CHAPTER 155

Mass Casualty Incidents: Organizational and Triage Management Issues

JAMES A. GEILING and FREDERICK M. BURKLE JR.

INTRODUCTION

Mass casualty incidents (MCIs) are characterized by such high numbers, severity, and diversity of injuries and illnesses that they can overwhelm the ability of local medical resources to deliver comprehensive, definitive medical care to all victims (1). Recent experience with large-scale natural disasters, bombings, threats of weapons of mass destruction, and pandemics suggest that modern-day mass casualty events would compromise the ability of health systems to deliver services consistent with established standards of care while rapidly overwhelming both the medical and public health systems. Yet no one recent event revealed the dangers and opportunities posed by potential MCIs more than the severe acute respiratory syndrome (SARS) pandemic that spread from rural China to 40 countries in 10 days (2,3). SARS exposed severe international political and legal impediments that not only prevented an effective and efficient local-to-international response but also contributed to the transmission of the disease. Only when emergency actions by the World Health Assembly gave the World Health Organization (WHO) unprecedented authority to overcome national sovereignty restrictions in favor of international protection was the pandemic controlled (4,5). Though the mass critical care of Ebola virus disease patients in the West Africa outbreak of 2014–2015 captured the world’s attention, the impact on global critical care was limited and isolated, and except for specified Ebola virus disease-receiving centers which focused on preparation, training, and supportive treatment (6–8). Clearly, what happens locally, as a potential global threat, has immediate international implications. Over a prolonged period of time, local capability and capacity to optimize health services, including critical care, requires unprecedented collaboration, communication, and cooperation of state, national, and international resources (2).

Victims in the developed world are not prepared for the sudden challenges posed by an MCI that limits resources. Nowhere is this more evident than in countries that can provide highly advanced and technologically dependent medical, surgical, monitoring and care to critically ill victims. Arguably, critical care is the most expensive high technology and resource-intensive area of medical care, and the pressure to respond in like-minded fashion to any MCI with unlimited resources is immense (9). MCIs, in particular, the 1995 Tokyo Subway sarin attack, the 2001 anthrax letter attacks, and the 2003 SARS outbreaks, have transformed the requirements for health care facilities (HCFs), and in the process, made the critical care community more aware of how devastating are the potential expectations and risks of their roles and responsibilities. The greatest challenge for HCFs, already overwhelmed on a daily basis with high acuity, declining bed capacity, and health care worker (HCW) shortages, will be the sudden presentation of large numbers of severely critical victims (10). HCFs are expected to increase their capacity (staffing, equipment, and prioritization of care) by 110% to 120% to cope with a major MCI (11). Depending on the cause of the MCI, the patient mix may range from primarily “walking wounded” or those with minimal illnesses (e.g., influenza pandemic), to the vast majority of those requiring hospital admission for critical care (e.g., inhalational plague, anthrax, mutational avian influenza). Novel, highly virulent diseases such as Ebola virus disease can similarly have a negative impact on critical care capacity and capabilities due to the medical training and logistical demands these patients require (12,13).

Research in the area of organization science challenges communities to continuously maintain effective, high-quality, and competent working conditions despite disasters that “fluctuate widely and are extremely hazardous and unpredictable” (14). New organizational systems that achieve flexibility and a degree of reliability under turbulent conditions have in common: standardization, specialization, formalization, and hierarchical authority. One community level system is the National Incident Management System (NIMS) and its Incident Command System (ICS), designed and used by many public safety professions. The NIMS has shown consistent capacity and reliability in conventional disaster conditions along with the ability to structure and restructure on a moment-to-moment basis to respond to unforeseen complications provoked by large, complex, and dynamic emergencies and disasters (14). This chapter will focus first on the description of established disaster management schemes under the NIMS that address the integration of multidisciplinary local, national, regional, and international assets required for effective management of MCIs, including issues of critical care decision making and communications. Knowledge of these schemes will allow the critical care community to be a more effective player at the emergency response table (10). Second, this chapter will address critical care decision making, capacity surge, and triage management of limited resources (2,15).

