THIRD EDITION

DISASTER NURSING AND EMERGENCY PREPAREDNESS

FOR CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL TERRORISM AND OTHER HAZARDS

Tener Goodwin Veenema

SPRINGER PUBLISHING COMPANY

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Third Edition

Tener Goodwin Veenema, PhD, MPH, MS, RN, FAAN, is an internationally recognized expert in disaster response and emergency health services, and in public health emergency preparedness. As President and Chief Executive Officer of the Tener Consulting Group, LLC, Dr. Veenema has served as senior consultant to many agencies of the United States Government, including the Department of Health and Human Services, Department of Homeland Security, Department of Veterans Affairs, and most recently FEMA and the Administration for Children and Families. She has received numerous awards and research grants for her work, and is an elected Fellow in both the National Academies of Practice and the American Academy of Nursing. Veenema is a member of the National American Red Cross Scientific Advisory Board, Disaster and Mental Health Services subcommittee, and has been a volunteer American Red Cross nurse for many years.

As Senior Consultant for Disaster Preparedness to the Office of Human Services Emergency Preparedness and Response, Administration for Children and Families at the U.S. Department of Health and Human Services, Dr. Veenema was advisor to the *FEMA/ACF Disaster Case Management Program* from 2009 to 2012 and lead author for the *Interim Report of the National Commission on Children and Disasters* (2010). While at the University of Rochester, Dr. Veenema developed the curriculum for a 30-credit master's 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.

A highly successful author and editor, Dr. Veenema has published textbooks, handbooks, decision support software and multiple articles on emergency nursing and disaster preparedness. She is the author and developer of two nationally award winning Disaster e-Learning Courses, *Red Cross ReadyRN Disaster and Emergency Preparedness for Health Services* (American Red Cross, 2007) and *ReadyRN* (Elsevier, MC Strategies, 2008). These interactive, e-learning programs have trained thousands of nurses and other disaster health services responders in caring for victims of disasters, terrorist events, and public health emergencies. A highly motivated, energetic self-directed leader with a high degree of creativity and innovation, Dr. Veenema is in high demand as a speaker and her decision-support software and information technology applications for disaster response have been presented at conferences around the globe.

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EDITOR

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NEW YORK

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Springer Publishing Company, LLC
11 West 42nd Street
New York, NY 10036
www.springerpub.com

Acquisitions Editor: Allan Graubard
Composition: Newgen Imaging

ISBN: 978-0-8261-0864-7
E-book ISBN: 978-0-8261-0865-4
Instructors Manual ISBN: 9780826169723
The Instructors Manual is available on request from textbook@springerpub.com

12 13 14 15/ 5 4 3 2 1

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Library of Congress Cataloging-in-Publication Data
Disaster nursing and emergency preparedness for chemical, biological, and radiological terrorism and other hazards / Tener Goodwin Veenema, editor. — 3rd ed.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-0-8261-0864-7 — ISBN 978-0-8261-0865-4 (E-book)
I. Veenema, Tener Goodwin.
[DNLM: 1. Disasters. 2. Emergencies—nursing. 3. Disaster Planning. 4. Terrorism. WY 154.2]

616.02'5—dc23 2012016938

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Printed in the United States of America by Bang Printing.

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 how proud I am of you. Know that no matter how far away life takes you, home is always a safe harbor. And know that I tried to make the world a safer place.

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FOREWORD

In this third edition of *Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards,* Dr. Veenema continues her mission to help our nation's nurses develop the knowledge and skills needed to efficiently and effectively respond to disasters. As the nation's largest health care workforce, it is essential to ensure that all nurses understand the implications of natural and man-made disasters, so they are prepared to respond if required. This edition builds on the solid foundation of the first two editions with an expanded focus on human services, the mental health aspects of disasters, and the needs of those who are most vulnerable during disasters, such as children. It also includes more of an international focus.

As we commemorate the 11th anniversary of the terrorist attacks of September 11, 2001, it is time to reflect on how far we have come in our preparedness to respond not only to natural disasters, but also the threat of terrorism. The National Health Security Strategy was published in December 2009 and is intended to galvanize efforts to minimize the health consequences of disasters (www.phe.gov/Preparedness/planning/authority/nhss/strategy/Documents/nhss-final.pdf). The vision for this strategy is built on a foundation of community resilience—healthy individuals, families, and communities with access to health care and the knowledge and resources to know what to do to care for themselves and others in both routine and emergency situations.

As such, the nation has strengthened community resilience and supported initiatives to prepare for a number of threats. For example, investments in hospital and public health emergency preparedness have provided funding to improve surge capacity and enhance community and health care preparedness to promote safer and more resilient communities. To aid state and local responders in preparing and planning for public health incidents, plans and playbooks have been developed to address the broad range of threats—from terrorism to natural disasters. An all-hazards and whole-community approach is needed for our nation to be resilient in the face of disaster and this must include the nurses in our country.

Investments have been made to develop and procure medical countermeasures to treat the effects of chemical, biological, radiological, or nuclear (CBRN) agents and other emerging infectious diseases. Following any public health incident, it is critical that adequate response capabilities and personnel are available, including volunteer nurses who sign up in advance to respond if needed. Since 2001, we have also invested in detection capabilities and are better able to test and monitor public health threats. The U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response now has Regional Emergency Coordinators (RECs) located throughout the country to promote coordination among federal, state, local, tribal, and territorial officials and health care representatives. As demonstrated during the events of September 11, 2001, effective coordination and communication are important to ensure all responders are effectively working together.

In this respect, federal partners, working with state and local officials, wrote the *National Response Framework*. This Framework presents the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies—from the smallest incident to the largest catastrophe. The Framework describes how communities, tribes, states, the

federal government, and private-sector and nongovernmental partners apply these principles for a coordinated, effective national response.

Many times nurses assume that they aren't emergency responders, so they don't need to understand how the system works. When a disaster strikes a community—whether a bus accident, a tornado, a hurricane, or terrorist attack—nurses will be on the front lines helping those who are in need. To protect themselves, their families, and their communities, nurses need to understand the principles and content of this comprehensive textbook. I encourage all nurses to develop the knowledge and skills presented here that are needed to achieve the vision of resilient communities outlined in the National Health Security Strategy.

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FOREWORD

Recent history has shaped our understanding of the health and medical impact of natural disasters, especially lessons learned from the January 2010 earthquake in Haiti and the powerful 9.0-magnitude earthquake that hit Japan on March 11, 2011, unleashing massive tsunami waves that crashed into Japan's northeastern coast of Honshu, the largest and main island of Japan. According to the Government of Japan, at least 25,000 people were confirmed dead. Japan's social, technical, administrative, political, legal, health care, and economic systems were tested to their limits by the nature, degree, and extent of the socioeconomic impacts of the earthquake, tsunami, and by the looming possibility of a "nightmare nuclear disaster." During April and May of last year, there was record flooding along the Mississippi River with displacement of tens of thousands and 2011 was the worst year on record for tornado-related deaths (both for an outbreak [375 deaths] and for a single event [130 deaths]), and food-borne disease outbreaks. With the incidence of such catastrophes of nature—and the number of people affected by such events—on the increase, the importance of disasters as a public health problem has captured the attention of the world. This situation represents an unprecedented challenge to medical and public health practitioners.

