

Edited by ROBERT POWERS and ELAINE DAILY
World Association of Disaster and Emergency Medicine

DISASTER NURSING

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INTERNATIONAL DISASTER NURSING

The effects of a disaster on health care can range from conditions that immediately besiege the system with large numbers of patients, to catastrophes that strain its long-term sustainability. Nurses, as frontline health professionals, must have an understanding of the situations they may face before, during and after a disaster and they must develop the skills and strategies to provide effective and immediate care. *International Disaster Nursing* is the first truly comprehensive and internationally focused resource to address the diversity of issues and myriad scenarios that nurses and other health personnel could encounter during a disaster event.

This text defines the many roles of the nurse within a multidisciplinary team, and aids the implementation of the community's disaster plans in a crisis. International experts provide chapters on biological, chemical, natural, pandemic and explosive disasters. Others address disaster events and implications in the world's poorer countries; populations with special needs; ethical issues, and conducting disaster research. Important features include chapter objectives, real-world vignettes, and extensive references. With an alarming increase in the occurrence of disasters in the last decade, *International Disaster Nursing* is the hallmark text in the field.



INTERNATIONAL DISASTER NURSING

ROBERT POWERS AND ELAINE DAILY | EDITORS



A PUBLICATION OF THE WORLD ASSOCIATION
FOR DISASTER AND EMERGENCY MEDICINE
IN CONJUNCTION WITH CAMBRIDGE UNIVERSITY PRESS



CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore,
São Paulo, Delhi, Dubai, Tokyo

Cambridge University Press
477 Williamstown Road, Port Melbourne, VIC 3207, Australia

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org

Information on this title: www.cambridge.org/9780521168007

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First published 2010

Printed in China by Printplus

A catalogue record for this publication is available from the British Library

National Library of Australia Cataloguing in Publication data

International disaster nursing / editors, Robert Powers; Elaine Daily
9780521168007 (pbk.)

Includes index.

Disaster nursing.

Disaster medicine.

Emergency management.

Powers, Robert.

Daily, Elaine 1943–

610.73

ISBN 978-0-521-16800-7 Paperback

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FOREWORD I

I*NTERNATIONAL DISASTER NURSING* will become a hallmark for the field of disaster health, and is testament to the broad scope of this discipline. It is a coherent summary of what we know today and the evidence upon which the science of disaster health is based. The editors of this book have assembled experts in their respective areas of disaster health who include not only the nurses to whom the text is directed, but experts from other disciplines who work in disaster health. The authors hail from fourteen different countries and, thus, truly represent the international community — the content has been guided to reflect many perspectives and health systems.

This text will serve those nurses interested in disaster planning and responses as it lays out the essential components of practice in extreme circumstances. It should help to hone the knowledge and skills of nurses participating in the continuum of emergency/disaster health care and public health from the evolution of plans to the implementation of plans in the prehospital, in-hospital, and non-traditional healthcare setting. It includes organizational aspects as well as individual and team roles and responsibilities. In so doing, the text provides essential elements required for the definitions of disaster health competencies. Importantly, the scope of the information in this book also will serve as the basis for the disaster education and training for health professionals in disciplines other than nursing. The information and its synthesis will be useful for all levels of practitioners.

The consistent format used in each of the chapters includes educational objectives and will facilitate the development of courses in disaster health. Further, the material easily can be adapted for planners and responders who are expected to perform at some of the many levels of responses required during a disaster.

In addition to core knowledge and information relevant to the practices in disaster health, several chapters address cutting-edge topics, such as disaster ethics and the design and conduct of disaster research and evaluations. Despite the fact that the field of disaster health is rife with ethical concerns and dilemmas, there are no other texts relevant to disaster health that comprehensively address the associated ethical issues. This book also provides a sound foundation for those who are or will become interested in the conduct of disaster research and the evaluation of interventions that have or will be used in disaster planning, relief, and recovery. It further develops the conceptual and operational frameworks that provide the structure for the conduct and reporting of disaster research/evaluation projects. Several chapters amplify the concepts and

information by providing concrete examples using specific events and the resultant disasters and others examine variations of methods used by different countries.

The references used by each of the contributing authors are the basis of the current evidence that exists in disaster health. Their sources not only have included the peer-reviewed literature, but also legal documents, standards, and guidelines developed by the humanitarian health community, as well as material found only in the gray literature. The contributing authors have added their respective synthesis of the current information using their expertise. What has resulted is a text with many faces and uses.

International Disaster Nursing is the first text provided by the World Association for Disaster and Emergency Medicine (WADEM). Through this publication, the Nursing Section of the WADEM has set a very high standard for future WADEM publications. The WADEM is proud to provide this extraordinary work to the health community. I congratulate all of the contributors to this compendium and especially the editors, Robert Powers and Elaine Daily, for assembling this cadre of experts and for their commitment to making this text the hallmark that it will become.

Marvin L. Birnbaum, MD, PhD

Immediate Past-President, WADEM

Editor-in-Chief, Prehospital and Disaster Medicine

FOREWORD II

DISASTERS OCCUR DAILY somewhere in the world and have a dramatic impact on the quality of life of individuals, families, and communities. The *World Disasters Report 2007* confirmed a 60% increase in the occurrence of disasters in the last decade (1997–2006) compared to the previous decade.¹ The number of reported deaths associated with disasters increased from 600,000 to more than 1.2 million while, at the same time, the number of people affected rose from 230 million to 270 million — a 17% increase. No nation, region, community, or individual is immune to the potential devastations of a disaster.²

According to the United Nations' Bureau of Crisis Prevention and Recovery, nearly 75% of the world's population live in areas that were affected at least once by an earthquake, a tropical cyclone, flooding, or drought between 1980 and 2000. In the year 2007, 133 countries were impacted by some disaster-producing event — up from an average of 116 countries during the period 2000–2006.²

Nations with less resources are particularly vulnerable and require special attention, as they are less able to finance and support disaster preparation, emergency efforts, and infrastructure reconstruction initiatives. When disaster strikes, funds are diverted from other urgently required programs. Disasters, therefore, can change the face of a resource-poor nation in minutes, wiping out years of development. Disaster reduction and sustainable development are thus closely linked.³ The data justify the importance given to sound disaster planning and mitigation efforts. Included in these efforts is the preparation of a workforce that is able to respond effectively during a disaster.

Nurses, with their technical skills and knowledge of epidemiology, physiology, pharmacology, cultural-familial structures, and psychosocial issues can and do assist in disaster preparedness programs, as well as disaster relief response and recovery activities. As team members, they can play a strategic role cooperating with health and social disciplines, government bodies, community groups, and non-governmental agencies, including humanitarian organizations. They have vital roles in prevention, mitigation, preparedness, and relief interventions. For this reason, in 2009, the International Council of Nurses and the World Health Organization/Western Pacific Region released the *ICN Framework of Disaster Nursing Competencies* — a valuable tool for education, training, and accreditation program, rosters, and deployment strategies.

There is increasing awareness of the care and support (meeting daily physical and emotional needs) that must be provided to relief workers who are experiencing human tragedy first-hand, and become stressed and fatigued, trying to

provide services with too few resources in physically unsafe circumstances. Research has documented that nurses and other care providers may experience post-traumatic stress disorders during and after a disaster. Attention must be given to their health, including accident and professional indemnity insurance coverage. The occupational health and safety of care givers must be maintained if effective health care is to be provided.

The publication of this book is timely and needed. The content covers a wide range of topics, illustrating the broad scope of disaster nursing while informing decision-making in critical aspects of disaster nursing care and preparedness planning. The learning objectives for each chapter are clearly indicated, providing easy access to specific areas of disaster nursing, including theory, practical examples, lessons learned, and recommendations for future work. *International Disaster Nursing* is a valuable reference for advancing the care provided by nurses in disaster prevention, mitigation, preparedness, and relief. Nurses have always been actively involved in such efforts. It is important to support them, advance their practice, and recognize their contributions to the well-being of our communities.

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PREFACE

ALL ASPECTS OF HEALTH CARE, and all health disciplines may become involved, at some level, in the health response(s) to and recovery from a disaster. Specialized education is fundamental in preparing nurses for their evolving and expanding roles during crises and disasters. The 2007 report from the World Health Organization's Consultation on Nursing and Midwifery in Emergencies called for improved skills and competencies of nurses involved in emergencies and disasters, and for disaster nursing education to be integral in both pre-service and in-service nursing education.

Knowledge is key to disaster preparedness and effective responses. The intent of this text is to provide nurses with an in-depth, comprehensive understanding of their potential role(s) during a disaster, the issues that they may face, how the various response systems and agencies function, and the impact of these disaster response systems on the role(s) and functions of the nurse.

To this end, we have sought input from numerous experts in various fields and disciplines in disaster health. In recognition of the fact that roles and functions often blend and cross over during a disaster, we have selected authors from the disciplines commonly involved in disaster health (such as nursing, medicine, and public health) as well as governmental and non-governmental agencies. As the discipline of disaster health is fairly nascent and without a strong, evidential base, it is essential that we make every effort to share information among the involved professions and to learn from each other.

This textbook represents the current state of knowledge as compiled by experts in specific areas of disaster health. Each chapter is a synthesis of the best available science and information that exist today and forms the basis upon which we can direct our practice and advance our profession.

Disaster-producing events occur throughout the world, and while the impact and the responses may differ in different countries, many commonalities exist. We can learn valuable lessons through the examination of systems and practices used by our colleagues in other parts of the world. Thus, an additional aim of this book is to provide an international perspective that has been lacking in disaster nursing textbooks.

The text also includes chapters addressing the important emerging fields of disaster ethics and disaster research. Additionally, the text contains a chapter describing the use of a disaster research framework to help build the science of disaster health. These are original topics not addressed in other disaster nursing textbooks.

Disaster nursing responses and interventions occur at different practice levels that can be viewed as a continuum of care ranging from the very basic,

PREFACE

awareness level, to the most advanced practice. To address this range, we have attempted to provide basic care information required for safe practice during a disaster, as well as information necessary for nurse leaders and researchers. Thus, this text will be useful to nursing students as well as advanced practitioners. Educators will find the content and objectives of each chapter useful in designing curricula for disaster nursing educational programs.

