, 82–83
intervention resistance, overcoming, 84
management, 255–256
normal described, 84–85
in nurses, 89–90
of Oklahoma City bombing, 86, 90, 91
overview, 80–82, 92
resource assessment, 83–84
special needs populations, 87–90
in volunteers, 89, 98–99
PTSD. See Posttraumatic stress disorder (PTSD)
Public access system defined, 610
Public health
capacity, development of, 574
children, care of, 286–285
environmental tracking, 352
Index

Public health (cont.)
functions, essential, 180–181, 197–198
information, 41
needs, assessment of, 182–183
standards, minimum, 183–188

Public health nurse (PHN)
contributions of, 590–591
education of, 590, 595–596, 598–599
overview, 588–590
roles in
in biological events, 593
in chemical disasters, 594
in disasters, 591–593
in point of distribution plans, 593–594
in radiological events, 595

Public Health Security and Bioterrorism Preparedness and Response Act, 296

Public health surveillance defined, 610

Public Health Training Network (PHTN), 460–461

Public Information Officer, 149, 152, 610

Public information systems, 31, 59

Pulmonary agents, 372, 373, 484, 493–495, 507, 508

Pulmonary contusion, 247

Push Packages, 461–462

Q fever, 375–376, 624

Quality assurance issues, 570, 572, 579–582

Quality care, providing, 43

Quality of life defined, 181

Quarantine issues, 106–107, 629–630

Radiation
burns described, 228
case studies, 541–542
children
case of, 288–290
effects on, 277, 280, 282
containment control kits, 538–539
containment control measures, 520, 532–537
data collection, 537–538
defined, 610
dosage units, 522–523
exposure, clinical signs of, 531–532
exposure, health effects of acute, 524
encephalovascular syndrome, 526
chronic, 527–528
gastrointestinal syndrome, 525–526, 535
hematopoietic syndrome, 524–527
linear, no-threshold (LNT) model, 528
overview, 523–524
prognosis and, 528–529, 541
prodromal syndrome, 524, 531, 535
reproductive effects, 528
threshold model, 528
incidents/emergencies
medical assistance on-scene, 530–531
overview, 529–530
patient management, 531, 532, 538–539
PHN, roles of, 595
samples, obtaining, 510
Internet resources, 603
irradiation attacks, 536
LD₅₀ dose, 525, 532, 609
overview, 520, 522–523
safety personnel responsibilities, 534–535
thyroid gland exposure, 282
treatment
radioactively contaminated, 532, 534
whole-body exposure, 532, 533
Radiation dispersal devices, 228, 529, 531, 535–536
Radiation Emergency Assistance Center/Training Site (REAC/TS), 603
Radioactive contamination defined, 522
Radioactive contamination defined, 610
Radio as platform, 125–126
Radio bands defined, 611
Radio frequencies, 59
Radioiodines, 282, 289
Radiological/chemical/biological hazards consultation, 41
Rapid needs assessment defined, 611
Rash, recognition of, 426–427
Readiness defined, 611
Real-Time Outbreak and Disease Surveillance (RODS) Project, 395
Reasonable accommodation defined, 314
Recognition of attacks
bioterrorism (See Bioterrorism)
clinical, 423–425
demographic patterns in, 394, 425–426
health indicator data in, 426
laboratory detection, 428–429
nurse agents, 487
overview, 423
syndromic approach to, 426–428
Reconstruction defined, 7, 611
Reconstruction phase, 85
Recovery
burn disasters, 228–229
defined, 7, 611
in disaster management, 140, 141, 150, 156
emotional, phases of, 85
factors affecting, 528
federal assistance in, 601–602
holistic, addressing, 611
plans, 611
Recovery Area Staff job description, 477
Refugee camps, 287–288, 583
Regional assets, EHS system, 55
Regional Disaster Information Center-Latin America/Caribbean (CRIB), 603
Regional Operations Center (ROC), 611
Registration Staff job description, 475
Rehabilitation Act of 1973, section 504, 314
Rehabilitation Act of 1990, 314
Rehabilitation facilities, service maintenance in, 59
Relafon (Zanamavir), 293
Relief defined, 611
Reporter access guidelines, 127–129
Report format defined, 611
Reporting unit for surveillance, 611
Resilience, promotion of, 86, 95–96
Resources
avian influenza (H5N1), 461
avian influenza (H5N1), 665
bioethical allocation of, 103, 110–111
critical, EMS, 55–56
distribution, 9, 56–57
financial, 59, 82
hospitals, management in, 58–59
human, 55, 58 (see also Staffing issues)
identification of, 13, 83–84
Internet, 601–604
management defined, 608
NRP response, 35–40
pathogen recommendations, 458, 460
sharing between agencies, 59
stockpiling, 633–634
surveillance systems, 396