Ten years have now passed since the landmark first edition of *Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards* by Tener Goodwin Veenema, PhD, MPH, was published in the wake of the catastrophic events of September 11, 2001. The attack on the World Trade Center and ensuing anthrax releases in the U.S. Postal System registered the awareness and the recognition of the nursing professional in disaster management. Dr. Veenema correctly believed at the time that nurses knew how to be nurses and were able to provide consistently high-quality clinical care but needed a better understanding of the structure of the health systems' response to disasters. Thus, the first edition of the textbook presented multiple topics such as disaster management, triage, leadership, allocation of scarce resources from a health systems perspective, with a broad focus that included public health emergency preparedness and also terrorism response. The second edition, published in 2007, presented proven management methods and practices essential for the security of our nation against domestic and foreign threats. It became by far the most up-to-date course textbook and desk reference available for nursing professionals and health managers to be ready to respond to disasters and other public health emergencies. Professional nurses and emergency managers found the book absolutely indispensable.

The first and second editions were so successful in part because the author was able to convey complex topics such as chemical, biological, and radiological terrorism, and other hazards in a very readable and understandable manner. It also provided a quick reference for nurses in both public health and clinical practice who required quickly available information in an easy-to-access "practice guide" format. The third edition of *Disaster Nursing and Emergency Preparedness* was confronted with the daunting task of both summarizing the many important new findings that have now become available through extensive research and the experience of public health practitioners, and yet maintain the convenience and user-friendliness of the first two editions. Dr. Veenema has succeeded in accomplishing this magnificently.

The third edition of *Disaster Nursing and Emergency Preparedness* has almost double the number of pages compared with the first edition including a much stronger

and expanded clinical management section to address clinical situations not frequently encountered by nurses (e.g., blast injuries, burn mass casualties management, and emerging infectious diseases). The reader is provided with substantially greater coverage of the needs of children and adolescents following the recommendations of the National Commission on Children and Disasters (2010) with updated and expanded chapters and pediatric case studies on children's mental health, Disaster Nursing in Schools and Congregate Child Care Settings. Completely new chapters have been added on Social Disruption, Individual Empowerment and Community Resilience; Climate Change and the Role of the Nurse; Global Complex Emergencies; Information Technology in Disaster Response; Care Settings; Care of the Pregnant Woman and Newborn During Disasters; Hospital and Emergency Department Preparedness; Innovations in Disaster Nursing Education; Medical Countermeasures Dispensing; and Care of Patients with HIV/AIDS During Disasters.

Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards by Tener Goodwin Veenema will continue to serve as both a timely and comprehensive text for this nation's 2.7 million nurses and for educating the next generation of nursing professionals.

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FOREWORD

The auspicious arrival of this third edition of *Disaster Nursing and Emergency Preparedness* is a most opportune time in the history of local, national, and global catastrophes. Reports on the number and kinds of disasters in daily news media are almost overwhelming. The magnitude of these disasters, man-made or natural, have seemed to escalate in this past decade both in the United States and also in faraway places: like the tsunami that created the nuclear disaster in Japan, to the floods in the northeast United States and Thailand, to the oil spills in the Gulf of Mexico and the earthquakes in Haiti, China, and Turkey. These horrendous and tragic human situations are generating the urgency for a great need for awareness, preparedness, political prowess, and leadership, and, most of all, teamwork on all levels of governments, educational institutions, human services, environmental organizations, and many others.

This updated edition addresses all of these needs with an in-depth focus on the special physical and mental needs of children in various venues, on vulnerable populations, and those of high risk such as the elderly and chronically ill.

The contributing authors read like a "Who's Who" of disaster leaders. They lend their special expertise and insights, which are supported and elucidated by cogent learning strategies in the use of case studies, student questions, and packed content in all areas of disaster participation, preparedness, policies, and research.

Many teachers, students, practitioners, and policymakers will find this edition a treasure trove of new information, ideas and ideologies, and will use this volume as a text, a reference, and resource for the challenging work they do in disaster preparedness and practice. For over 10 years *Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards* has been the hallmark text in its field and this edition proves to be the best ever.

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FOREWORD

As a Robert Wood Johnson Executive Nurse Fellow, Dr. Veenema, a disaster nursing expert, has dedicated her professional career to ensuring that nurses, the largest segment of the health care workforce, have the knowledge and skills they need to respond to disasters and alleviate human suffering. *Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism, and Other Hazards,* third edition, provides the nursing field with a phenomenally comprehensive textbook of best practices to help ensure that the nursing workforce is adequately prepared to respond to any disaster or public health emergency.

This book should be incorporated into the curriculum at every school of nursing to ensure that students develop the competencies to prepare for chemical, biological, and radiological attacks, as well as for public health emergencies, response, and recovery. Furthermore, this book should provide nurses at all stages of their careers with updated disaster preparedness training to enable them to provide the best care possible when disasters strike.

As nurses, we are uniquely trained to be able to give back to our society in times of greatest suffering and it is my firm belief that nurses, no matter what their chosen specialty, should be prepared to give back in this way. We have the compassion and ability to provide care and emotional and spiritual support to those who have lost family members and friends and seen their communities devastated, and we can refer survivors on to other professionals as needed. It is our duty to give back to society by using our gifts and skills in times of greatest need and prepare ourselves for this role. The American Red Cross started the National Student Nurse Program to engage prelicensure nursing students as volunteers to jump start this process.

Volunteering as a Red Cross nurse myself following the tornadoes in Alabama in 2011, I met an inconsolable 21-year-old, who was swept up into the sky holding onto her baby for dear life, and whose hard landing back to the ground caused six broken ribs, a torn knee, a black eye, a broken collarbone, and pneumonia. I provided her with a doctor's visit, filled prescriptions, food and gas money to get to her doctor's appointments and pick up her baby (who was doing well) from her boyfriend's house many miles away. At the end of 2 hours she smiled and asked how she would ever repay me. I said simply, "pay it forward." She hugged me tightly, groaned from the pain of her broken ribs, and said she would. And I know she will.

It is my hope that all schools of nursing will use this book as part of a disaster preparedness curriculum and that all nurses will become familiar with its contents and inspired to volunteer when disaster strikes. Disaster victims and their families deserve nothing less from our nation's nurses.

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PREFACE

Chance favors the prepared mind.

—Louis Pasteur

In the global community within which we all live, concern for the health and well-being of our citizens and for the sustainability of our environment has not diminished in any way. In light of recent world events, our concerns have now expanded to include hazards such as emerging and reemerging infectious diseases, the ubiquitous fear of terrorism and the detonation of nuclear weapons, an increasing awareness of the danger of climate change, and the devastating health impact of the forces of Mother Nature on communities affected by natural disasters such as tsunamis and earthquakes.

Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards has continued to evolve to meet the unique learning needs of nurses across the globe and the third edition of this hallmark text promises to be the best ever! I am extremely proud and excited to present our newest edition along with its sister "e-book" and companion digital instructor's manual.

The third edition of this textbook holds us to our highest standards ever with an ambitious goal—to once again provide nurses and nurse practitioners with the most *current, valid, and reliable* information and comprehensive disaster health policy coverage available. The genesis of the book was predicated on the belief that *all nurses should possess the knowledge, skills, and attitudes (KSAs) to be able and willing to respond in a timely and appropriate manner to any disaster or major public health emergency and keep themselves and their patients safe*. Our goal is simple—*to improve population health outcomes following a disaster event or public health emergency.*

Every chapter in this edition has been researched, reviewed by subject matter experts, and matched to the highest standards in disaster education. Whenever possible, we have mapped all content to published core competencies for preparing health professions' students for response to terrorism, disaster events, and public health emergencies. The third edition contains a significant amount of new content and strives to expand our focus as nurses to: (a) increase our awareness of the human services side of disaster response, (b) deepen our understanding of the importance of protecting mental health throughout the disaster life cycle, and (c) expand the international scope of the book to meet the needs of our global nursing colleagues.

We have remained vigilant of the release of relevant major policy recommendations by congressionally convened commissions, scientific advisory boards, and by such organizations as the Institute of Medicine to inform the evolution of our discipline. In light of the publication of the 2010 recommendations from the National Commission on Children and Disasters, we have strengthened our pediatric focus with updated and expanded chapters on caring for children's physical, mental, and behavioral health following a disaster. We have added brand new chapters on disaster nursing in schools and other community and congregate child care settings, and added content addressing the care of the pregnant woman and newborn following a disaster.

The framework of the book relates directly to the U.S. National Health Security Strategy and remains consistent with the National Response Framework, the National Incident Management System, the World Health Organization (WHO), and Centers for Disease Control and Prevention (CDC) Guidelines for response to public health emergency events. As with the previous editions, the overarching concepts of the book have been mapped to the Public Health Preparedness and Response Core Competency Model (www.asph.org) and to the

International Council of Nurses foundational competencies for disaster nursing practice—all of this representing nothing less than a Herculean effort. We have added many new chapters addressing critical topics such as climate change, global complex human emergencies, information technology and disaster response, hospital and emergency department preparedness, and human service needs in disasters and public health emergencies, with a comprehensive case study on disaster case management. We have highlighted the wonderful work of the American Red Cross in expanding the scope of practice for American Red Cross nurses responding to the health and mental health needs of citizens impacted by disasters. We have built upon our fundamental belief in a safe and clean environment as a foundational building block for health, and have updated and expanded existing chapters on natural disasters, environmental disasters, and on restoring public health following a disaster. Finally, in response to the tragic earthquake in Haiti we have added a chapter on caring for patients with HIV/AIDS following a disaster.

A bit of a historical perspective on the evolution of this book is warranted. Back in 2002 when the first edition was published the focus of the book was specifically from the health systems perspective. In the wake of 9/11 and the anthrax attacks, health care providers were barraged by an onslaught of information from numerous sources (of varying quality) regarding topics on disaster planning and response, and our book filled a major gap in the literature for nurses, nurse practitioners, and nurse executives. I believed then (and still do) that nurses need to understand the unique characteristics of disaster nursing (e.g., triage, decontamination and the use of PPE, allocation of scarce resources) and the systems framework (ICS) for response. To do so, both civilian and military nurses needed to be able to access a comprehensive resource that was evidence based and competency driven, 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.

The book continued to evolve and the second edition (2007) added a much stronger and expanded clinical management focus to address those specific clinical situations not frequently encountered by nurses. This was accomplished with the addition of chapters on blast injuries, burn mass casualties management, and emerging infectious diseases (SARS, avian influenza, etc.). We specifically addressed the need to identify and plan for those high-risk, high-vulnerability populations who are disproportionately impacted by disaster events. The book was a major asset to nurse educators with the inclusion of study questions, Internet activities, and lessons learned via case-based studies. We also broadened our perspective to recognize the incredible contributions and learning needs of military nurses and many of our contributors were from the Public Health Service or branches of the military.

Fast forward to today and we continue to live in a world where our health care systems are severely taxed, financially stressed, and our emergency departments are functioning in disaster mode on a daily basis. The concept of accommodating a sudden, unanticipated "surge" of patients remains overwhelming. We have reason to believe that these challenges will continue and clinical demands on staff and the need for workforce preparedness will continue to grow in the future. In the years since the first edition of this textbook was published, other disaster 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 continues to be very rewarding to witness increased interest in disaster nursing as more nurses get involved.

This textbook represents one step in my lifelong journey to contribute to building strength and safety in our nursing workforce. I remain personally committed to my work in preparing a *global nursing workforce that is adequately prepared* to respond to any disaster or public health emergency and I encourage you to join me and get involved. This work involves improving and expanding programs for interdisciplinary disaster education, lobbying for the advancement of nurses in federal and other key leadership positions to develop disaster-related policies, coalition building across key stakeholders, ensuring access to appropriate and sufficient supplies of personal protective equipment, and much more. This work is consistent with the recommendations of the Institute of Medicine Future of Nursing Report (Institute of Medicine, 2010), which calls for nurses to lead change to advance health recommending that *nurses should be full partners, with physicians and other health professionals, in redesigning health care in the United States*. This includes working to establish functional and ongoing community partnerships that foster collaboration and mutual planning for the health of our communities and the sustainability of our environment. 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 crisis standards for clinical care (Institute of Medicine, 2009) during disasters and public health emergencies.

This third edition of 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 third 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 all nurses—*making every nurse a prepared nurse*—staff nurses, nurse practitioners, educators, and administrators.

This book continues to represent the foundation for *best practice in disaster nursing and emergency preparedness,* and is a stepping stone for the discipline of disaster nursing research. The editor welcomes constructive comments regarding the content of this text.

Tener Goodwin Veenema

ACKNOWLEDGMENTS

As with each of the previous two editions 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 is the product of a highly coordinated team effort. The third edition is significantly larger—representing the work of over 60 contributors, many of whom are international subject matter experts in their field of disaster response. There are so many exceptional individuals who gave generously of their time and talent to make this book a reality. My *sincere thanks* goes to these wonderful colleagues who researched, reviewed, wrote, and revised their manuscripts, ensuring that the information contained within was valid, accurate, and reliable, and reflected the most current state of the science.

I would like to acknowledge Ted Nardin, Allan Graubard, and Christina Ferraro at Springer Publishing Company in New York City. I sincerely thank you for all your hard work in assisting with the publication of the third edition, and for your enthusiasm and ongoing commitment to me as an author.