ORGANIZATION FOR MASS CASUALTY MANAGEMENT

The coordinated response to large-scale disasters by local communities, regions, nation-states, and international organizations...
such as the WHO is no longer an ad hoc process derived from local disaster plans. Disasters are typically divided into four phases (mitigation, preparedness, response, and recovery) with specific activities occurring during each phase (16). The medical and public health planning requirements that support critical care will first occur at a local level and within HCFs responsible for those services (10). As the planning process evolves and the MCI escalates, it is necessary to integrate activities at regional, state, national, and even international levels. At regional and national levels, governmental jurisdictions have adopted NIMS for achieving unified intra-agency and interagency management during operations for any large-scale and MCI disaster. The NIMS goal is to ensure that there is a comprehensive national framework to support efficient and effective incident management regardless of size, nature, or complexity of the incident (Fig. 155.1) (17,18). However, health care and public health must still work to standardize their terminology for resources (people, equipment, etc.).

Within this NIMS scheme is the ICS, the Unified Command System (UCS), and the Emergency Operations Center (EOC) concept that facilitates policy and operational processes at the local level. To ensure that ongoing services remain a viable and credible option when practice and resources are constrained, critical care services must understand the larger system in which they will need to work. HCWs will be required to make uncomfortable, but real, decisions that are often population based and are not part of their daily routine. Understanding the system and operational language in which management of an MCI occurs is a first step in the process of providing the capabilities to care for large numbers of critically ill victims (17–21).

Incident Command System

Traditionally, disaster management has involved integration of local fire, police, and emergency medical services (EMS). However, modern responses to MCIs involve services from many different agencies and organizations including public health. The more complex the disaster, the more agencies will participate, requiring unprecedented coordination, collaboration, and cooperation to ensure operational success. In the 1970s, the ICS was created to provide a common organizational structure and language to coordinate and simplify communication and establish clear lines of authority. For more than 30 years, disaster management resources in North America, the United Kingdom, and parts of New Zealand and Australia have continued to use the ICS as the accepted standard for all disaster response (17,18,21,22).

The ICS is organizationally flexible to meet the needs of disasters of any kind and size, yet is based upon consistent and common features seen in all disasters. The ICS structure is based on common functional requirements, not titles (Fig. 155.1). The basic organizational structure of ICS has five major functional management activities (17,20).

1. The Incident Commander maintains overall responsibility for disaster response and the Incident Action Plan (IAP).
2. The Operations Section is responsible for the following.
   a. Directing and coordinating all operations.
   b. Ensuring the safety of Operations Section personnel.

![Figure 155.1 National Incident Management System: policy level and operations level.](image-url)
c. Assisting the Incident Commander in developing response goals and objectives.
d. Implementing the IAP.
3. The Planning Section is responsible for the following.
   a. Collection, evaluation, dissemination, and use of information about the development of the incident and status of resources.
b. Creation of the IAP, which develops action plans and collects/evaluates information.
4. The Logistics Section is responsible for the following.
   a. Provision of facilities, services, and materials for the incident, including essential personnel to meet incident needs.
b. Long-term or extended operations (i.e., the Medical Unit in the Logistics Section provides care for the incident responders, not civilian victims).
5. The Finance and Administration Section is responsible for monitoring costs and overseeing human resource activities (e.g., overtime, employee health and safety).

Under the ICS, only those management sections and positions that are needed are activated, but the responsibilities for each function falls to the Incident Commander if the section is not activated. Any ICS sections or positions may be opened, closed, expanded, or contracted depending on need. To ensure universality and transparency, the common position titles remain no matter how large or small the ICS structure (20,21). Briggs (19) emphasizes that the structural basis for ICS continuity is found in familiar basic and public health terminology. As well, use of ICS provides the structure to address the many disparate concerns and public health consequences of MCIs (Table 155.1).

Unified Command System

The ICS structure is modular and generic (17–22). For disasters of a minor nature, all functional elements may not be used. However, when a new service enters the ICS (which is common as the MCI escalates, intensifies, and becomes more complex), a UCS is formed (see Fig. 155.1). The Unified Command guarantees a single command structure when there is overlap of jurisdictional (e.g., county, state, national) or functional responsibilities (agencies with different or competing legal, geographic, and functional responsibilities that need to work together). In the case of a hospital scenario, Unified Command would dictate that different hospital departments must work in cooperation, often with community fire, police, and other agencies, to develop a common goal for responding to the MCI. This is referred to as the IAP, and determines the allocation of scarce resources and assistance under a common, unified goal. This is illustrated in a pandemic when coordination among local, national, regional, and international organizations is critical to managing rapidly constrained resources while preventing secondary infections by impeding transmission of disease across geographic boundaries.