Response
burn disasters, 223–228, 233
defined, 7, 681
design of, 14
DHHS coordination of, 105
in disaster management, 140, 141, 144
EHS system (see Emergency health services (EHS) system)
ethical issues in (see Ethical issues in disaster response)
HAZMAT, 485
infectious disease outbreaks, 112–113
medical needs defined, 600
nurses roles in, 42, 183, 206, 546, 575–576
principles, mental health care, 257
Reverse triage, 56
Ribi virus, 418
Rib fractures, 246–247
Richer Scale, 332, 611
Risn, 426
Rit Valley fever, 415–417
Riley Act, 274
riot control agents, 495, 507, 508
Risk communication of, 122–125, 133–134
as a function of hazard and vulnerability, 611
high-risk populations, 463–464
indicator defined, 611
infectious disease outbreaks, 182
management defined, 611
PTID, 82, 88–90, 254, 258
Risk assessment
benefits of, 2
in disaster management, 140–143
overview, 11–13, 611
staffing issues, 141–142
Risk Management Program Rule, 354
Robert T. Stafford Disaster Relief and Emergency Assistance Act, 5, 36, 37
Roe, Whalen v., 106
RVS inactivated vaccine, 627
Ryan White Care Act program, 318

Sierra Leone, 3
Sigma Theta Tau Online Journal of Knowledge Synthesis for Nursing, 603
Simulation technology, 598–599
Singapore Airlines crash of 2000, 59–60
Size-up/assessment defined, 608
Skull fractures, 245
Smallpox
case study, 115–116
CDC classification of, 404
in children, 277, 282, 291, 293
containment measures, 16, 126–128, 364, 374, 466
described, 376, 413–416
detection of, 393
lab identification of, 626, 628