I will be eternally grateful to my wonderful friend and colleague Adam B. Rains who is VP for Information Technology at the Tener Consulting Group LLC, and President of Rains Analytics. Adam was project manager for both the second and third editions of this book as well as being a lead author in this most recent edition. He masterfully led our parade of authors through the lengthy and often exhausting process of researching, reviewing, and fact checking 39 chapters and multiple case studies and annexes. There is no way that I can thank him enough for his assistance with the preparation of this massive manuscript. His intelligence, humor, and wit—and limitless talent—were a gift to this project.

CHAPTER 1

ESSENTIALS OF DISASTER PLANNING

Tener Goodwin Veenema and Colleen Woolsey

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 four areas of focus in emergency and disaster planning—preparedness, mitigation, response, and recovery—and introduce the critical importance of 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.

KEY MESSAGES

The frequency and intensity of natural and man-made 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.

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.

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.

Consistent with the recommendations in Institute of Medicine's Report on the Future of Nursing (2010), nurses must participate as full partners with the medical, public health, and emergency management community in all aspects of disaster planning, mitigation, response, and recovery.

NOTE—This chapter is mapped to the CDC's Public Health Preparedness and Response Core Competency Model (www.asph.org/document.cfm?page=1081) (Appendix I). This model states that nurses should able to

- Contribute their expertise to a community hazard vulnerability analysis (HVA)
- Contribute their expertise to the development of emergency plans
- Participate in improving the organizations' capacities
- Maintain situational awareness

CHAPTER OVERVIEW

The foundational principles of disaster planning and mitigation, 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 based on their common and unique features, onset, duration, effect (immediate aftermath), and reactive period. The concept of the disaster nursing timeline as an organizational framework for strategic planning is introduced. The four areas of focus in emergency and disaster preparedness—preparedness, mitigation, response, and recovery—are addressed and a fifth focus, evaluation, is proposed. 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, dislocation, and altered health status. The risk of a disaster is ubiquitous. On average, there is a disaster that requires international assistance occurring somewhere every week. 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 has placed an imperative on disaster planning for emergency preparedness. Global warming, climate shift, sea-level rise, resource depletion, and societal factors may coalesce to create future calamities. Population shifts to urban settings and the growth of "megacities" contribute to increased risk (Maclean, 2010; Knight, 2011). Finally, war, acts of aggression, populist uprisings such as the Arab Spring, and the incidence of global terrorist attacks are reminders of the potentially deadly consequences of our inhumanity toward each other.

An extensive review of the past decade of disasters—including significant political strife and conflicts in the Middle East, Africa, and elsewhere—indicates that few disasters are the result of a single cause and effect. More frequently they are complex human emergencies associated with global instability, economic decay, political upheaval and collapse of government structures, violence and civil conflicts, famine, and mass population displacements (Maclean, 2010; Knight, 2011). Current humanitarian crises are near the "tipping point" of being beyond recovery and represent profound public health emergencies with a preponderance of excess or indirect mortality and morbidity, and will require global solutions for resolution in the future (Burkle, 2010). Finally, the effects of Hurricane Katrina (2005), the Indonesian (2004) and Haitian (2010) earthquakes, epidemics, and famine, as well as the Japanese (2011) earthquake, tsunami, and nuclear event point to the complexities of managing disasters within a broader sociopolitical context. While our understanding of the environment and its associated hazards has improved significantly over the past decade, and while we now possess increasingly sophisticated tools for hazard monitoring and Risk communication, the political willingness financial resources required to successfully confront these hazards is often lacking (Smith & Peltey, 2009; Burkle, 2010; Tierney, 2012).

In the United States, as in many countries across the globe, nurses constitute the largest sector of the health care workforce and will certainly be on the frontlines of any emergency response (American Nurses Association [ANA] 2011; U.S. Department of Labor, Bureau of Labor Statistics [DOL], 2012). As part of a 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 reactive 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

What is a disaster? A disaster may be defined as any destructive event that disrupts the normal functioning of a community. It may be viewed as an ecologic disruption, or emergency, 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. Health care providers characterize disasters by what they do to people—the consequences on health and health services. A *health disaster* is a catastrophic event that results in casualities that overwhelm the health care resources in that community (Al-Madhari & Zeller, 1997) and may result in a change in standards of care due to limited resources (Institute of Medicine [IOM], 2009) (http://iom.edu/reports/2009/). Noji (1997) describes disasters quite simply as "events that require extraordinary efforts beyond those needed to respond to everyday emergencies" (p. 1). Disasters may be classified into two broad categories: *natural* (those caused by natural or environmental forces) and *man-made* (human generated). The World Health Organization (WHO) defines *natural disaster* as the "result of an ecological 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. Natural disasters are the consequence of the intersection of a natural hazard and human activity (Wisner, Blaikie, Cannon, & Davis, 2003). Man-made disasters are those in which the principal direct causes are identifiable human actions, deliberate or otherwise (Noji, 1996; 2007). 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 can be further divided into three broad categories: complex emergencies, technologic disasters, and 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, and 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). Frequently, natural and human-made disasters trigger each other (Walker, 1998) and the distinctions between the two disaster types may be blurred. A natural and human-generated disaster 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 Japan (March, 2011) when an earthquake and tsunami caused damage to the Fukushima Daiichi nuclear reactor, resulting in wide-scale evacuation, illness, and long-term population displacement (referred to as an indirect causalty event). Disasters can and do occur simultaneously (e.g., a chemical attack along with a nuclear assault), potentiating the death and devastation created by each indirect casualty event.

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, advance warnings are issued enabling planners to implement evacuation and early response plans. A bioterrorism attack may be sudden and unanticipated and have a rapid 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; Burstein, 2005). Further classification of terms in the field of disaster science distinguishes between hazards, disasters and risk. A *hazard* (cause) is a potential threat to humans and their welfare (Smith & Peltey, 2009). *Risk* is the actual exposure of something of human value and is often measured as the product of probability and loss (Smith & Peltey, 2009). 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 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 tax hospital resources due to numbers of patients or types of injuries (Gans, 2001; Burstein, 2005). 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 facility itself, 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, clinics, and 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; Danna, Bernard, Schaubhut, & Matthews, 2009; Rodriquez & Aguirre, 2006).

DECLARATION OF A DISASTER

In the United States, the Robert T. Stafford Disaster Relief and Emergency Assistance Act,[2] passed by Congress in 1988 and amended in 2000 and 2007, 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, 50 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 Association [FEMA], 2011a). If the consequences of a disaster are clear and imminent and warrant redeployment actions to lessen 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 website (www.fema.gov/news/disasters.fema). A current list of international declared disasters and emergencies and links to disease outbreaks can be located on the WHO's website (www.who.int/topics/disasters/en/).

There exist concerns and discussion that the Stafford Act should be amended to include a new, additional category generally known as a "catastrophic declaration." Catastrophic declarations would be invoked for high-profile, large-scale incidents that threaten the lives of many people, create tremendous damage, and pose significant challenges to timely recovery efforts (Congressional Research Service, July 2011).