Emergency Operations Centers

Mignone and Davidson define the EOC as a “location from which personnel representing various organizations, both public and private, come together during an emergency or disaster event to: (a) coordinate response and recovery actions; (b) conduct strategic decision-making; and (c) manage resource allocation” (23). The EOC is the location where the Emergency Control Group (ECG) meets to manage the “big picture” decisions of community-wide resources and response (see Fig. 155.1) (20–22). Whereas the Incident Commander runs the incident, the EOC/ECG ensures organizational continuity through such activities as:
   a. Requesting mutual aid resources
   b. Locating requested resources and directing them to the ICS staging area
   c. Managing a wide-scale evacuation
   d. Establishing shelters and coordinating social services
   e. Coordinating messages with the ICS Information Officer
   f. Transmitting information over the Emergency Alert System (EAS)
   g. Resolving policy issues

In any large urban area, EOCs may exist in every organization, agency, and hospital, and are generally institution specific (24). In public health emergencies, such as pandemics where the incident is ubiquitous rather than geographically defined, the lead agency EOC may, in effect, be that of the jurisdictional Department of Health that expands as needed with ethicists, legal consultants, and specialists in infectious disease, critical care, and other areas. In this setting, health care providers used to individual-based care must make an operational shift to population-based triage management including the necessity for a health-inclusive EOC (2,15).

Hospital Incident Command System

For many hospitals in the United States, the Hospital Incident Command System (HICS) has become the adaptation of ICS to hospital emergency functions (25,26). The HICS uses a similar ICS management structure that incorporates defined responsibilities, clear reporting channels, and common nomenclature. The HICS identifies positions designed to facilitate expanding or contracting requirements as needs dictate, such as the demand for multidisciplinary medical specialists to support existing critical care assets. Both the ICS and the HICS have been modified based on emerging needs such as adding expert advice in chemical, biologic, radiologic, and nuclear (CBRN) emergencies, critical care, more robust
mental health consultation, mass fatality and expectant triage category experts, and leadership to coordinate the massive requirements for information technology services and systems (26). Representatives from other hospital HICS may be called on to serve as ICS consultants to provide expertise and collaborative sharing of scarce resources (24).

THE INCIDENT COMMAND SYSTEM AND CRITICAL CARE

The ICS methodology addresses the inherent inability of disaster managers to adjust their agencies, organizations, or services to shifting situational demands, nonstandard terminology, and communications procedures among responding agencies (16,18). To have a voice in MCI decision making and resource allocation, the responding critical care community must have a clear understanding of the ICS. This includes the ability to optimize available critical care resources and ensure that requested requirements are both realistic and well understood within the framework of ICS policies and structure.

Management decisions require a strong and coordinated public health workforce and leadership to ensure a smooth integration of multidisciplinary assets. No one agency, organization, or authority possesses the total expertise and resources to address and manage all population-based requirements (2,15). The ICS addresses the problems of adjusting through action planning protocols and guidelines that include requirements for critical care resource allocation and surge capacity. Specific Job Action Sheets for each ICS position, which should be written before any disasters, large or small, describe the specific duties of each team member from the ICS to the EOC, and indicate steps to be taken throughout the stages of the MCI (20).

In an illness-dominated MCI, such as a pandemic, the central jurisdictional EOC becomes the operations center providing a decision-making hub (2,15,27,28) for the following:

- Broad evidence-based situational awareness of the MCI
- Local linkages for regional resources
- Ongoing development and maintenance of strategic alliances with local to international agencies and organizations
- Facilitation and integration of resources
- Communication and health information system content and management
- Just-in-time training of volunteers to meet surge capacity requirements
- Development of community-wide triage protocols and the analysis of triage-related outcomes of resources and strategic decision making under surge capacity requirements

This strategic triage decision-making function within the EOC is critical in establishing lines of authority to eliminate competition for resources among providers and health facilities (15). To optimize outcomes, the EOC, or its equivalent at higher levels, must possess a timely and accurate evidence-based situational awareness capacity to coordinate changing triage management decisions which are immediately passed on to hospitals, ambulatory HCFs, and other public and private agencies and organizations with health care responsibilities (2). Situational awareness includes data regarding both present and future forecasted system demands and resource availability. Daily outcome data analyses seed the situational awareness information and allow the EOC to maintain an overall status of the MCI’s impact on the population base and redirect resources where needed. Analysis of outcome data and subsequent revision of triage protocols based on this information is necessary to prevent either over- or undertriage, both of which decrease overall survival (2,15,29).

