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Preface: Critical State of Disaster Preparedness **xiii**

Marie R. Baldisseri, Mary Jane Reed, and Randy S. Wax

Intensive Care Role in Disaster Management Critical Care Clinics **535**

Tanzib Hossain, Marya Ghazipura, and Jeffrey R. Dichter

The "daily disasters" within the ebb and flow of routine critical care provide a foundation of preparedness for the less-frequent, larger events that affect most health care organizations at some time. Although large disasters can overwhelm, those who strengthen processes and habits through daily practice will be the best prepared to manage them.

Preparing the Intensive Care Unit for Disaster **551**

Randy S. Wax

Critical care teams can face a dramatic surge in demand for ICU beds and organ support during a disaster. Through effective preparedness, teams can enable a more effective response and hasten recovery back to normal operations. Disaster preparedness needs to balance an all-hazards approach with focused hazard-specific preparation guided by a critical care-specific hazard-vulnerability analysis. Broad stakeholder input from within and outside the critical care team is necessary to avoid gaps in planning. Evaluation of critical care disaster plans require frequent exercises, with a mechanism in place to ensure lessons learned effectively prompt improvements in the plan.

Augmenting Critical Care Capacity in a Disaster **563**

Gilbert Seda and John S. Parrish

A health care facility must develop a comprehensive disaster plan that has a provision for critical care services. Mass critical care requires surge capacity: augmentation of critical care services during a disaster. Surge capacity involves staff, supplies, space, and structure. Measures to increase critical care staff include recalling essential personnel, using noncritical care staff, and emergency credentialing of volunteers. Having an adequate supply chain and a cache of critical care supplies is essential. Virtual critical care or telecritical care can augment critical care capacity by assisting with patient monitoring, specialized consultation, and in pandemics reduces staff exposure.

Triage **575**

Michael D. Christian

This review provides an overview of triaging critically ill or injured patients during mass casualty incidents due to events such as disasters, pandemics, or terrorist incidents. Questions clinicians commonly have, including "what is triage?," "when to triage?," "what are the types of disaster

triage?," "how to triage?," "what are the ethics of triage?," "how to govern triage?," and "what research is required on triage?," are addressed.

Natural Disasters **591**

Jorge Hidalgo and Amado Alejandro Baez

Natural disasters are extreme events generally caused by abrupt climate change and other environmental factors. Intensive care units (ICUs) need to be prepared, because in the event of a natural disaster, the number of patients that require service stresses an already occupied facility. It is critical that personnel be able to do a proper ICU triage. Efforts have been made to prepare the health care system to be ready for a disaster. A natural disaster can disrupt the daily routine of a hospital and ICU personal need to be equipped with the necessary tools to be able to respond appropriately.

Intensive Care Unit Preparedness During Pandemics and Other Biological Threats **609**

Ryan C. Maves, Christina M. Jamros, and Alfred G. Smith

In the twenty-first century, severe acute respiratory syndrome (SARS), 2009 A(H1N1) influenza, and Ebola have all placed strains on critical care systems. In addition to the increased patient needs common to many disasters, epidemics may further degrade ICU capability when staff members fall ill, including in the course of direct patient care. In a large-scale pandemic, shortages of equipment and medications can further limit an ICU's ability to provide the normal standard of care. Hospital preparedness for epidemics must include strategies to maintain staff safety, secure adequate supplies, and have plans for triage and prioritization of care when necessary.

Disasters Resulting from Radiologic and Nuclear Events **619**

John S. Parrish and Gilbert Seda

Radiation accidents are rare, but can produce large numbers of casualties with predictable patterns of injury. Casualties may suffer from a wide range of radiation exposures. Triage based on presence or absence of conventional injuries and an accurate assessment of radiation dose based on event history, symptoms, and laboratory testing, is critical. Treatment of acute radiation syndrome is supportive: including fluids, antibiotics, blood products, colony-stimulating factors, and stem cell or bone marrow transplantation. Care of radiation-injured patients with conventional trauma or burns needs to be modified to account for adverse effects of radiation on wound healing and susceptibility to infections.

Chemical Agents in Disaster: Care and Management in the Intensive Care Unit **633**

Rashmi Mishra and James Geiling

Chemical agents of warfare are divided into lung agents, blood agents, vesicants, and nerve agents. Intensivists must familiarize themselves with the clinical presentation and management principles in the event of a chemical attack. Key principles in management include aggressive supportive care and early administration of specific antidotes, if available. Management includes proper personal protection for critical care

providers. Patients may make complete recovery with aggressive supportive care, even if they appear to have a poor prognosis. Hospitals must have an emergency response disaster plan in place to deal with all potential causes of disasters, including illnesses resulting from chemical agents.