Table 1–1 Federally Declared Disasters, 1980–2011

YEAR	TOTAL	YEAR	TOTAL
1980	23	1996	75
1981	15	1997	44
1982	24	1998	65
1983	21	1999	50
1984	34	2000	45
1985	27	2001	45
1986	28	2002	49
1987	23	2003	56
1988	11	2004	68
1989	31	2005	48
1990	38	2006	52
1991	43	2007	63
1992	45	2008	75
1993	32	2009	59
1994	36	2010	81
1995	32	2011	99
Total			1,554
Average			50.12

Source: Federal Emergency Management Agency (FEMA, 2011a). Retrieved January 07, 2012, from www.fema.gov/news/disastertotalsannual

[2] Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and related authorities as of June 2007: The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 100–707), signed into law on November 23, 1988, amended the Disaster Relief Act of 1974 (Public Law 93–288). The Stafford Act constitutes the statutory authority for most Federal disaster-response activities, especially as they pertain to the Federal Emergency Management Agency (FEMA) and FEMA programs.

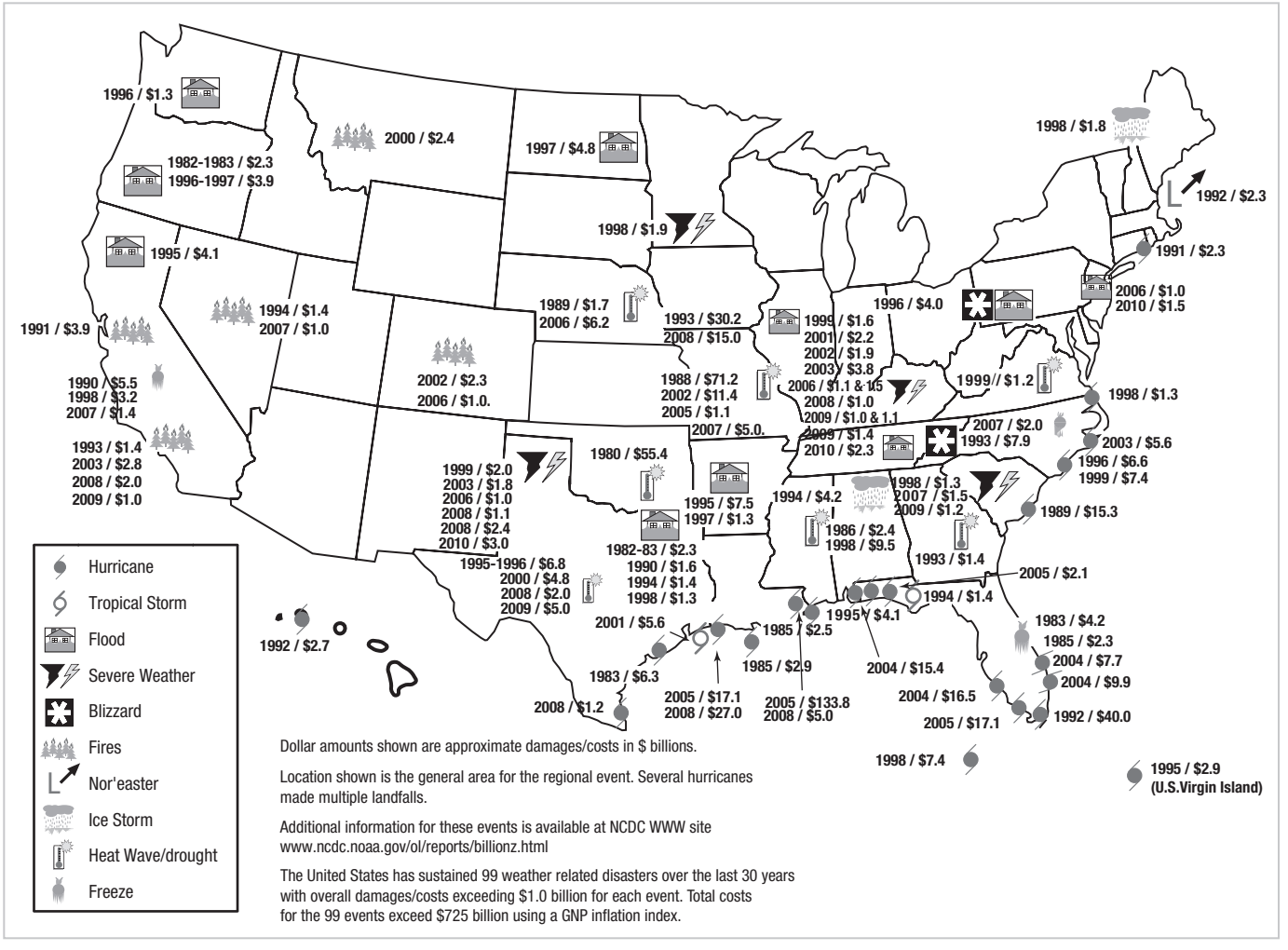

Figure 1–1 Billion dollar U.S. weather disasters, 1980–2011.
Source: National Oceanic and Atmospheric Administration. Retrieved January 26, 2012, from www.ncdc.noaa.gov/oa/reports/

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 and 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 livelihood of the community. The impact of disasters caused by weather over the last 30 years has generated a huge impact (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 17 for further discussion). In addition to causing illness and injury, disasters disrupt access to primary care, and preventive services, and exacerbate underlying psychiatric illness (Potash, 2008; Rabins, Kass, Rutkow, Vernick, & Hodge, 2011). Depending on the nature and location of the disaster, its effects on the short- and long-term health and mental health of a population may be difficult to measure (see Chapters 6 and 7 for more information).

Epidemiology, as classically defined, is the quantitative study of the distributions and determinants of health-related events in human populations (Gordis, 2009; see Chapter 20 for further discussion). Disaster epidemiology is the measurement of the adverse health effects of natural and human-generated disasters and the factors that contribute to those effects, with the overall objective of assessing the needs of disaster-affected populations, matching available resources to needs, preventing further adverse

health effects, evaluating program effectiveness, and planning for contingencies (Lechat, 1990; Noji, 1993, 1996). Disasters affect the health status of a community in the following ways:

- Disasters may cause premature deaths, illnesses, and injuries in the affected community, generally exceeding the capacity of the local health care system.
- Disasters may destroy the local health care infrastructure, which therefore will be unable to respond to the emergency. Disruption of routine health and mental health care services and prevention initiatives may lead to long-term consequences in health outcomes in terms of increased morbidity and mortality.
- Disasters may create environmental imbalances, increasing the risk of communicable diseases and environmental hazards.
- Disasters may affect the psychological, emotional, and social well-being of the population in the affected community. Depending on the specific nature of the disaster, responses may be fear, anxiety, depression, widespread panic, terror, and exacerbation of pre-existing mental health problems. Children in particular, may be deeply affected by the impact of a disaster (Save the Children, 2005).
- Disasters may cause shortages of food and cause severe nutritional deficiencies.
- Disasters may cause large population movements (refugees) creating a burden on other health care systems and communities. Displaced populations and their host communities are at increased risk for communicable diseases and the health consequences of crowded living conditions (Noji, 1996).
- Disaster frameworks for response are increasingly shaped by globalization, changing world dynamics, social inequality, and socio-demographic trends (Tierney, 2012).