The outcomes from a disaster depend on many factors. Chief among these factors is a knowledgeable and prepared workforce. As the largest representative discipline within the healthcare workforce, nurses are challenged to assume roles and responsibilities during a disaster for which they may have been previously unprepared. The aim of this textbook is to narrow the knowledge gap experienced by many nurses regarding disaster health through the enhancement of nursing knowledge and skills in order to improve the outcomes from a disaster.

Robert Powers

Elaine Daily

ACKNOWLEDGMENTS

Many individuals contributed to the creation of this book. We gratefully acknowledge the selfless contributions of disaster health colleagues from around the world. They have made this book what it is and what it provides to the field of disaster nursing.

We also are grateful to the World Association for Disaster and Emergency Medicine for its encouragement and assistance in bringing this book to fruition. The organization was a stalwart supporter of this project from the very beginning.

And we are indebted to the unwavering commitment and tremendous talent of Kathie Campbell Inboden, who realized the concept of this book. Her vision, her aesthetic skills, and her untiring efforts made an idea a reality.

Robert Powers

Elaine Daily



CHAPTER 1

INTRODUCTION TO DISASTERS AND DISASTER NURSING

Robert Powers

NURSES ARE OFTEN CALLED UPON to provide aid and care during a variety of disaster events, including war environments, complex emergencies with displaced populations, large-scale disasters that disrupt the normal delivery of health care to the community, and local emergencies that temporarily strain resources. In these settings, nurses utilize their unique skills, abilities, and understanding of the community to the betterment of the population by striving to deliver the highest attainable level of care that the adverse circumstances allow.

OBJECTIVES:

- Define disasters and disaster nursing;
- Describe the characteristics of disaster nursing; and
- Understand the phases of a disaster and nursing's role during each phase.

The critical thinking and problem-solving skills of nurses, coupled with their flexibility and adaptability, help provide the methods for managing the difficulties that arise during disasters, such as shortages of supplies and staff and failures in communication. Although no two disasters are exactly the same, and nurses often must be able to improvise and adapt their care practices, they must be well-versed in their potential role to effectively deliver care in a disaster. This preparation comes through education in relevant disaster topics, skills acquired through hands-on practice, interaction with preparedness procedures, and a firm understanding of local and regional capabilities and resources.

Nurses possess the necessary coordination and delegation skills which, when coupled with their care management experience, positions them to serve

capably in healthcare leadership roles during disasters. Nursing leadership may be provided through established leadership roles or through the spontaneous assumption of a leadership role by a nurse identifying and taking action to solve a particular problem.

Nurses, therefore, should be well-prepared for their potential role in a disaster setting and should participate in all phases of a disaster to the fullness of their capabilities.

DISASTERS

During disaster events, people may be without power, shelter, communication, food, and water. Emergency response capabilities can quickly become overwhelmed due to the magnitude of the damage. Injured members of the community may be unable to find transportation to healthcare facilities as the local emergency medical services (EMS) may not be able to gain access to victims or may be overwhelmed by the sheer mass of those in need. Healthcare facilities may be damaged directly during the impact and be unable to provide emergency services, or they may need to be evacuated. Those healthcare facilities that remain operational soon become inundated with more arriving patients than they have the staff or space to manage.

These events, typically, are called “disasters” by the media and by the affected community. However, many of these events are more accurately classified as an accident or an emergency if the local emergency resources, though potentially overwhelmed initially, are able to quickly manage the situation without requiring resources from other communities.¹

Disasters are events that inflict significant damage to life or property and that substantially overwhelm the local community’s resources. In some cases, the magnitude of the damage can even prevent the community from responding.

HEALTHCARE DISASTERS

Considering the increasing population density and escalating development in disaster-prone areas, the potential of disasters to impact health care is growing. A healthcare disaster is defined as: “a precipitous or gradual decline in the overall health status of a community with which it is unable to cope with adequately without outside assistance.”¹

Healthcare disasters involve a failure of the normal provision of healthcare. This may be caused by direct damage to healthcare facilities or by the large influx of patients during a disaster that overwhelms the existing healthcare services and requires outside assistance. Although opinions differ regarding classifying events such as armed conflicts or ongoing humanitarian crises as disasters,² they also can result in conditions that limit or prevent the delivery of health care.

DISASTER NURSING

Nurses comprise the largest healthcare workgroup in most countries and are at the forefront of the healthcare response to disasters. From the work of Florence Nightingale in the Crimean War to the recent care provided by nurses in the aftermath of Hurricane Katrina in 2005 and the Asian tsunami of 2004, nurses historically are linked to the provision of care during crises. Unique additions to the knowledge base of nursing, coupled with the distinct dilemmas that must be properly managed during the different phases of a disaster, necessitate the distinction of disaster nursing as its own individual specialty.

The International Council of Nurses (ICN) defines nursing as follows:

Nursing encompasses autonomous and collaborative care of individuals of all ages, families, groups and communities, sick or well, and in all settings. Nursing includes the promotion of health, prevention of illness, and the care of ill, disabled and dying people. Advocacy, promotion of a safe environment, research, participation in shaping health policy and in patient and health systems management, and education are also key nursing roles.²

THE GOAL OF DISASTER NURSING is ensuring that the highest achievable level of care is delivered through identifying, advocating, and caring for all impacted populations throughout all phases of a disaster event, including active participation in all levels of disaster planning and preparedness.

Disaster nursing provides this care, advocacy, and promotion of health within the context of a disaster. Disaster nursing is provided in numerous environments and settings, each with unique conditions with which disaster nurses must be familiar. Essential nursing abilities needed for the appropriate management of disaster victims include critical thinking, adaptability, teamwork, and leadership. Proper patient care and management in disaster settings mandates an understanding of both individual care and mass patient care. Nurses cannot be unprepared when the health care of their community is in need.

CHARACTERISTICS OF DISASTER NURSING

Caring for the Community During a Disaster

The disruptions in a community resulting from the impact of a hazardous event have varying impacts on nursing and the provision of health care. These impacts may be short- or long-term, based on the magnitude of the damage to the community and the ability of local resources to readily address and meet

the healthcare needs of the community without additional resources. During a medical disaster, nurses must be aware of the potential hindrances in delivering care and the modifications necessary to provide this care.

Whether the precipitating event is a relatively small multiple-casualty incident or a catastrophic event, the provision of health care can, at least temporarily, be overwhelmed. Nurses may be called upon to care for large numbers of patients, often at a rapid pace. Without proper planning, the response can become chaotic, resulting in less effective care delivery. Nurses must properly triage patients, ensure appropriate distribution of available nursing staff to maximize care delivery, and coordinate the appropriate distribution and placement of essential supplies and equipment.

With healthcare resources overwhelmed, the ability to provide the usual standard of care may not be possible. Unless regional plans have identified acceptable levels of care during a disaster, the nurse may face the difficult task of determining what constitutes reasonable care for the patients with the given resources. The balancing act between legal and ethical concerns and what nurses are physically capable of providing is a difficult one.

Providing nursing care during a disaster also necessitates coordinating care with other agencies and disciplines within the healthcare system, and maintaining the functionality of the healthcare facility itself. Some important roles of the nurse during a disaster are overseeing the transfer of patients to regional hospitals located away from the disaster-impacted area, assigning supplemental healthcare workers, and obtaining needed supplies.

The scope of care provided by nurses also may expand in response to a disaster. Based on the magnitude of the event, the community may be in need of food, water, and shelter. Public health nurses as well as nurses not routinely involved in addressing these basic survival needs may be called upon because of the severity of the conditions or because normal public health functions have been damaged. Nurses also may be needed to practice outside of their healthcare facility as first responders on the scene or to care for vulnerable populations during a disaster.

An ineffective nursing response can negatively impact the community's outcome from a disaster by failing to appropriately match nursing resources with need. Nurses must be well versed in strategies for overcoming disaster-induced adversities, and fully understand the different roles they may be required to embrace in order to deliver care effectively in a disaster setting.

Personal Impact

In a disaster, nurses may witness and be affected by troubling images around them. Regardless of the emotions elicited by these images, nurses' perseverance in providing needed care in times of a disaster is vital to the community's outcome.

Nurses working in disasters also may experience losses of their own. Due to a lack of communication or the pressing need of their duties, they may not know the status of their family or friends. The nurse's family, in turn, may not know the welfare of the nurse until after the disaster has abated.

There also may be increased physical demands during a disaster, such as working long shifts in abnormal, difficult conditions. One quandary for health-care workers in disasters is providing care to others while taking measures to care for their own needs. Nurse leaders must incorporate care for the nurses into disaster planning. This should include strategies for rotating staff, measures to obtain and provide information about family to the nurses on duty, and ensuring the availability of immediate support for those having difficulty coping. Nurses, in turn, must understand how a disaster could affect them, both immediately and in the long-term, and develop coping strategies and support networks to care for themselves and their colleagues within the nursing community.

Adverse Conditions

The nature of a disaster can cause adverse environmental conditions, such as flooding or high winds. Structural damage from events such as earthquakes can render the healthcare facility a potentially unsafe environment. Weather conditions, e.g., flooding, can result in the closing of community medical centers and hospitals, and in difficulties in receiving and evacuating patients. These weather conditions and the damage they cause, also can hamper the arrival of assistance and increase the isolation of the affected community from healthcare response. Nurses working in disasters should be aware of potential hazards and incorporate these considerations into planning and response.

Lack of Recognition

In some parts of the world, nurses are not allowed to voice their ideas nor are they allowed to participate in administrative decision-making. This may be more pronounced in the arena of disaster healthcare, in which planning and response decisions may be made by other disciplines, and in which disaster nursing may not be well-integrated. This results in a detrimental delivery of care to the community during a disaster. The importance of the contributions of nurses often is not understood by other members of the medical community or by other sectors of the community despite the fact that, in many instances, nurses may be the only healthcare workers providing care in a community. Frequently, they are at the frontlines of a disaster, and have significant insight into the immediate needs of the community.