Anthropogenic Disasters **647**

Michael Powers, Michael James Ellett Monson, Frederic S. Zimmerman, Sharon Einav, and David J. Dries

Anthropogenic disasters may be defined as any disaster caused by human action or inaction. Natural disasters occur without human interference. Injuries caused by terrorists and related criminal activities may be broadly grouped into 3 categories: blunt, blast, and penetrating trauma. Most terrorist and criminal activities that create a mass-casualty situation are performed using the weapons most readily available, such as firearms or explosives. A consistent pattern, comparing terrorism with interpersonal violence, is the greater severity of impact on the victim.

Provision of Care for Critically Ill Children in Disasters **659**

Mitchell Hamele, Ramon E. Gist, and Niranjan Kissoon

Children are affected by all types of disasters disproportionately compared with adults. Despite this, planning and readiness to care for children in disasters is suboptimal locally, nationally, and internationally. These planning gaps increase the likelihood that a disaster will have a greater negative impact on children when compared with adults. New voluntary regional coalitions have been developed to fill this gap. Some are pediatric focused or have pediatrics well integrated into the greater coalition. This article discusses key points of pediatric disaster planning, specific vulnerabilities, and the care of children in general and in specific disaster situations.

Special Populations: Disaster Care Considerations in Chronically Ill, Pregnant, and Morbidly Obese Patients **677**

Timothy M. Dempsey, Stephanie C. Lapinsky, Eric Melnychuk, Stephen E. Lapinsky, Mary Jane Reed, and Alexander S. Niven

Special populations, which include the morbidly obese and patients with chronic, complex medical conditions that require long-term health care services and infrastructure, are at increased risk for morbidity and mortality when these services are disrupted during a disaster. Past experiences have identified significant challenges in restoring necessary care services to these patients following major environmental events. This article describes the impact of disasters on special populations, provides a framework for future disaster preparation and planning, and identifies areas in need of further research. Gravid patients, who are often overlooked in disaster planning and preparation, are also discussed.

Principles and Practices of Establishing a Hospital-Based Ebola Treatment Unit **697**

Peter Kiiza, Neill K.J. Adhikari, Sarah Mullin, Koren Teo, and Robert A. Fowler

Outbreaks of Ebola virus disease and high-risk transmissible infections are increasing and pose threats to health care workers and global health

systems. Previous outbreaks offer lessons for health system preparedness and response, including establishment of hospital-based high-risk pathogen treatment units. Their creation demands early preparation and interprofessional coordination; infection prevention and control; case management training; prepositioning of supplies; conversion of existing structures to treatment units; and strengthening communication and research platforms. Hospital-based Ebola and high-risk pathogen treatment units may improve case detection, interrupt transmission, and improve staff safety and patient care.

Battling Superstorm Sandy at Lenox Hill Hospital: When the Hospital Is Ground Zero **711**

Maciej Walczyszyn, Shalin Patel, Maly Oron, and Bushra Mina

In preparation for Superstorm Sandy, the emergency control center at Lenox Hill Hospital (LHH) was activated. Patients were evacuated safely to increase hospital capacity, including increased critical care beds, hospital equipment and supplies, including ventilators. A triage center was established in the emergency department at LHH. Efforts were coordinated between LHH and New York University (NYU) Langone Medical Center. NYU medical staff was granted Disaster Emergency privileges, credentialed at LHH, and oriented to LHH. NYU residents and fellows were added by the Office of Graduate Medical Education.

Disaster Ethics: Shifting Priorities in an Unstable and Dangerous Environment **717**

Valerie Bridget Satkoske, David A. Kappel, and Michael A. DeVita

Emergency and critical care medicine are fraught with ethically challenging decision making for clinicians, patients, and families. Time and resource constraints, decisional-impaired patients, and emotionally overwhelmed family members make obtaining informed consent, discussing withholding or withdrawing of life-sustaining treatments, and respecting patient values and preferences difficult. When illness or trauma is secondary to disaster, ethical considerations increase and change based on number of casualties, type of disaster, and anticipated life cycle of the crisis. This article considers the ethical issues that arise when health providers are confronted with the challenges of caring for victims of disaster.