THE DISASTER CONTINUUM

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, 2005; Landesman & Morrow, 2008). 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 *response*, 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. FEMA recognizes only the four previously mentioned phases of the disaster life cycle; however, the importance of response evaluation cannot be underestimated. After a disaster, it is essential that evaluations be conducted to determine what worked, what did not work, and what specific problems,

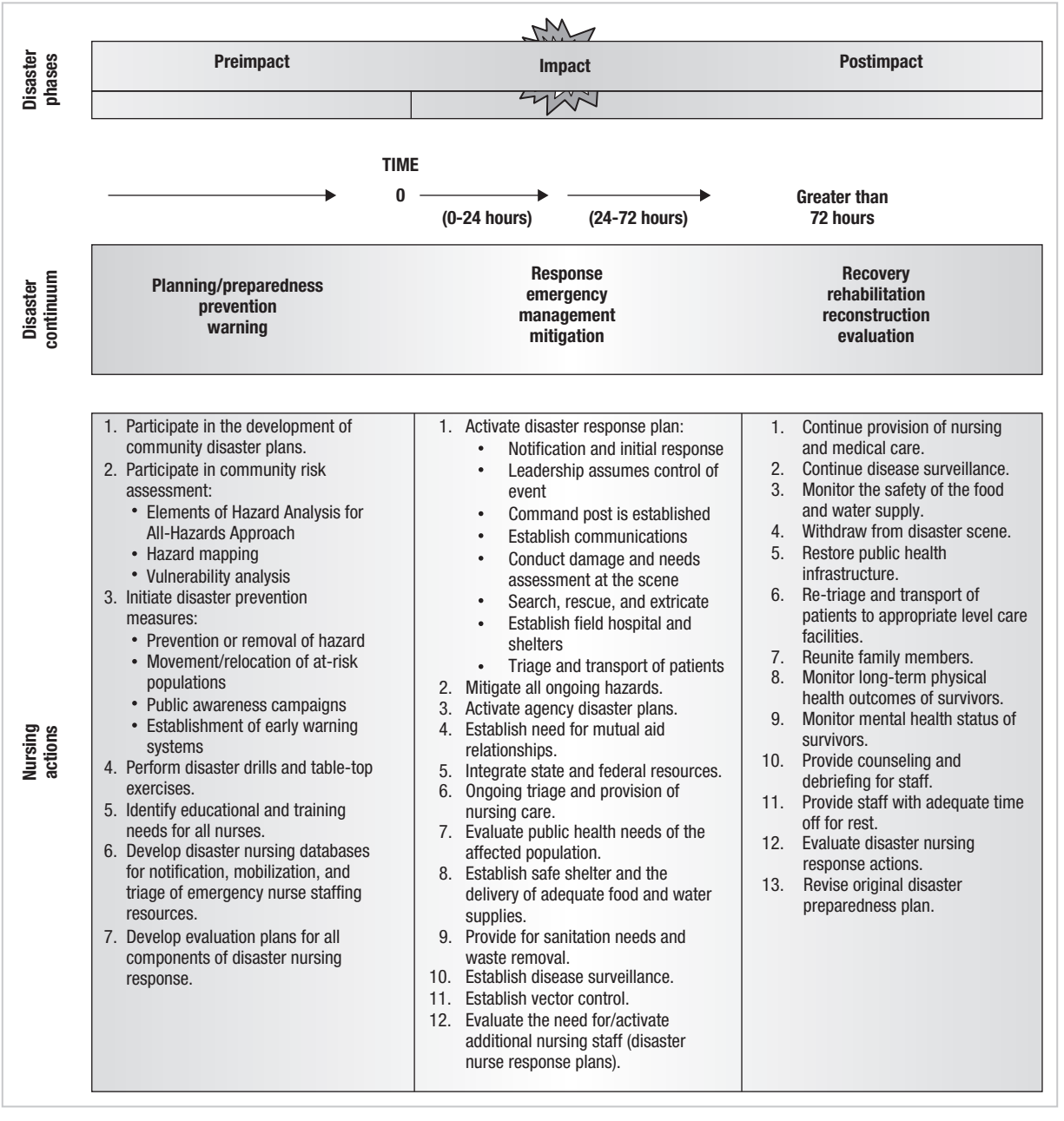

Figure 1–2 Disaster nursing timeline.
Source: Copyright 2001 Tener Goodwin Veenema.

issues, and challenges were identified. Future disaster planning needs to be based on empirical evidence derived from previous disasters (Auf der Heide, 2006, 2007).

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 (Burstein, 2005; Gans, 2001). 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; Noji, 2007; 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.* Historically, communities that embraced the agent-specific approach focused 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 Framework 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* (FEMA, 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, 2006). Frequently, these issues and challenges can be effectively addressed in core preparedness activities through enhanced cooperation, collaboration, and communication. Attention should be addressed in disaster planning to:

1. Anticipate communication problems
2. Address operational issues related to effective triage, transportation, and evacuation
3. Accommodate the management, security of, and distribution of resources at the disaster site
4. Implement advance warning systems and increase the effectiveness of warning messages
5. Enhance coordination of search and rescue efforts
6. Effective triage of patients (prioritization for care and transport of patients)
7. Establish plans for the distribution of patients to hospitals in an equitable fashion
8. Patient identification and tracking
9. Damage or destruction of the health care infrastructure
10. Management of volunteers, donations, and other large numbers of resources
11. Organized improvisational response to the disruption of major systems
12. Finally, encountering overall resistance (apathy) to planning efforts. Auf der Heide (1989) stated, "Interest in disaster preparedness is proportional to the recency and magnitude of the last disaster."

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 and is particularly difficult in today's changing communication environment (Haddow & Haddow, 2009). 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 are critically important (see Chapter 36). In the spring of 2011 during the Middle East uprisings, the use of web-based communication systems provided information about unrest in real-time across the globe. Short message service texting is another communication option that had a high level of success in contacting anesthesia staff immediately after a simulated mass casualty event (Epstein, Ekbatani, Kaplan, Schechter, & Grunwald, 2010). After the Virginia Tech campus shootings in 2009, many colleges instituted text-message warning systems. Most of these methods require the intended recipients to enroll to receive the messages. Currently it is unknown how wide-spread infrastructure damage, inherent in natural disasters, will affect these alternative communication systems.

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 (Zschau & Kuppers, 2003; Basher, 2006). Warnings can now be made months in advance, as in the case of El Niño, to seconds in advance of the arrival of in earthquake and tsunami waves at some distance from the earthquake. Computers are 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 people devise ways to respond successfully. Effective dissemination of warnings provides a way to reduce disaster losses that have been increasing in the United States as citizens move into at-risk areas (FEMA, 2000). The emergency alert system (EAS) and integrated public alert warning system (IPAWS) are examples of coordinated efforts across federal agencies (FEMA, NOAA) to provide timely and accurate emergency warnings as "an effective, reliable, integrated, flexible, and comprehensive system to alert and warn the American people . . . and to ensure under all conditions the President can communicate with the American people" (Executive Order 13457, 2006). For more detailed information regarding the development and operation of this emergency early warning system (FEMA, 2011b), see www.fema.gov/emergency/ipaws/.