Nurse representatives must be included in discussions concerning their community and regional healthcare disaster plans, and their input should be mandated and integrated by emergency planners and healthcare leaders. The active cultivation of nursing insight and innovative thinking into disaster

planning and preparedness will ensure that nursing care will be provided, to the good of the community.

Critical Thinking

Critical thinking and problem-solving are crucial skills in managing the effects of a disaster. Nurses begin learning critical thinking skills early in their careers as they assess and determine patient needs, then apply and adapt nursing care to meet those needs. The application of critical thinking to the disaster setting is one of nurses' substantial strengths and, if properly directed, can be of substantial value to the overall healthcare response.

With a strong knowledge base of the community and its potential resources, nurses are in a key position to assist with the necessary problem-solving required during a disaster. Possible problems to address include creating alternate ways to obtain needed supplies when the normal routes are unavailable, or determining non-traditional locations to position bases of community care to serve the disaster-affected population.

When issues related to direct patient care and care management arise, the value of nurses' critical thinking skills becomes unequivocal. Ineffective triage, unrecognized injuries or changes in a patient's condition, lack of documentation, and poorly managed transfers to the operating room or to regional hospitals all can negatively impact the community outcome. Nurses have the ability to recognize these and similar complications of disaster response, and affect corrective action through their critical thinking and problem-solving skills.

These same critical thinking skills are major contributions nurses can bring to all levels of disaster planning, preparedness, and evaluation. Perceiving gaps in current disaster plans and envisioning improvements for greater functionality are valuable components of nurses' critical thinking capabilities. Although these strengths of nursing may be overlooked because of the difficulty in defining or measuring them, nurses in disaster settings should fully utilize these skills toward the improvement of the care delivered and, ultimately, of the overall disaster response.

Adaptability

Because of the rapidly changing circumstances during a disaster, adaptability is essential. Flexibility and adaptability increase the nurse's capacity to function efficiently and effectively during disaster events.

Nurses may need to provide care in a crowded emergency department (ED), or at the scene of the event, or in a quickly converted hospital cafeteria, or in a makeshift tent. During a disaster, healthcare locations are not static and nurses may need to shift locations multiple times as the conditions change.

Shortages of, and problems with, equipment also necessitate adaptability. Nurses may be required to provide care without the usual provisions. Dim or

no lighting, lack of electrical power, and difficulties with communication systems are issues that nurses may face and have to adapt to during a disaster; these conditions may be intermittent and require frequent re-assessments and adaptations.

Creativity often emerges during the process of adaptation as nurses combine their critical thinking skills with the needs of the current situation. For example, shortages of supplies may lead to improvised methods of sharing the limited equipment between patients, or using a different method or resource to perform the same function. Improvisation is spontaneous, but must be grounded in solid nursing knowledge and experience to provide the appropriate modifications for the situation.

Flexibility related to the variety of assigned or improvised tasks nurses perform will be needed; these tasks may range from direct patient care to leading the healthcare facility or community disaster effort. Some of these roles are developed well before the disaster through careful disaster planning; other roles develop spontaneously because of an identified need during a disaster. These roles also may change abruptly, and the nurse may be adapting hastily, moving from one role to the next in response to the shifting needs.

Leadership

Nurses must fully utilize their leadership abilities to coordinate and organize efforts during all stages of a disaster. Nurses in leadership positions are necessary not only to properly manage other nurses involved during a disaster, but also to address the overall healthcare response.

In a disaster response, nurse leaders oversee the effectiveness of that response; they are the coordinators who use their experience and knowledge to shape the disaster effort — coordinating personnel as well as supplies and resources. They may reallocate nurses, supplies, and equipment to fill gaps in the response effort, or reinforce areas that are being overwhelmed, e.g., redirecting patient flow in the hospital to prevent patients from bottlenecking unnecessarily while they await treatment. These changes often are made as the nurse leader interacts with other services and refines the response effort.

Community-wide responses, such as the establishment of shelters or fever clinics, also are implemented through nursing leadership. The nurse leader ensures that the healthcare facility — be it hospital, medical clinic, or community center — is adequately and appropriately addressing the needs of the community. Critical to this effort is the involvement of nurse leaders in all disaster planning and preparedness to ensure that their leadership experience is incorporated before a disaster occurs. Utilizing nurses' management knowledge and experience will help disaster planners and hospital administrators foresee problems and correct them well before these problems negatively impact the response.

Ideally, nursing roles and positions in disasters are pre-established by careful disaster planning. However, in the absence of a designated leader, a nurse who begins to coordinate and delegate responsibilities in an attempt to overcome an identified response shortcoming may spontaneously assume a leadership role. The individual nurses who solve problems related to a multitude of issues throughout the disaster response also demonstrate nursing leadership skills. Without strong leadership, the effectiveness of the disaster response will be severely limited. Nurses possess the necessary coordination and delegation skills which, when coupled with their care management experience, position them to capably serve in healthcare leadership roles during disasters.

During a disaster, the population is in a period of need and there is no large group of healthcare workers better poised to care for them than nursing. Nurses must clearly understand and practice beforehand their potential role in a disaster and have the necessary disaster education and skills to be in a position of readiness. Nursing knowledge and care skills coupled with their strengths of flexibility, teamwork, critical thinking, and leadership will be crucial in addressing the healthcare needs of the disaster.

Nursing in the Phases of Disasters

Disaster management encompasses the efforts to deal with hazards and the disasters they may produce. It is divided into three phases: preparedness, relief response and recovery. Each phase is an integral component of a holistic approach to an effective healthcare response. To be truly successful in their role of providing care during disasters, nurses must be involved integrally in all phases.

Preparedness

This phase involves the planning and preparedness activities performed prior to a disaster. Mitigation initiatives are specific preparedness strategies designed to reduce the losses from disasters, e.g., building earthquake-resistant hospitals. Planning begins with a hazard-vulnerability assessment, which is an analysis of the particular risks that a specific community and its healthcare system could face. Preparedness efforts are guided by these identified risks; in other words, planning focuses on preparing for those hazards that are most likely to occur in that given community.

Effective preparedness hinges on the development of a well-organized disaster response plan. In many countries, nurses are not allowed to contribute to this essential plan due to a lack of professional recognition and/or gender issues. However, when local or regional leaders work to design the healthcare response, nursing involvement is crucial to guide the planning toward effective health care during a disaster. Nursing expertise can guide plans by evaluating and

redesigning ineffective care strategies, assuring proper utilization of nursing potential, and ensuring efficient and cohesive patient flow throughout the healthcare facility and the community.

Training and practice are essential components of the preparedness phase. Drills provide an opportunity to identify areas within the disaster plans that need improvement. Education, coupled with the hands-on practical experience during drills, provide nurses with confidence in their capabilities by rehearsing and familiarizing them with their potential disaster roles and responsibilities.

Relief Response

The healthcare relief response to a disaster encompasses the broad scope of those actions intended to provide immediate health care to the community and begins with the initial notice of an impending or actual event. Often, the first notification of an event that healthcare facilities receive is not a radio call from an EMS crew on the scene, but, rather, the sudden, unannounced influx of arriving patients. Gradual onset events, such as emerging infectious diseases, tend to begin slowly but increasingly overwhelm healthcare resources as more patients develop symptoms and seek care. The ED triage nurse or the public health nurse may be the first to recognize the impact on health care and determine appropriate care as they call for the implementation of the emergency response plan. In the instance of chemical, biological, or radiological attacks or accidents, nurses may be involved in the immediate role of decontamination, setting up showers, and donning chemical suits and respirators.

Occurring simultaneously and in synergy with patient care, is the coordination of the response so that all of the healthcare facility's resources, including the nursing staff, are utilized to their fullest. This draws upon the work put into the disaster planning phase by following the procedures for establishing the hospital emergency operations center, implementing staff recalls, creating surge areas, and maintaining supply deliveries to the facility.

Outside of healthcare facilities, nurses also will be integrally involved in assessing community needs; providing shelter; food, and water; establishing and staffing vaccination or distribution centers; and providing psychosocial assistance. Additionally, nurses may be providing care at the scene of the event or at field hospitals established to administer supplemental care to the community.

Recovery

The focus of relief response efforts is the delivery of health care throughout the time of the community's immediate needs. Gradually, this phase will give way to the recovery phase of the disaster, with a decline in the number of patients in urgent need of care, and the arrival of outside resources to augment the healthcare capacity of the community. Recovery efforts are directed to rebuilding the

basic societal functions of the community, including rebuilding the healthcare system to ensure adequate mechanisms are in place to effectively provide and monitor the ongoing health needs of the community.

Disaster healthcare recovery plans should incorporate the long-term support provided by the nurses who care for the individual needs of the population. Post-response nursing tasks include public health surveillance, establishing temporary clinics, guiding immunization programs, and ensuring that the ongoing health and survival needs of the community are met. Healthcare facility nurses may be providing care in tents or other temporary shelters for an extended period of time, if their facility sustained significant structural damage. Nurses also may be involved in providing psychological care to the community to assist its members with the grieving and coping processes. Nurses' knowledge of the community, coupled with their flexibility in providing a broad range of needed tasks, underscores the need for their extensive involvement in the recovery efforts to return the community to a pre-disaster state.

CONCLUSION

During disasters, nurses will be called upon to provide aid and care utilizing their unique skills, abilities, and understanding of the community. Without the care provided by nurses, the community is likely not to fare well. To be effective, nurses must be prepared; this preparation includes education in relevant disaster topics, skills acquired through hands-on practice, interaction with preparedness procedures, and a firm understanding of local and regional capabilities and resources.

DISASTER NURSING ADAPTABILITY: AUSTRALIAN TEAM IN THE MALDIVES POST-TSUNAMI 2004

The ability to adapt is critical during disaster relief responses. Supplies may not be available and improvisation to devise substitutes for infrequently used or unusual items may be required. Members of the Australian Team's relief response to the Maldives following the tsunami became creative in finding alternative items for missing needed supplies. Some examples of their creativity include:

- Using the large, rigid containers used to transport medical supplies as privacy screens and walls between treatment areas in a temporary ED;
- Using polyvinylchloride (PVC) body bags to store and transport sterile consumables to keep them clean and dry in humid, tropical conditions;
- Using 350 milliliter plastic water bottles as spacers for multi-dose inhalers used in the treatment of salt-water pneumonitis; and
- Using rigid plastic drink bottles as sharps containers at each patient's bed area.