Index
654

Index

Smallpox (cont.)
recognition of, 427, 428
reporting requirements, 105
summary, 621
vaccination, 126, 291, 293, 413–415
Small Pox Vaccination Clinic Guide, 462–463
Smoke inhalation injuries, 225
Snowstorms, 336
Social support networks, 260–261, 313
Solid waste materials disposal, 41, 194–195
Southern California Earthquake Center, 603
Spalling injuries, 241
Span of control defined, 608, 612
Special Medical Augmentation Response Teams (SMARTs), 223, 235
Special needs populations
blind people, 314–315
case studies, 319–323
children, 283, 285, 298
deaf people, 315–316
developmental/intellectual/mental disabilities, 317–318
disabled persons, 312–314
disaster planning, 320–323, 631–632
elderly people (See Elderly people)
HIV/AIDS-infected people, 318
immigrants, 311–312
inclusion, need for, 318
limited English proficiency, 312
mobility impairments, 316–317
overview, 309–310, 570
poor people, 310–311
psychosocial effects, 87–90
Specific competency, 549
Sphere Project, 183, 184, 187, 195, 572, 580
Sphere Standards, 570, 580, 582
Spill Prevention, Control, and Countermeasures (SPCC) program, 354
spinal cord injuries, blast trauma, 244, 249
spinal shock, 249
Staff health activity, Red Cross, 72
Staffing issues
competency, 143, 144
contact information list, 465
disaster triage team, 167
HICS job assignments, 149–150
mass gatherings, 212
mitigation of, 143
recruitment/screening/training, 256–258
risk assessment, 141–142
Stafford Act, 3, 36, 37
staging area defined, 608
Staphylococcus Enterotoxin B, 626
Staphylococcus food poisoning, 188, 190
STARRCC principle, 122
START (Simple Triage and Rapid Treatment), 163, 167–169, 171–172, 284, 515
State assistance in disaster planning, 14
State coordinating officer defined, 612
State governments in public health regulation, 102–104, 107–108
State Medical Assistance Teams (SMATS), 55
Station nightclub fire, 230–231
STAT pack charts, 166
Stockpile defined, 612
storm surge, 331
Strategic National Stockpile (SNS), 55, 56, 223, 290, 461–462, 486
Strategic planning, 138, 207
Streptomycin, 412, 413
Stress reactions. See also Psychosocial effects
in adolescents, 86, 263, 273–274, 298
in children, 82, 85–86
in communities, 80, 83–84, 90–92
cultural/ethnic subgroups, 88–89
depression as normal, 7, 81, 82, 260
in elderly people, 88, 313
in firefighters, 89, 90, 98–99
in infants, 85
in mental illness, 88
normal described, 84–85
overview, 80–82, 92
in prehospital children, 85–86
in school-aged children, 86–87
special needs populations, 87–90
strike team defined, 608
structural collapse
children, care of, 284
injuries types, 242, 251
Subarachnoid hemorrhage (SAH), 245
Subdural hematoma (SDH), 245
Substance Abuse and Mental Health Services Administration, 93, 267
Substance abuse disorders, 82
Sudan, 3
Suicidal ideations, post-disaster, 82, 258
Sulfonamides, 412
Sumatra tsunami (2004), 4, 54, 179, 180, 275, 572–573
Superfund Amendment and Reauthorization Act, 17
Superterrorism, 366
Supplies, 55, 59. See also Resources
Supply Distributor(s) job description, 477
Supply Management Program (SUMA), 612
Support Annexes, 33
Surface fire defined, 337
Surface water, 184–185
Surveillance systems
biostatistics, 396, 429
bioterrorism attacks, 392–393, 424
case studies, 398–399
clinicians, role of, 393
and communication, 395
data collection, 391–392
functions of, 388
HAZMAT, 500
health, 40
health departments, role of, 393
HHSN, 500
influenza pandemic, 391, 396
Internet resources, 602
MERSHP, 303
outcome/postdisaster, 610
overview, 390–391, 396, 612
public health, 612
reporting unit for, 611
resources, 396
syndrome, 393–396, 430
Symptomnet (Amarantidine), 293
Syndromic surveillance, 393–396, 430
Synergistic disaster, 4
Table-top exercise defined, 612
Tachyphoea, in children, 280
Taiwan earthquake, 58, 274
Tanifu (Osotamivir), 293
Task force defined, 608
Tear gas, 495, 507, 508
Technical Advisory Response Unit (TARU), 462
Technical skills competency, 549–550
Technological hazard defined, 612
Technologic disaster defined, 4
Tension pneumothorax, 247
Terrorism Research Center, 603
Terrorists. See also specific types of terrorism attacks by, statistics, 239
children and, 277–278
explosives used by, 240
methods, preferred, 363
and news media, 83, 118, 121–122
Tertiary prevention defined, 612
Testing issues, 108–109
Tetanus prophylaxis, 287
Tetracycline, 412
Theory defined, 612
Thermal injury. See Burn disasters
Three Mile Island, 82, 536, 542
Threshold model, 528
Thunderstorm/heavy rainfall, 328, 335
Thyroid cancer, 282
Time components, in disasters, 54
Timeliness defined, 612
T-2 Mycotoxins, 626
Toilets, reestablishing, 187–188
Tools, stockpiling, 633–634
Top-down defined, 608
Tornadoes
case study, 345
classification of, 4, 5
environmental effects of, 328
overview, 334–335
psychiatric sequelae in, 82
PTSD rates, 82
Tornado Warning defined, 332
Tornado Watch defined, 332
Toxicological disaster defined, 612
Toxin defined, 612
Trachoma, 199
Training, 38, 60. See also Education
Transfer agreements, 222
Transitions, management of, 262
Translator vs. interpreter, 577
Transportation issues
air transport, 562
alternative mechanisms, 61
burn patients, 222, 227–228, 230, 235
children, 283–287, 290, 297
Cultural competence, 88–89
data collection, 182
discharged persons, 322
disaster aid, 20, 372, 381–382
EHS system coordination of, 51–58
explosions, 250
HAZMAT, 17, 174, 352, 354, 505
hospitals, impact on, 142, 147, 148, 231
infectious disease, 446
mass gatherings, 294, 296, 208, 210, 211, 216–218
NRF coordination of, 29, 34–35, 40, 233
overview, 6–7
patient assessment, 550
pesticides, 194
planning for, 9–12, 14
pregnant women, 202
as public health function, 197
radiation exposure, 533–535, 538, 342
security procedures, 470, 476
SNS materiel, 462
triage, 163, 164, 166, 168, 171, 172
VHF specimens, 417
and water pollution, 185
winter storms, 336, 344
Transportation Unit Leader, 154, 155
Traumatic grief, 263
Traumatization, secondary, 89, 90, 98–99
Triage
ABA policy, 224
anthrax, 163
avian influenza (H5N1), 163
bioterrorism, 56, 163
blast injuries, 238, 251
burn disasters, 224, 232–233
catastrophic casualties, 156–157
chemical terrorism, 56, 169, 172–175
children, 160, 283–285
civilian vs. disaster, 164–165
daily, 162, 164, 165
described, 110–111
disaster overview, 162, 164, 166–167, 175–176
principles, 172
systems, 167–172
in disaster planning, 10
earthquakes, 284
elderly people, 171
ethical issues in, 111
HAZMAT, 169, 172–175
immunization/prophylactic clinic, 468, 477
incident, 162
in-hospital systems, 165–167, 506–507
mass casualty decontamination, 174
MCI, 163, 215–216
noor agents, 56
PHNs in, 594
prehospital, 167, 168
principles of, 161–164
psychological, 254, 257–258
radiation exposure, 536, 537
and resource management, 160
reverse, 56
SEBR classification, 163
special conditions, 163, 504, 506–507
tactical military, 169, 164, 167
tags, 172–174
transportation issues, 163, 164, 167, 168, 171, 172
WMD, 160, 163
Trichuriasis, 282
Tropical Storm Allison (2001), 329
Tropical Storm Warning defined, 332
Tropical Storm Watch defined, 332
Tsunamis, 328, 333, 335–336
TTV/TTD, 315
Tuberculosis, 318, 449–450, 452
Tularemia
CDC classification of, 404
delivery of, 375
described, 376, 412–413, 415
lab identification of, 625, 627
prophylaxis, 252
recognition of, 427, 428
summary, 622
Turkey earthquakes (1999), 274–275, 281
TV as platform, 125–126
TWA Flight 800 crash, 90
Typhoon Lili, 375
Typhoons, 330–332