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 9 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, 2006).

Disaster planning must include a community mutual aid plan in the event that the hospital(s), nursing home(s), or other residential health care facilities need to be evacuated. Plans for evacuation of health care facilities must be realistic and achievable, and contain sufficient specific detail about where patients will be relocated and who will be there to care for them. Evacuation of patients was a major challenge to disaster response efforts following Hurricane Katrina, and it was hampered by the destruction of all major transportation routes in and out of the city (Burkle, 2009). Preplanning for the possibility of evacuation of entire health care facilities must address alternative modes of transportation and include adequate security measures (see Figure 1–3).

Figure 1–3 New Orleans, LA, September 9, 2005—Neighborhoods throughout the area remain flooded as a result of Hurricane Katrina. Crews work on breaks in the levee to avoid additional flooding.
Source: FEMA (2005). Photo by Jocelyn Augustino.

Nuclear events, highlighted by the Fukushima and the Chernobyl experiences, present difficulties in disaster planning. Considering that over one-third of the U.S. population lives within 50 miles of a nuclear reactor (Physicians for Social Responsibility, 2011), determining appropriate evacuation zones is crucial. The correct evacuation distance from a nuclear event depends on the style of the nuclear device, type of radiation released, building structures, prevailing wind patterns, river/ocean currents, and populations living in the fallout area (Fong, 2007). Also, experts differ in the correct approach to a nuclear event; for example, the British favor sheltering in place and the United States, evacuation (Fong, 2007). Disaster planners need to evaluate all of these elements when planning and establishing evacuation zones in nuclear events (see Figures 1–4 and 1–5).

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

Figure 1–4 Fukushima I nuclear power plant before the 2011 explosion.
Source: KEI (2007) from Wikimedia Commons under GNU Free Documentation License.

more than one 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. Potential collection points may include golf cVourses, shopping malls, or any large expanse of open land capable of accommodating both ground and air transport to serve as a staging area (Schultz et al., 1996).

Information systems need to be identified or developed that will track patients across multiple (and perhaps temporary) settings. *Patient evacuation and tracking* during disasters is a major challenge because of lack of interoperable registration systems 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.

Figure 1–5 Fukushima Power Plant after the meltdown March 24, 2011—The composition of the gas escape cloud is a key determinant for the safe evacuation distance from the nuclear plant.
Source: Digital Globe (2011) released under Creative Commons Attribution-Share Alike 3.0 license.

HAZARD IDENTIFICATION, VULNERABILITY ANALYSIS, AND RISK ASSESSMENT

Hazard identification and mapping, vulnerability analysis, and risk assessment are the three cornerstone methods of data collection for disaster planning (see Table 1–2). The first step in effective disaster planning requires *advance identification of potential problems* for the institution or community involved (Gans, 2001). Different types of disasters are associated with distinct patterns of illness and injuries, and limited predictions of these health outcomes can sometimes be made in advance, with appropriate and adequate data. 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 (NFPA) 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 identified and regularly updated to accommodate population shifts and changes in the environment (Landesman, 2005).

Table 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 the following:

- 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

Source: Information obtained from Landesman, L. (2006, 2011). In *Public health management of disasters: The practice guide.* 3rd Ed. Washington, DC: American Public Health Association. The author gratefully acknowledges Dr. Linda Landesman and the American Public Health Association for permission to reproduce this work.

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 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; Burstein, 2005). 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)
- Containment of the hazard or implementation of mitigation strategies (e.g., enforcing strict building regulations in an earthquake-prone zone, increased engineering codes for buildings in coastal areas)
- 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)
- Enhancement of a local community's capacity to respond (e.g., health care coordination across the entire

Table 1–3 Hazard Analysis

NATURAL EVENTS
Drought
Wildfire (e.g., forest, range)
Avalanche
Winter storms/blizzard; snow, ice, hail
Tsunami
Hurricane/windstorm/typhoon/cyclone
Biological event
Heat wave
Extreme cold
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
CONTEXT HAZARDS
Climate change
Sea level rise
Deforestation
Loss of natural resources
Intensive urbanization
Catastrophic earth changes

Source: From Smith & Peltey (2009).

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 (Burstein, 2005; Cuny, 1998; Gans, 2001). Resources include both human and physical elements, such as organizations with specialized personnel and equipment. Disaster preparedness includes 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. Redundant 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 a readily available, complete record of all personnel, including 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. 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 home 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 (Lasker, 2003; Landesman, 2005, 2011). 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, 2006). Sound disaster preparedness includes a comprehensive review of the existing disaster preparedness 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, 2007).

4. *Community needs assessment.* A community needs assessment must be conducted and routinely updated to identify the preexisting prevalence of disease and to identify those high-risk, high-need patients that may require transport in the event of an evacuation or whose condition 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.* Incident command system (ICS) is the mandated leadership form for leading an emergency response (FEMA, 2007). 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. ICS is an excellent management structure for the immediate post-event response. The planning process, often more important than the final written plan, benefits from a participatory process. Those who take part in planning are more likely to agree to and abide by the final product resulting in plans with a higher likelihood of acceptance and compliance (Lasker, 2003). Identification of the command post must also be decided in advance and communicated to all members of the organization or community (see Chapter 11 for further discussion).

6. *Design of local response in first 24 to 48 hours.* 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 (Auf der Heide, 2007; Noji, 1996). Thus, the effectiveness of the local response is a key determinant in preventing death and disability (Auf der Heide, 2007). 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 (see Chapter 31).* A community disaster plan must accommodate the needs of all people, including patients residing in hospitals, long-term care facilities such as nursing homes, assisted living, psychiatric care facilities, and rehabilitation centers. Children in residential living centers, homeless individuals, people detained in the criminal justice system, and prison populations must all be accommodated within the plan. Invisible populations such as the undocumented and migrant workers must be considered. Poison control and suicide hotlines need to be maintained, and the continuity of home health care services must be safeguarded as well. 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).* The disaster plan provides direction for identifying training needs, including mock drills, and acquiring additional resources and PPE. A comprehensive discussion of PPE is found in Chapter 29.
10. *Plan for the early conduction of damage assessment.* In emergency medical care, response time is critical (Schultz et al., 1996). A crucial component to any disaster response is the early conduction of a proper damage assessment to identify urgent needs and to determine relief priorities for an affected population (Lillibridge, Noji, & Burkle, 1993). 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. Ongoing assessment of the affected population's burden of chronic disease is an element of evaluation often overlooked in disaster preparedness planning. As a result, many disaster victims may experience untimely death simply because they do not receive treatment for these preexisting conditions (Burkle, 2007).