Jeffrey Williams

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CHAPTER 2

HEALTHCARE FACILITY PREPAREDNESS

Knox Andress

“PREPAREDNESS IS THE AGGREGATE of all measures and policies adopted before an event occurs that promotes mitigation of the damage caused by an event, and minimizes the dysfunction that could result from the damage. It consists of measures that a facility/community/country/region maintains, at a particular time, to combat the potential deleterious effects of local hazards. It includes the capacity to withstand a forthcoming event, to provide for effective emergency management, and to assist expedient recovery to the pre-event state.”¹

TRADITIONALLY, HOSPITALS HAVE lagged behind other public service providers in their level of disaster preparedness. Reasons for this include a lack of funding and a lack of understanding of the role of the hospital during a disaster. Simply put, the role of the hospital is to maintain operations through a disaster to properly care for the community’s health needs. Evidence demonstrates that hospital and health system disaster preparedness improves associated mortality rates. Relationships between the number of case fatalities and health sector preparedness were demonstrated in a study of four earthquakes: two in the US state of

OBJECTIVES:

- Describe the four phases of disaster management;
- Explain the different classifications of hospital vulnerabilities; and
- Understand the components of the hospital emergency operations plan.

California (Loma Prieta and Northridge), one in Kobe, Japan, and one in Armenia.² The two Californian health systems with high disaster preparedness indices had low fatality rates (67 deaths among the 3,824 injured in Loma Prieta, and 57 deaths among the 9,057 injuries in Northridge). In Kobe, Japan where health systems had mixed preparedness levels, there were 4,571 deaths among the 19,249 injuries within the city, and 5,480 deaths out of the 100,380 injured in the metropolitan area. And in Armenia, with a low disaster preparedness index, there were 25,000 deaths among the 40,000 injured.² While preventing an earthquake is not possible, reducing the mortality from an event is possible and equates to enhancing healthcare system preparedness.

Preparedness involves having the plans, supplies, and staff in place to respond in a timely and efficient manner during a disaster. Preparedness also requires the funding and executive-level support within the hospital as well as interagency support within the community to ensure implementation and cohesion of plans and processes. Additional challenges to disaster preparedness occur in developing plans for events that could compromise a hospital's functionality secondary to structural, non-structural, and organizational impacts. Hospitals may experience structural failure; lose infrastructure, supplies, staff, and equipment; and may be unable to accommodate a large influx or surge of patients. The 2003 Algerian earthquake rendered 50% of the hospitals and healthcare facilities in the impacted region non-functional, while the 2005 South Asia earthquake completely destroyed 49% of hospitals and health facilities in the most heavily affected region.³

Other challenges to preparedness are economic and management issues as hospitals and hospital systems are expected to provide disaster care, yet, often are not given the financial resources to accomplish this.

Despite all of these hurdles, hospitals play a critical role in community disaster response, making preparedness, resilience, and sustainability essential. In recognition of the vital contributions of healthcare facilities to the community, the World Health Organization (WHO) has proposed that governments, public health authorities, and hospital managers undertake necessary actions to ensure the safety of healthcare facilities during emergencies and disasters. In April 2009, the WHO celebrated World Health Day by directing attention to the large number of lives that could be saved during an emergency or disaster through improved design and construction of healthcare facilities, and through adequate preparation and training of healthcare staff.⁴

PREPAREDNESS PRINCIPLES

Hospital preparedness is a continuous, dynamic, and evolving process as identified threats and hazards change (e.g., a newly identified fault line beneath the hospital or a new chemical factory within the community), and

levels of preparedness fluctuate (e.g., staff turnover may result in a lack of individuals with disaster experience currently working in the emergency department). Evaluations of responses to disaster exercises or actual events also may identify necessary changes for improvement of disaster plans and processes.

Although hospitals must be prepared for a variety of disaster-causing events, most disasters place similar demands on hospitals. Because of these similarities, it is not necessary to develop totally separate plans and procedures for every different disaster imaginable. Thus, hospitals are encouraged to view disaster planning from an “all-hazards” approach; separate plans for different disasters can confuse staff and cause an unnecessary strain on budgets and storage capabilities. Preparedness plans should address the commonalities among the different types of disasters that could occur in that area. For example, a plane crash and a bomb blast both result in an influx of patients who are in need of triage and rapid interventions, even though the cause of their injuries is different. Thus, the core of the hospital disaster preparedness plan is common to all events, with supplements included for those events needing specific responses, e.g., an event requiring the addition of a decontamination team to the hospital’s disaster response.

Additionally, hospital planners should bear in mind that anticipating all of the possible problems encountered during a disaster response is impossible, and that plans can become quite complex and confusing to staff if they contain too many details. Nothing defeats the purpose of a plan more than having staff urgently flip through thick policy books to determine what to do in the midst of a disaster. “Keep it simple” is a defining statement of effective disaster planning.

DISASTER PLANNING PRIOR TO THE BAM EARTHQUAKE

In an unpublished survey of responders and victims involved in the 2003 earthquake in Bam, Iran, the following response shortfalls were identified:⁵

- Lack of plans for the provision of health services;
- Shortage of pre-established locations for providing medical services;
- Lack of coordination between responding groups;
- Lack of an adequate information system;
- Poor division of duties, and a mismatch between the skills and tasks undertaken by responders;
- Unnecessary duplication of some services, while others were overlooked; and
- Interference from outside responding groups and volunteers.

The participants of the study believed that effective disaster management planning prior to the earthquake could have prevented most of these problems from occurring. One participant noted:

“... If another earthquake occurs, I am greatly afraid that a lack of preparedness will prevail again, unless there is a directive as to where my place is. And what should I do? When do I get ready?

The time of disaster is not a good time for planning...”

Hamidreza Khankeh

PHASES OF DISASTER MANAGEMENT

Preparing for a disaster requires an understanding of the phases of a disaster. The Federal Emergency Management Agency disaster management continuum defines four primary components or phases of a disaster:⁶

1. *Preparedness phase* — includes the assessment of and planning for hospital hazards and vulnerabilities. Preparedness involves those actions taken to bolster a hospital's state of readiness in response to a disaster and includes activities such as developing plans, creating policies, training staff, purchasing identified supplies, and performing drills or exercises;
2. *Mitigation phase* — is similar to preparedness in that mitigation activities are undertaken to decrease the damage from an event. Mitigation efforts might include moving generators away from basements to areas that are less likely to flood, building waiting rooms without large glass windows that could shatter in high winds, and/or building a hospital according to seismic building codes to minimize earthquake damage;
3. *Relief response phase* — includes the actual relief response activities undertaken to save lives and prevent injuries during a disaster. It is during the relief response phase when plans generated in the preparedness phase are put into place and those actions previously taken to mitigate the effects and impacts of an event are appreciated. The relief response phase is dynamic and transitions into the recovery phase;
4. *Relief recovery phase* — includes those activities aimed at returning the affected population/community to its pre-event status. This phase may be long-term, based on the magnitude of the event.

Sundnes and Birnbaum identify a fifth phase of a disaster, the *Development phase*, which includes those activities aimed at improving the state of the affected society beyond its pre-event level.⁷ This phase is linked to the preparedness and mitigation phases using strategies based on lessons learned from the disaster, e.g., building more resilient structures that will be less vulnerable in a future event, developing improved warning and communication systems, and providing community education.

HOSPITAL VULNERABILITIES

Hospital vulnerabilities refer to the potential weaknesses and failures that a hospital might experience during an event. The understanding and the careful identification and assessment of potential hazards and vulnerabilities allow for effective planning and disaster risk management. Planning should focus

on those threats that are deemed likely for the given geographic location of the hospital.

Hazards are the potential threats that may occur during a given time period in a given place. Events can be caused by natural hazards (earthquakes, volcanoes, cyclones, etc.) or man-made hazards (hazardous material spills, industrial site explosions, transportation accidents, etc.), or a combination of the two.

Vulnerabilities are the identified points of weakness that an organization may have for a specific hazard. A hospital's vulnerabilities can be impacted by its level of preparedness. For example, the higher the hospital's level of preparedness for the possibility of flooding, the lower is its level of vulnerability to that event.

Risk is the probability of damage or loss of function that will occur given the hazardous event taking place, and the level of vulnerability to that particular hazard. The risk(s) to a facility is the product of both the hazard and the facility's vulnerabilities, minus the facility's capacity to cope with and/or minimize the functional changes.⁷ This can be expressed as:

$$\text{Risk (R)} = [\text{Hazard (H)} \times \text{Vulnerability (V)}] - \text{Capacity}$$

The ability of the facility to cope and to continue to function despite damage and a change in available resources (i.e., its *buffering capacity*) can be altered in order to reduce its risk(s).⁷ For example, while New York City may not be prepared specifically for a volcanic eruption (with a low risk of occurrence), it has become prepared for another terrorist attack (with a high probability of occurrence) by taking actions to correct identified points of prior weakness and vulnerability. Such preparedness activities not only have decreased New York City's vulnerability to a terrorist attack, but, by actively improving its buffering capacity, the city's level of vulnerability and, thus, its overall risk have been reduced.

In terms of healthcare facilities, vulnerabilities can be classified as external or internal. *External vulnerabilities* are vulnerabilities to those events that occur outside of the hospital, but that impact the hospital and its ability to provide health care. Examples of external events include war and geopolitical conflict, volcanoes, tsunamis, earthquakes, and hurricanes. The impact of these events on the hospital may be a rapid influx of a large number of patients, or limitations in services secondary to damage within the community that impairs access to the hospital by the staff and medical suppliers.

Internal vulnerabilities are vulnerabilities to events that impact or damage the hospital directly, such as building damage from a tornado, earthquake, fire, or flooding.