Index
Index

Unabomber case, 127
Undue hardship defined, 314
Unexplained Deaths and Critical Illnesses Surveillance System, 392
Unified medical command system, 60
Uniformed Services University of the Health Sciences, 93, 267
United Nations High Commissioner for Refugees (UNHCR), 603
United States Army, 604
United States Census Bureau, 604
United States Geological Survey (USGS), 604
Unity of command defined, 608
University of Alabama at Birmingham Center for Disaster Preparedness, 604
University of Rochester School of Nursing (URSON), 546
University of Wisconsin Disaster Management Center, 604
Urgent care centers, 52
Urgent defined, 165
Urine output, normal, 248
U.S. Department of Agriculture (USDA), 33–34
U.S. Public Health Service, 39
U.S. public health system, 43
U.S.AID-Disaster Assistance, 604
Utilitarian theory, 101
Vaccination
anthrax, 408
botulism, 410
Internet resources, 601
mandatory, 101, 102, 107–108
medication estimates, high-risk populations, 464
plague, 412
ring, 126
smallpox, 126, 291, 293, 413–415
tuberculosis, 413
viral hemorrhagic fevers, 418
West Nile virus, 444
V agents, 486, 487: See also VX
Vector control, 41, 194–195, 334
Vendor managed inventory (VMI), 462
Venezuelan equine encephalitis (VEE) virus, 368
Versailles Wedding Hall, 60
Vesicants (blister agents), 126, 244, 488–490, 907, 506
Veterinary Medical Assistance Teams, 38, 41
Voluntary agency (VOLAG), 612
Volunteer Coordinator job description, 470
Volunteers
benefits/limitations of, 58, 563
convergent, 58
immunization clinics, 477
mental health care of, 256
news media direction of, 126, 127
psychiatric sequelae in, 89, 98–99
recruitment/screening/training, 256–258
Vulnerability analysis
frequency of, 148
overview, 11, 12, 305, 612
VX, 371, 373, 381, 464, 487
Wald, Lillian, 590–591
War, effects on children, 278–279
Warning and forecasting defined, 612
Warning defined, 7
Water
contamination of, 185, 373–374, 376–378
explosives and, 241
freezing in pipes, 337
Internet resources, 602
issues, 184–187, 199–200
maximum contaminant level (MCL) defined, 609
planning for, 632–633
Water Supply Standard 1, 184–185
Water Supply Standard 2, 185–186
Water Supply Standard 3, 186–187
Weapons of mass destruction (WMD)
care issues, 142, 150
case issues, 142, 150
case studies, 385–386
CB attacks (See Bioterrorism, Chemical terrorism)
defined, 612
triage, 160, 163
Weather conditions as factor in injury/illness types, 204, 209–210
Weather disasters, billion-dollar, 6
West Nile virus, 345–346, 391, 396, 443–444, 449
Whalen v. Roe, 106
White Paper on the Clinical Nurse Leader, 546
Wildfires, 337–338
Wind chill defined, 336
Winston, C. E. A., 180
Winter storm warning defined, 336
Winter storm watch defined, 336
Wocker health/safety, 40
World Health Organization (WHO)
case study, 198
health defined, 180
water guidelines, 184–187
Web sites, 6, 604
9/11 World Trade Center disaster
air pollutants, 356
burn injuries in, 221
cleanup operations, 9
communications technology for sensory impaired, 316
disaster response by health workers, 112
and federal regulation of public health, 104
information dissemination by news media, 126, 127
mental health care response, 235, 237
mental health services case study, 269–271
news media reporting of, 125–126, 130
as planned disaster, 54
psychosocial effects of, 82, 87–90, 98–99, 256, 283
resource allocation following, 14
volunteerism in, 58
vulnerability analysis and, 103
World War II, 561
Wound botulism, 409
Yellow fever, 415–417
Yersinia pestis, 406: See also Plague
Zanamavir (Relenza), 293
Zeebrugge ferry disaster, 82