Guha-Sapir (1991) developed a template, or tool, from disaster epidemiology that includes useful indicators for a rapid needs assessment after earthquakes and 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 needs 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 triaged 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 or 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 ensure 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; 2007; Haddow & Haddow, 2009). 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

Megacities

Megacities—those in which the population exceeds 10 million—present unique challenges in disaster. The planet has more than 25 megacities (e.g., Manila, Calcutta, Cairo, Sao Paulo, London, New York), which tend to be at increased risk for environmental and occupational hazards and infectious disease outbreaks. The concentration of people, the lack of urban planning, unavailability of quality building materials, and substandard construction practices results in crowding (Kapadia & Badhuri, 2009; Khan & Pappas, 2011). These cities present extremely difficult challenges to planning for an effective disaster response. Limited access (ingress and egress), potentially widespread shortages of technical equipment and supplies, and the underlying existing urban ecology combine to create seemingly overwhelming obstacles to disaster planning. Existing megacities have severely taxed public health's capacity in many parts of the world (Khan & Pappas, 2011) and disaster events will serve to intensify these challenges.

Disasters Within Hospitals

"Internal" disasters refer to incidents that disrupt the everyday, routine services of a medical facility and may or may not occur simultaneously with an external event. Although these concurrent events are rare, experiences such as the Northridge, Haitian, and Japanese earthquakes, and Hurricanes Katrina and Rita are evidence that they can happen with devastating consequences (Aghababian et al., 1994; Quarantelli, 1983; Wolfson & Walker, 1993; Rudowitz, Rowland, & Shartzer, 2006). Before Hurricane Katrina's impact, there were 22 hospitals in New Orleans. Following the rupture of the city's levy system, 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. Nurses should be aware of the current JCAHO standards for hospital disaster preparedness (JCAHO, 2005). These standards provide guidance for developing an emergency management program that identifies six critical functions, regardless of the cause or causes of an emergency. It is important that organizations have an understanding of their capabilities in meeting these six critical functions when a facility's infrastructure, the community's infrastructure, or both are compromised. These functions are:

- Communicating during emergency conditions
- Managing resources and assets during emergency conditions
- Managing safety and security during emergency conditions
- Defining and managing staff roles and responsibilities during emergency conditions
- Managing utilities during emergency conditions
- Managing clinical activities during emergency conditions

Hospitals are dependent upon the infrastructure of the community where they are located and must be able to survive and sustain operations in the event of a loss of this essential infrastructure. Unplanned (unanticipated) and planned (scheduled maintenance) disruptions to infrastructure can disrupt the ability of the hospital to remain functional and create a dangerous environment for patients and staff. *Any event* that may result in the disruption of electrical power, water, steam, cooling, sewer, oxygen, and suction systems must be accounted for in the hospital's internal disaster plan. 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.

Internal disaster plans must address all potential scenarios, including:

- Loss of power, including auxiliary power
- Loss of oxygen and other medical gases
- Loss of water, steam, 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 (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. Disaster drills and table top exercises should be designed and routinely performed to ensure that staff are adequately prepared. Emergency or preventive evacuations of patients and staff are also key components of an effective hospital disaster plan.

Bioterrorism/Pandemic Disease

The lessons learned from the SARS (2003) and H1N1 (2009) outbreaks provided evidence that infectious disease outbreaks create unique challenges to planners both in the United States and internationally. Historical review of these events provided a chronicle in the progression of response from outbreak management to disaster management and resulted in the advance of several surveillance systems (see Chapter 23). 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 available, then a population-based triage management model may be needed (Burkle, 2006).

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. 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 of themselves and their families to the disease. Health care facilities play a vital role in the detection and response to biological emergencies, including emerging infections, influenza outbreaks, and use of biological weapons by terrorists. 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. In 2006, the Agency for Healthcare Research and Quality (AHRQ) issued a report entitled "Altered Standards of Care in Mass Casualty Events" regarding the management decisions needed during bioterrorism and other public health emergencies (see Chapters 29 and 30 for more information about these events).

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, 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 (Levintin & Siegelson, 1996, 2007). The chemical industry and the U.S. government have made substantial efforts since 9/11 to increase security preparedness. 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 chemical agents from exposed individuals is the first step in preventing serious injury or death. Hospitals need to be prepared to decontaminate patients, despite plans that call for field decontamination of patients prior to transport. 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 first receivers rush to the aid of contaminated individuals arriving in the emergency department without taking proper precautions (e.g., donning PPE), they may become contaminated and become the newest victims (Levitin & Siegelson, 1996, 2007). Because mismanagement 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, 2007). A detailed discussion of hazmat and patient decontamination is found in Chapter 29.

PROFESSIONAL NURSING MANDATE

Caring for patients and the opportunity to save lives are 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." Definitions of nursing have evolved to acknowledge six essential features of professional nursing:

- 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 (ANA, 2003, pp. 1–5).

All nurses should have an awareness of the basic life cycle of disasters, the distinct patterns of illness and injury associated with the major events, and a framework to support the necessary assessment and response efforts. Both national and international nursing organizations have focused on the need for improved disaster nursing preparation. The ANA, the Emergency Nurses Association, and the Association for Professionals in Infection Control and Epidemiology, to name a few, have each issued position statements regarding the need for nurses to advance their disaster knowledge and preparedness skills. Multiple sets of disaster nursing competencies have been proposed along with a variety of educational programs.

Although not all nurses may desire to become "disaster" nurses, each nurse has the potential to be involved in a disaster at some point in his or her personal or professional life. It is imperative that all nurses 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. In doing so, nurses are better prepared to keep themselves, their colleagues, their patients and families, and ultimately their communities safe.

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. Nurses who possess an awareness and understanding of the concepts of preparedness are better able to keep themselves and their patients safe.

STUDY QUESTIONS

1. Differentiate "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 three floods in the past 3 years. Using the five focus areas of disaster planning, construct a disaster response plan for this community.
5. What are different disaster management styles? Why are different management styles more effective during distinctive phases of disaster planning?
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. Many Japanese citizens living in proximity to the Fukushima nuclear power plant experienced fear and panic following the disaster. Confusion and distrust of the government persisted as to what a safe evacuation zone should be. What could have been done to mitigate this?
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. Following the Haitian earthquake the water supply and the sewage systems were damaged or destroyed resulting in a cholera outbreak. What planning could have mitigated, this?
11. Describe the impact nursing involvement can have in each of the five focus areas of disaster planning and response.
12. Create a disaster scenario that involves both public health and hospital based interventions. Include areas of intersection between the two and distinctive roles for each.

INTERNET ACTIVITIES

1. Go to the National Traffic and Road Closure In formation website at 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 websites 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 website and Review FEMA's Strategic Plan for fiscal years 2003–2008 entitled "A Nation Prepared" (www.fema.gov/pdf/library/fema_strat_plan_fy03–08(no_append).pdf). 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 (www.fema.org) 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 website is information regarding essentials of disaster planning for vulnerable populations. Find "Disaster preparedness for people with disabilities" (www.fema.gov/plan/prepare/specialplans.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 www.phe.gov/preparedness/. What is the purpose of this agency? Find the National Disaster Medical System (www.phe.gov/preparedness). 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?

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