Hospital vulnerabilities also can be viewed as structural, non-structural, and administrative/organizational in nature:⁸

➤ *Structural vulnerability* includes weaknesses in the hospital

buildings or structural components that are required for physical support (e.g., foundations, supporting walls, beams, and columns). These components are subject to weakening and failure in a number of events, including floods, explosions, typhoons, hurricanes, and earthquakes;

- *Non-structural vulnerability* refers to the vulnerability of infrastructure components that are essential to the functionality of the building, including plumbing, heating, ventilation, air conditioning, information management/technology, water supply, and electrical power; and
- *Administrative/Organizational vulnerability* refers to the human resources and supply management that are necessary to maintain functioning of the hospital.

Assessing a Hospital's Vulnerabilities

The foundation of a hospital's preparedness and planning includes a hazard assessment or hazard-vulnerability analysis (HVA), which considers all identified potential threats to the hospital. The HVA is a component of the hospital emergency operations plan and must be re-evaluated regularly for new threat developments or hazard considerations. Probability and impact are the two main components of risk considered in the HVA.⁹ The hospital's HVA should be in concert with the community's HVA.

A thorough HVA of the hospital is conducted using the following steps:

1. Determine all the hazards that potentially could impact the hospital, either directly or indirectly. Utilize historical records, community hazard data, weather history, and flood maps, and consider every event that could cause a disruption in service (power outages, Internet down, water loss, etc.);
2. Determine the hazard occurrence probability. Rank the probability of occurrence by categorizing it as having a high, medium, low, or zero possibility of occurrence, and assign each ranking a number;
3. Determine the hospital's risk. Rank the impact upon the hospital taking into account the threats to: life, health, and safety; property damage; business viability; community trust; internal systems failures; and legal ramifications;
4. Determine the hospital's current preparedness level for each identified threat; and
5. Determine the priority of actions required to achieve preparedness, or obtain a higher level of preparedness for the identified, potential, damaging, and disruptive hazards.

Various techniques, models, and tools are available for calculating the

HVA; many are available on the Internet, through consulting firms and in other publications. The American Society of Healthcare Engineering of the American Hospital Association offers one method that considers potential natural, technological, and human threat events, and evaluates each for probability, risk, and preparedness by considering the following issues:¹⁰

1. Probability issues:
 - a. Known risk;
 - b. Historical data; and
 - c. Equipment manufacturer statistics.
2. Risk issues:
 - a. Threat to life and/or health;
 - b. Disruption of services;
 - c. Damage/failure possibilities;
 - d. Loss of community trust;
 - e. Financial impact; and
 - f. Legal concerns.
3. Preparedness issues:
 - a. Status of current plans;
 - b. Training/education status;
 - c. Insurance;
 - d. Availability of backup systems; and
 - e. Community resources.

With this tool, the probability, risk, and preparedness ratings are multiplied for each threat event. The total values, in descending order, represent the priority areas of organization focus and emergency resource planning. The method also determines a value at which no action is necessary, i.e., an acceptance of the level of determined risk.

Hospital Safety Index

The Hospital Safety Index (HSI), a product of the Pan-American Health Organization's (PAHO) Disaster Mitigation Advisory Group (DiMAG), assists hospitals in assessing their safety, prioritizing planning, and preventing facilities from becoming a casualty of a disaster.¹¹ The HSI provides an overview of the probability that the hospital will be able to function in a disaster or emergency situation. The tool incorporates a standardized Safe Hospitals Checklist for the evaluation of 145 areas within the hospital, taking into account structural, non-structural, and functional components of the hospital. An evaluation team's score of each area is entered into a computer with software that calculates results and ranks the hospital's ability to withstand an event and continue functionality. The final HSI score, which is calculated automatically, places the hospital into one of three categories:

Category A — facility is able to protect the life of its occupants and is likely to continue functioning during disaster situations;

Category B — facility can resist an event, but equipment and critical services are at risk; and

Category C — facility and the lives and safety of its occupants are at risk from an event.

This rapidly deployable assessment/diagnostic tool is available at: http://safehospitals.info/index.php?option=com_content&task=view&id=30&Itemid=103.

HOSPITAL PREPAREDNESS PLANNING

Hospitals must plan and prepare for managing the identified threats and hazards of the HVA and HSI in an organized and systematic manner considering potential facility impacts and resources needed to manage and recover from the event. Two primary hospital preparedness and management goals include providing a safe environment for patients and staff while, at the same time, responding effectively to the disaster. The hospital preparedness process includes: (1) developing hospital emergency preparedness policy; (2) planning responses for indicated emergencies or disasters; (3) training and educating staff; and (4) monitoring and evaluating outcomes.¹²

Emergency Operations Plan (EOP)

The hospital EOP, which contains the strategies for managing hospital disasters, provides the framework for emergency and disaster planning, education, exercises, and assists in increasing the hospital's disaster resilience. The EOP contains the written strategy for hospital disaster and emergency preparedness, response, mitigation, and recovery phases. EOPs utilize an "all-hazards" strategy that allows flexibility and scalability in the disaster response, and is based on the results of a hazard-vulnerability analysis or threat assessment.¹³ Components of the hospital EOP include:

- Planning and management;
- Personnel roles and responsibilities before, during, and after the disaster or emergency;
- Medical care provisions;
- Communications (internal and external);
- Logistical support;
- Finance;
- Equipment;
- Patient tracking;
- Fatality management;
- Decontamination;
- Plant, facility, and utility operations;

- Safety and security; and
- External agency coordination.

The preparedness process also includes the coordination of the response inside and outside the facility implementing an accepted incident command or management system, such as the Hospital Incident Command System (HICS).¹⁴

Response Components

The primary measures that hospitals need to undertake to improve their disaster preparedness capabilities generally are divided into the “three Ss:” *Staff*, *Stuff*, and *Structure*.¹⁵

Staff includes all personnel as well as all measures related to improving the human resources component of a disaster response. Such measures include: creating staff recall lists; creating staging areas for staff reporting back to work; changes in scheduling; changes in nurse-to-patient ratios; re-assignment of staff

ER ONE: THE NEXT GENERATION OF MITIGATION STRATEGIES FOR HOSPITAL EMERGENCY DEPARTMENTS

ER ONE is a unique care facility, located at Washington Hospital Center, Washington, DC. It is funded by the US Congress and designed as a prototype for all new emergency departments (EDs). Its unique design features are aimed at mitigating the impact on hospitals of conventional and non-conventional threats. Traditional ED designs are problematic for the proper response to terrorist events. Some of these problems include:

1. Inadequate surge capacity;
2. An unsafe environment from re-circulated air and surface contamination;
3. Inadequate arrival and departure area capacity;
4. Poor control of entry points;
5. Poor data availability;
6. Inadequate decontamination facilities;
7. Poor communications capabilities; and
8. Dependence on external utilities.

To address these issues, ER ONE has incorporated design principles that include:

1. Dual-use capability — features that have a role in day-to-day functioning as well as disaster operations;
2. Surge capacity/scalability — capability of handling large patient surges without stockpiling rarely-used equipment;
3. Modularity/flexibility — system designs that allow functions to be altered easily based on current needs;
4. Familiarity — tasks and equipment approximate staff's daily routine; and
5. Knowledge management — pertinent, functional knowledge/information built into systems or facility design to aid staff in determining appropriate action/intervention.

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to areas other than their primary unit; providing meals and sleep areas for staff during long-term events; and assigning specific duties related to the response.

Stuff refers to the materials required to provide for the care of the disaster victims. This includes needed medical equipment, medications, and supplies. These materials may be used in everyday care; additional or supplemental materials may be stockpiled solely for a disaster event. Most hospitals keep specific levels of stock, i.e., baseline levels, or “just-in-time” inventory on hand. Increasing these levels to allow for a larger amount of supplies on hand that rotate through normal hospital usage tends to work better than maintaining a separate stockpile that isn’t utilized except during a disaster. Separate, unused stockpiles tend to contain expired materials, missing materials, and uncertain materials when finally needed. Specific supplies to have on hand include: ventilators; particle filter masks; decontamination equipment; medications specific to a disaster situation, such as ciprofloxacin or doxycycline; triage and patient tracking items; and “soft goods”, such as bandaging supplies.

Structure consists of both tangible and non-tangible structure. Tangible (physical) items include: (1) the construction of decontamination facilities; (2) additions to hospital buildings, such as stand-alone facilities created for screening centers during a pandemic; (3) electronic equipment capable of “locking down” entrances to the hospital; and (4) redesign of the ED for better patient flow in a high-volume disaster situation. Non-tangible structure refers to those items that lend structure to the response through the organization of available resources, such as the hospital’s Incident Command System and the EOP.

EDUCATION, TRAINING, AND EXERCISES

There are many types of education and training that must be provided to the hospital staff to prepare them to respond effectively to a disaster. Education and training can be of a general nature, yet specific to a certain facility or agency; ideally, both aspects are combined in training. General education and training topics include:

- Terrorism and weapons of mass destruction;
- Hazardous materials;
- Decontamination; and
- Hospital incident command.

These topics provide a foundation of knowledge that can be linked to the processes and plans of a specific facility. For example, decontamination training provides knowledge as well as experience in the use of available personal protection equipment that are linked to education on when and how to implement the hospital’s decontamination plan. Specific education and training would include: (1) when to establish incident command; (2) when and how to begin a disaster response; (3) how and where disaster triage is performed; (4) what areas are set up to receive triaged patients; (5) how to use the hospital’s decontamination system; and (6) where to set up the decontamination zone.

Distinct challenges in providing education and training include the lack of educational standards and universally accepted competencies. Thus, determining if people have been educated and trained to an appropriate level, and ensuring that all staff are appropriately prepared for their level of responsibility within the organization are problematic. For those hospitals attempting to receive US government grant money, the US Hospital Preparedness Program mandates staff education and training in the National Incident Management System (NIMS), and the incident command system. Yet, there are no standards for determining the effectiveness of the classes offered.

Exercises and drills are used to test the hospital system and the performance of individuals during a simulated disaster. In turn, the post-drill evaluation process can be useful in identifying overlooked educational topics or individuals. Exercises and drills may be planned and announced, or may be a surprise to all but the planners. Drills may consist of:

- *Computer simulations* that present a disaster scenario to individuals or groups of participants who respond to the situation through interactions with a computer program. The simulation allows staff to gain an understanding of their specific roles and responsibilities, and practice in making the types of decisions they will need to make during real events;
- *Tabletop drills* consist of the presentation of disaster scenarios to key individuals who work together as a group to respond to the scenario as if it were a real event, but within the confines of the meeting room. These drills provide staff an understanding of their roles and interactions with other members of the incident command structure; and
- *Operational or mock drills* consist of enacted events with volunteers acting as victims (with or without moulage) or with the use of paper-based victims (i.e., cards describing specific victim injuries in place of actual persons) and staff responding appropriately.

Drills may be conducted on various levels within a facility. They may involve one or two isolated departments (such as the ED), or they may be full-scale exercises involving the entire facility. A community drill may involve outside agencies or it may involve only local resources, such as emergency medical services and the fire department. Within a region, drills may involve other hospitals with all area hospitals receiving simulated patients, or they may involve only one hospital in an evacuation simulation with dispersal of all of its patients to the other hospitals in the area. Regional drills also may involve state and federal entities.

Drills should be tied to specific components within the Emergency Operations Plan that the organization wishes to evaluate. These evaluated components may be very specific, such as wanting to determine the amount of time needed to establish a decontamination shower, to more global issues, such as

evaluating the flow of information during a disaster. Evaluation is accomplished by assigning observers to assess specific components of the drill. The Johns Hopkins University's Evidence-based Practice Center recommends that the following four components of drills or exercises be evaluated:¹⁶

- Incident Command;
- Decontamination;
- Triage; and
- Treatment.

Although there are some differences in the assessment points within the different areas, evaluators must assess the following aspects in each of the areas:¹⁶

- Command structure;
- Adequacy of staffing and physical space;
- Communication and information flow;
- Security and victim and staff safety;
- Victim flow; and
- Adequacy of materials.

After a drill, evaluators discuss the drill with the participants (either all participants or key members from each area) in a debriefing or a "hotwash" session, for

ISRAELI USE OF AFTER ACTION REVIEWS (AARs)

The implementation of After Action Reviews (AARs) immediately following a mass-casualty incident or drill importantly contributes to the effective management of future events and the provision of a high quality of care to casualties. In order to enable all medical organizations to perform AARs in a professional and optimal manner, the Israeli Ministry of Health (MOH) has developed a structured protocol and methodology for their conduct. The tool identifies the following stages of an MCI to be reviewed:

1. Organization and preparation;
2. Admission of casualties;
3. Treatment; and
4. Return to routine operation.

The tool also identifies: (1) which participants/spokespeople must attend the AAR; (2) the elements that should be reviewed; and (3) guidelines for the director responsible for leading the AAR. Three levels of AAR are utilized:

1. A debriefing conducted in each department of the hospital immediately after the event;
2. An AAR conducted within 48 hours of the event, in which representatives from all departments involved in the MCI participate; and
3. A concluding meeting held within one to two weeks following the incident for all of the departments and units involved in the MCI.

The conclusions drawn from the AAR are distributed to all hospitals by the MOH.

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the purpose of obtaining further performance data, both good and bad. The intent is to gather information for improvement, not to find fault with specific individuals who may not have performed well. Based on the debriefing information gathered and the evaluators' reports, an AAR is compiled detailing shortcomings of the drill and corrective actions that must be taken to correct those issues.

HOSPITAL PREPAREDNESS INITIATIVES

The ability of hospitals to improve their preparedness capability and to protect the lives of patients and healthcare workers often is linked to national and international planning initiatives and guidance. Examples of international and national hospital preparedness initiatives and programs include: (1) Hospitals Safe from Disaster; (2) India's GoI-UNDP Disaster Management Program; and (3) the US Hospital Preparedness Program. Other preparedness capabilities may be related to the requirements of one of the following national or state regulatory groups:

Safe and Resilient Hospitals

The occurrence of catastrophic events can impact communities and hospitals negatively in both developing and industrialized countries. Many times, hospitals and healthcare facilities are not able to function during a disaster — the time when they are most needed. Examples of events that highlight the importance of hospital survival during and after catastrophes include the 26 January 2001 earthquake in Gujarat, India, which devastated 227 healthcare facilities, and the Southeast Asia earthquake and tsunami in 2004 that destroyed 42 hospitals and 195 healthcare facilities or clinics in the impacted region.¹⁷ Not only is the immediate medical response impacted, but community healthcare services may not be restored for months or even years after the disaster.¹⁸

Within the last 10 years, a number of global conferences and forums sponsored by the United Nations/International Strategy for Disaster Reduction (ISDR), the Joint Commission International (JCI), and the World Association for Disaster and Emergency Medicine (WADEM) have presented information and discussions regarding the importance and need for hospital disaster risk and vulnerability reduction. Forums have addressed the need for guidelines for designing, constructing, and evaluating “safe and resilient” hospitals. In support of this issue, the ISDR has adopted the Pan American Health Organization/World Health Organization's “Safe and Resilient Hospital” initiative. Ensuring physical and functional capability and integrity during and after disaster are the primary foci of this initiative.¹⁹

GoI-UNDP Disaster Management Program

Under the direction of the United Nations, the GoI-UNDP Disaster Risk Management Program is a national initiative that seeks to reduce the vulnerabil-

ities to a disaster due to an earthquake in 17 states and 169 districts within India.²⁰ Its “Guidelines for Developing a Hospital Emergency Management Plan” in-tends to support and assist hospitals in formulating their own all-hazards emergency response plan in accordance with their available human and material resources. The guidelines provide a hospital emergency response plan that could be integrated into existing community response planning to strengthen overall community coordination during a disaster.

Hospital Preparedness Program (HPP)

Established by the United States Department of Health and Human Services (HHS) in 2002, the Hospital Preparedness Program (HPP) aims to enhance the ability of hospitals and healthcare systems to prepare for and respond to bioterror attacks as well as other public health emergencies, such as a pandemic and other disasters.²¹ Past Hospital Preparedness Program priorities have included: (1) increasing hospital bed and personnel surge capacity; (2) expanding decontamination capabilities; (3) isolation capacity; (4) pharmaceutical supplies; (5) training; (6) education; and (7) drills and exercises. Current priorities for hospitals and healthcare systems include: (1) improving hospital disaster response capabilities in areas of interoperable communication systems; (2) bed tracking; (3) personnel management; (4) fatality management planning; and (5) hospital evacuation planning.

CONCLUSION

Healthcare organizations are challenged to respond to emergencies and disasters occurring from a variety of local, regional, national, and global hazards. Hazards can arise internally or externally to the healthcare facility; those compromising the hospital directly require additional preparedness plans. With the responsibility of providing health care to the community, healthcare facilities play a critical role in community disaster response and recovery, and must strive, through appropriate preparedness and mitigation activities, to remain safe, resilient, and functional.

Disaster preparedness involves all measures and policies undertaken to reduce the amount of damage that could occur from an event.¹ This includes having written and rehearsed plans, necessary supplies, and staff in place to respond to a disaster in a timely and efficient manner. Proper preparedness also requires funding and executive-level support within the hospital, as well as interagency support within the community to ensure implementation and cohesion of disaster management plans and processes. The state of preparedness is not static, but rather is dynamic, incorporating updated knowledge and procedures, newly identified threats, and the correction of areas of weakness that have been identified in drills or actual events.

As integral members of a hospital's healthcare team, nurses play a vital role in hospital disaster preparedness. Activities in which the nurse, individually or as a member of his/her national or international nursing association, may engage to improve hospital disaster preparedness include:²²

1. Becoming familiar with and raising public awareness of those natural events that his/her institution/region/country are most likely to experience;
2. Being informed of diseases and social behaviors associated with disasters and deteriorated living conditions;
3. Being aware of associated physical and mental health, socio-economic, and nursing needs of potential disaster victims;
4. Lobbying institutions and governments to prepare for disasters by assessing potential hazards and vulnerabilities;
5. Actively participating in his/her hospital's and/or community's disaster planning to ensure nursing input;
6. Supporting the development of an accountable chain of command within relief organizations and measures to facilitate access to goods and services;
7. Urging the development and implementation of relevant policies, procedures, and necessary legislation;
8. Participating in the education and training of nursing staff to be effective in a crisis/emergency situation;
9. Incorporating disaster preparedness awareness in educational programs and obtaining and/or providing continuing education to ensure a sound knowledge base, skill development, and ethical framework for practice; and
10. Networking with other professional disciplines, governmental, and non-governmental agencies at local, regional, national, and international levels.

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CHAPTER 3

COMMUNITY BEHAVIOR AND RESPONSE TO DISASTER

Tricia Wachtendorf,^a James M. Kendra,^a and Brandi Lea

ON 11 SEPTEMBER 2001, while the first formal emergency responders were trying to cope with the devastation caused by the attacks on the World Trade Center in New York City, an important — but rarely discussed — response activity was underway. In addition to the many people who evacuated Lower Manhattan by walking uptown or across the Brooklyn Bridge, an estimated 300,000 to 1,000,000 commuters and area residents were evacuated via an emergent flotilla of harbor vessels, including ferry boats, dinner cruise vessels, harbor tugs, and private watercraft. Some vessel captains followed directions issued by the US Coast Guard, whose officers had issued a call for all available boats to provide assistance. Other vessels converged to the site prior to, or without having heard, the Coast Guard call, and many acted independently and according to their best judgment, rather than under agency or harbor pilot direction. Quickly, a landward support network developed along the waterfront, with individuals taking steps to facilitate the embarking and dis-

OBJECTIVES:

- Understand the six steps of the warning process model;
- Discuss the four types of organizational behavior in disasters; and
- Describe convergence behavior and its benefit to the disaster response.

a. Tricia Wachtendorf and James Kendra are principal investigators on a project studying improvisation and organizational responses during waterborne evacuation. Unpublished findings from this study are drawn upon to illustrate several points throughout the chapter. The following sources of funding have contributed to this study: Multidisciplinary Center for Earthquake Engineering Research (MCEER) New Technologies in Emergency Management, No. 00-10-81 and Measures of Resilience No. 99-32-01; the National Science Foundation; the Public Entity Risk Institute No. 2001-70 (Kathleen Tierney, Principal Investigator); National Science Foundation No. 0603561 and 0510188 (James Kendra and Tricia Wachtendorf, Principal Investigators); and the University of Delaware Research Foundation (Tricia Wachtendorf, Principal Investigator). We are grateful to the South Street Seaport Museum (Mr. Jeffrey Remling, Collections Director) for access to interviews with participants in the waterborne operations. Funding to the museum for these interviews was provided by the National Endowment for the Humanities; and the interviews were conducted by David Tarnow. The views expressed here are those of the authors and do not necessarily represent those of funding agencies.

embarking of evacuees (either by providing direction, forming queues of evacuees, or removing barriers); providing basic first aid; transporting evacuees after they reached the waterfronts of New Jersey, Brooklyn, or Staten Island; or managing supplies, equipment, and emergency personnel to be transported back to the event site (Ground Zero). Although no pre-existing plan outlined the way in which this activity evolved, the waterborne evacuation was improvised successfully and illustrates the important role that citizens and non-governmental organizations play in emergency evacuations and disaster response efforts.

COMMUNITY EVACUATION BEHAVIOR^b

Evacuating people from a threatened area is one of the principal strategies used to protect lives. While there certainly are situations in which evacuation is not appropriate, as in tornados or incidents involving certain hazardous materials where sheltering-in-place is the better option, evacuation remains an important emergency response function. Evacuation can begin spontaneously if people perceive danger or if an emergency suddenly occurs, or evacuation may occur in advance of an impending event based on official recommendations or orders. But, whether spontaneous or directed, evacuation behavior is tied closely to people's understanding of their environment, their individual capacities and social relationships, and their comprehension of the threat to their life. In other words, as with other disaster-related activities, evacuation typically is a socially-mediated activity,¹ which means that it relies heavily on existing or emerging social networks.

Much evidence has accumulated showing that people do not begin the evacuation process immediately upon being directed to do so. Rather, they engage in a number of well-defined behaviors that have been demonstrated in many different crisis situations.¹⁻⁴ Receiving a warning to evacuate marks the beginning rather than the end of the warning process. People do not simply hear the message and take action. The *warning process model* contends that upon receiving a message, recipients experience six stages in which they: (1) hear the message (or read it); (2) evaluate and comprehend it; (3) believe it (i.e., assess its trustworthiness); (4) personalize it (i.e., realize that the warning is *for them* and that they are in danger); (5) decide what to do; and then (6) act.⁴⁻⁷ People are not likely to take action without surveying the environment for definitive signs of danger — such as threatening clouds or increasing winds — and will “confirm” the message with family, friends, or other sources.

Evacuation behavior is a group activity; people tend to leave a threatened area with the people who are closest to them. Families will evacuate before an oncoming storm in intact units whenever possible, and employees tend to leave threatened workspaces with their colleagues and office mates. In fact, people

b. This section principally addresses community-wide evacuations as opposed to the evacuation of buildings or other discrete facilities.

often will delay their own evacuation to ensure that those they are closest to will evacuate as well.^{2,3} This phenomenon belies the idea of panic, or that people are overcome with fear to the extent that it dominates their thinking and actions. A considerable body of research shows that widespread panic, popularly expected when people are exposed to danger, is a myth, and that, instead, people tend to be helpful and pro-social, except, perhaps, when there is a perception of immediate and severe danger, the closing of the time window for escape is imminent, and/or there is a lack of communication about the situation.^{8,9} In all the disaster literature, this evidence of group activity has been among the most durable principles of human behavior.¹

In the World Trade Center attack of 2001, for example, evacuation from the towers was orderly; people helped each other, sometimes at risk to their own lives.¹⁰ That behavior continued during the waterborne rescue operation; people stood in line, waited their turn, and helped each other. Certainly, people may describe themselves as having felt “panicky”, but what they mean is that they



Figure 3.1: New York City, 11 September — Coast Guard crew members patrol the harbor after the collapse of the World Trade Center. Terrorists hijacked four commercial jets and crashed them into the World Trade Center in New York City, the Pentagon in Washington, DC, and the Pennsylvania countryside.

were under stress, couldn't think clearly, or didn't know what to do. Fear is a reasonable response to terrifying situations, but it is not the same as panic. Panic, in a sociological sense, has been described as dysfunctional escape behavior¹¹ or the "collective flight based on a hysterical belief".¹² Instead, most people act with consideration and helpfulness, and panic is rare. In other words, how people describe their feelings is very different from the actions they undertake. Emergency officials may believe that it is necessary to withhold information from citizens in order to avoid panic. However, this concern is unfounded; people exposed to danger want information.^{10,13} Tierney noted that people in the Twin Towers in New York City, although certainly frightened, made phone calls, sought guidance from family and friends, watched television, and tried to make sense of their situation.¹⁰ A careful examination of photographs as well as documentary and news footage of the people fleeing the collapse of the towers through the streets of New York City, indeed, may show fear, but it does not show panic.

Evacuation is a social activity that is grounded in people's social experiences. One consequence of the social phenomenon of evacuation is that people's behavior will vary based on their particular circumstances. Not everyone evacuates the same way or at the same time because of factors such as varying

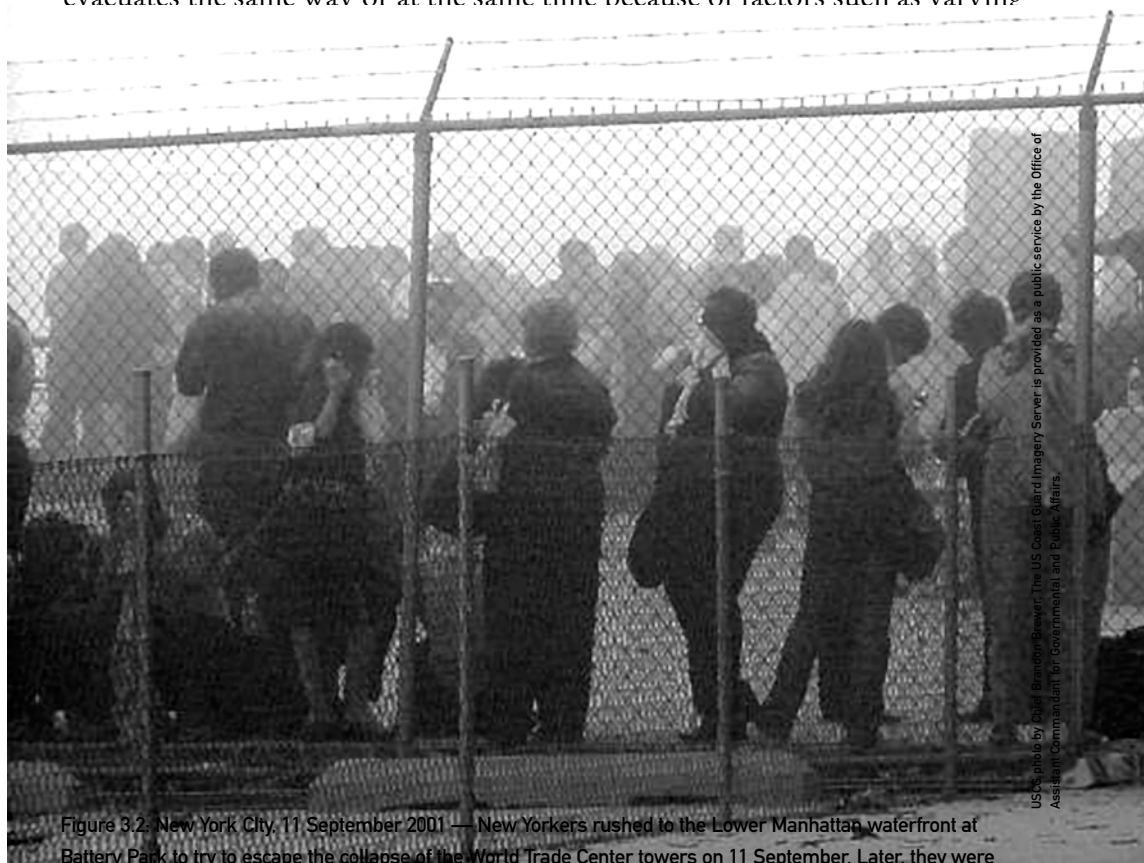


Figure 3.2: New York City, 11 September 2001 — New Yorkers rushed to the Lower Manhattan waterfront at Battery Park to try to escape the collapse of the World Trade Center towers on 11 September. Later, they were evacuated by ferries and tugboats from all over New York harbor.

USPS photo by David Brundage/Silver. The US Coast Guard Imagery Server is provided as a public service by the Office of Assistant Commandant for Governmental and Public Affairs.

or demographic characteristics. For example, households with children, as well as households with women, are more likely to evacuate than those without women or children.^{14–16} Others may fail to evacuate because they are institutionalized, lack mobility, or have failed to hear the warning because of ability, language, or their lack of connection to the community (such as transients or tourists).¹⁷ Others may remain behind to help those unable to leave.

While persuading some people to evacuate can pose a significant challenge, sometimes *more* people evacuate than should do so. This is termed *evacuation shadow* and refers to the evacuation of people outside of the recommended area of mandatory evacuation. One reason for this occurrence is that people may interpret their area to be at greater risk than officials do, and decide to leave anyway; or they may misunderstand where they are in relation to the area that officials want to evacuate.^{4,18} This *evacuation shadow* phenomenon occurred in Texas in advance of Hurricane Rita in 2005, when hundreds of thousands of coastal Texas residents left their homes for inland destinations. This mass exodus overwhelmed the highways causing trips that normally would take only a few hours to take a full day or more. Cars broke down or ran out of fuel along the way, further slowing vehicular movement. One expert on warning and evacuation suggests that some people anticipated the extreme conditions in New Orleans just a few weeks prior to Hurricane Katrina, and elected to leave rather than risk being stranded in their homes or shelters.¹⁹ The *evacuation shadow* can present management officials with challenges that are as serious as those encountered when people don't evacuate, since it means that many more people than expected will be traveling. More significantly, people who aren't in danger can slow the escape of people who are imperiled, and if the evacuation isn't complete before danger strikes, *all* might be caught in exposed locations.

Evacuation remains a social activity, whether it occurs spontaneously or through official channels preceding a disaster. Warning messages and information about evacuations must be specific and clear regarding the nature of the danger and the actions to be taken.^{4–7} The prevalent misconception about panic may lead to excess planning for behaviors that are exceedingly rare. It is important to remember that people will leave in groups (family or friends); families will not leave if all members (e.g., elderly, infirm members) are not able to evacuate; families with children will evacuate more readily than those without; and people will continue their pre-existing social network, as much as possible, throughout a disaster.

Informal Responses

Organizational behaviors in a disaster can be categorized into four types based on how they are structured and their responsibilities.^{20,21} *Established organizations*, such as fire departments, engage in routine tasks and maintain their pre-

disaster structure. *Expanding organizations*, such as the American Red Cross, engage in routine tasks, but adopt an alternate structure, such as expanding its structure to increase its numbers of volunteers, during a disaster. *Extending organizations* maintain the same structure that they had in place before the disaster, but take on non-routine activities (e.g., construction companies may become involved with clearing debris during search and rescue efforts). Finally, *emergent organizations* are organizations that did not exist before the disaster and, therefore, have new structures and engage in new tasks such as spontaneously formed search and rescue groups, and family assistance groups.

Established first responders, such as fire and police departments, play critical and obvious roles in a disaster response. However, the earliest responders to an event typically are neighbors, co-workers, surrounding businesses, and community-based groups closest to the disaster site. Although these individuals constitute emergent organizations, they also are expanding and extending organizations. Indeed, disasters typically lead to the creation of new or spontaneous social phenomena, or what often is referred to as *collective behavior*.^{22,23} This behavior is related to how groups operate and is organized prior to the event that becomes transcended, opposed, or modified through a joint effort of those involved in an event.²⁴

While the formal first responders provide assistance in disaster-impacted areas, they frequently must interact with other governmental agencies, the private sector, non-profit organizations, and individual citizens acting independently or as part of a collectivity. Some of these entities are part of an established emergency response organizational network.²⁵ Agencies and businesses may have set responsibilities assigned to them in the case of a disaster; their employees may have participated in disaster planning drills, and may even have a position allocated as a representative of their organization at the Emergency Operations Center. Expanding organizations — for example, the Salvation Army — may have strong networks and well-defined roles; others, however, may not have participated in pre-event planning and exercises, and thus, will be new to this network.

Aguirre *et al* studied search and rescue groups that emerged following the gas explosion in Guadalajara, Mexico.²⁶ Consistent with past research,²⁷ they found that these emergent groups were important in life-saving activities — particularly in the “golden” first hour of the disaster, before formal search and rescue teams arrive. They also found that coordination between volunteers and search and rescue professionals can prove difficult as conflict ensues over rescue strategies, ambiguous authority relationships, and relationships between independent agencies. Similar efforts were observed after the devastation of Hurricane Katrina; local citizens in New Orleans frequently were best suited to identify where an elderly neighbor who had refused or been unable to evacuate was stranded. While formal agencies, such as the US Coast Guard, had access to helicopters and personnel, and were essential in rescue efforts, so, too, were the citizens and

businesses from nearby areas using boats that were not destroyed in the hurricane. These civilians served as important auxiliary support for search and rescue activities of thousands of people stranded in the city, joining expanding search and rescue activities, or extending their own groups to participate in this new role. In other words, rescue operations relied on multi-organizational efforts involving a range of participants who converged upon the disaster site. The informal responders offered *human capital* (skills, knowledge, and experience), *physical capital* (tools and material resources, such as boats), and *social capital* (the norms and networks that facilitate collective action).^c Together, these various organizations, along with those individuals who operated alongside them, develop into what Drabek³⁵ terms an emergent multi-organizational network that must, for a limited time, work to address the emerging response needs.

Convergence and Informal Responders as Helpers

Convergence behavior, in the context of a disaster, involves the movement of people, materials, and information to a particular point associated with the event.³⁶ Among the people who converge in a disaster are: (1) helpers (formal and informal) attempting to provide assistance; (2) returnees, or those residents and employees who initially evacuated the area; (3) anxious family and friends seeking information about loved ones; (4) curious onlookers attempting to view the impacted area or relevant facilities; and (5) exploiters seeking to take advantage of the circumstances. The impact site is not the only area of interest to these convergers; i.e., they vie for access in a variety of areas associated with the response environment.³⁷ For example, hospitals, checkpoints, staging areas, warehouses, and other response-related facilities that may be located outside the impact zone. When people converge to the most devastated areas, it is because those sites have relevance to the response environment. At the same time, other facilities not in the most devastated areas may hold similar relevance and also attract convergers.

Informal helpers may assist response efforts because of their proximity to the disaster zone, familiarity with the site or the victims, flexibility to function outside bureaucratic mechanisms, and/or ability to provide needed skills when a gap in response capacity exists. At the same time, their involvement in the emergency response system can add complexity and confusion to a multi-organizational response. It can be challenging to identify those volunteers that possess useful skills from other well-intentioned volunteers who are less able to contribute to an effective response, particularly while emergency managers are occupied fulfilling their own response obligations. New volunteers often must be credentialed if they are to remain active within a response, may have limited liability or health compensation coverage for their work, and may be unfamiliar

c. Although social capital is often discussed with respect to economic growth, others have examined the concept examining a range of social problems.^{28–34}

with important information relevant to the response.^{1,33,37,38} They also may require food, shelter, first aid, and sanitary facilities, among other needs, thereby generating additional resource demands and management activities.

Consider, again, the waterborne evacuation of Lower Manhattan. Responding vessels already were within the harbor, many were *en route* to or from the impacted area. Most of the captains, mates, and deckhands were familiar with the harbor, and the waterfront's infrastructure; many also were familiar with the commuters who became the evacuees. Without an established plan to evacuate hundreds of thousands of people by boat, and with bridges and trains closed to traffic, the waterborne evacuation filled an important response gap. The participation of the harbor vessels also facilitated other informal and formal helpers as the boats transported converging personnel and supplies back to Ground Zero on return trips. Still, some well-intentioned individuals operated vessels that were less suited to a swift and safe response. Captains sometimes needed to negotiate their vessels within a heightened security environment and validate their response actions as they encountered government officials. Some individuals who assisted on the boats were not seamen or previously known to captains, mates, and deckhands. Rather, they were passers-by who were asked to help a short-handed crew. Their roles were instrumental; however, they were not credentialed and some had never before helped to operate a boat.

Preplanning for Informal Response

Several initiatives have been developed to integrate non-formal, unsolicited first responders into disaster responses. One example is the Medical Reserve Corps (MRC) program, which was started in 2002. Under the oversight of the US Office of the Surgeon General, the MRC program encourages communities to engage and train potential volunteers such as retired healthcare professionals, medical and nursing students, chiropractors, pharmacists, and dentists in training in their planning for the provision of disaster surge capacity. While these volunteers may or may not be skilled or credentialed to perform the same activities as usual healthcare providers, they can serve as a well-informed cadre of volunteers better suited than the average citizen to provide assistance to the formal healthcare responders. Other initiatives that have fostered community-based disaster approaches over the past decade include the Citizen Corps (focusing on homeland security and emergency response), Community Emergency Response Teams (focusing on training citizens in disaster response), and Project Impact (focusing on public/private, community-based disaster mitigation).^d In addition to the genuine contributions these participants can make to community disaster resilience, valuable by-products of

d. Project Impact, introduced by the US Federal Emergency Management Agency during the Clinton Administration, was terminated at the federal level during the Bush Administration; however, some communities that participated in the initiative have continued the program at the local level.

these programs are the relationships and familiarity that community groups develop with one another and with the emergency management community. At the same time, it is important to remember that spontaneous convergence still will occur, bringing with it valuable resources to meet unanticipated needs as well as the coordination challenges that plague complex disaster responses.

CONCLUSION

Definitions of a disaster generally refer to a situation in which community resources are overwhelmed and outside assistance is required.^{8,39,40} With the disruption of social structure and physical resources, informal responders have an important role to play in an effective disaster response. According to Shibutani, “if the normative framework does not provide an adequate guide to concerted action, the people involved in the situation must work together to improvise some way of coping with it.”⁴¹ By beginning dialogue with community groups and local citizens before a disaster develops, public officials with roles in emergency management may be able to identify and integrate citizen response as well as improve their ability to recognize the range of resources within a community when improvisation becomes necessary. Whether such planning is performed or not, spontaneous informal responders will converge to a disaster area; their presence is best dealt with in such a way that considers and reconciles the potential benefits and challenges they bring to the response. Similarly, formal warning and evacuation procedures are important in orchestrating evacuations; however, people rely on a variety of cues in their physical environment when engaging in evacuation behavior, and their activities are imbedded in the collective actions of their social network and those in close proximity to them. A stronger understanding by those in leadership roles of the ways in which existing and emergent mechanisms facilitate or impede effective community evacuation can bolster the community’s overall resilience to a disaster.

SELF-EVACUATION FROM TOKYO SUBWAY STATIONS

One hundred and thirty-one ambulances were dispatched to the 15 affected subway stations immediately following the 1995 sarin attack in Tokyo, Japan. Ambulances transported 688 victims, while more than 4,000 other victims walked or used different means of transportation, such as taxis and private vehicles, to reach nearby hospitals. At St. Luke’s Hospital, 25% of the victims that presented to the hospital’s emergency department were delivered by taxi, and two patients in cardiac arrest were delivered by private vehicle.⁴²

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