CRITICAL CARE MANAGEMENT: SURGE CAPACITY

Disasters and MCIs resulting in large numbers of casualties may overwhelm health care systems. Using the rubric of “stuff, staff, and space,” facilities and organizations can surge their capabilities beyond those of daily emergencies. The type and pace of the event—such as a sudden-impact conventional explosion versus a slowly evolving pandemic—will significantly determine the impact on the ICU (30,31).

Mechanical Ventilation

Since the SARS epidemic of 2002–2003, and the threat of an influenza pandemic, specific attention has been focused on how to plan for and implement a large-scale bioevent approach that requires triage management of large numbers of survivable and nonsurvivable respiratory failure cases where evacuation is not an option (32). The demand for positive pressure ventilation will likely far exceed conventional ICU capabilities, and without careful predisaster planning, hundreds or thousands of victims may have to forgo potentially life-saving critical care. Whereas most of these MCIs will likely occur in chemical inhalation disasters, radiation exposures, and tsunamis causing aspiration pneumonia and septic shock, it is bioevent public health emergencies that many believe have the greatest likelihood of causing mass respiratory failure.

Thousands of ventilators will be required for a mass illness response event such as an influenza pandemic. To support such a disaster, the number of full-feature ventilators currently available for use in the United States approximates 62,000, with another 83,000 less sophisticated ventilators also available (33). The US Centers for Disease Control’s Strategic National Stockpile (SNS) maintains an unpublished number of ventilators for deployment to disaster areas.

The stockpiling of full-feature ventilators by hospitals, hospital systems, or states is cost-prohibitive according to Rubinson et al. (34,35), suggesting that the stockpiling of portable ventilators, which provide only a basic mode of ventilation and are easy and safe to use for both adult and pediatric patients is the right thing to do, especially if large numbers of patients are monitored by single respiratory providers or small teams that may include health care providers with EOC-directed just-in-time training. Because pulse oximetry devices may also be in short supply, this training would also include frequent checking of vital signs with attention to respiratory rate and use of accessory muscles (32).

Medical Oxygen

Patient management will be limited by the availability of medical-grade oxygen, which is not supplied through the Strategic National Stockpile (32). Bulk liquid is the main source
Personnel

Workforce shortages, where staffing is a critical triage issue for most hospitals, are already prevalent on a daily basis, and 12% of ICUs have been forced to close beds due to nursing shortages (32). Critical shortages also exist in trained respiratory care specialists, pharmacists, and physicians. This will be the major barrier to the provision of critical care should an MCI occur. A two-tiered staffing model, using the care team approach, calls for non–critical-care trained personnel to work collaboratively with specialized health care professionals (28). This model is also supported by the Society of Critical Care Medicine’s Fundamental Disaster Management course, which imparts core critical care knowledge and skills to non–critical-care, hospital-based personnel. For example, teams of dentists, a profession comfortable with the airway and who, in the past, have been trained by the military to be anesthetists during all-out war, can be trained in intubation and manual ventilation while being supervised by a respiratory therapist who assumes the role of team respiratory supervisor.

Infection Control

The goal of all care management in a large-scale bioevent is to prevent secondary infections (2,15). The risk of secondary infections may be higher in the critical care setting in part due to the number of interventions (e.g., endotracheal intubation, suctioning, manual ventilation) causing aerosolization of infectious material (36,37). Studies support the efficacy of personal protective equipment (PPE). Unfortunately, compliance among health care providers is low, ranging between 56% and 67%. Thus, infection control is a key component of any MCI involving an infectious bioagent. As mentioned earlier, the SARS pandemic showed that HCWs and patients in the critical care environment are particularly vulnerable to nosocomial transmission of infectious agents, due to invasive procedures such as intubation, suctioning, and central line insertion (36–39). This highlights the need for infection control to be incorporated into all disaster planning (40). The basic approach to infection control in critical care units should utilize administrative controls, environmental engineering, protective equipment, and quality control (36). The primary goal is to prevent transmission of infection to HCWs and other patients. Cohorting of patients based upon likelihood of infection is an important first step in containing the spread of illness, and is facilitated through use of the SEIRV protocol discussed in the Triage section below.

During a biologic disaster involving an infectious agent, separate ICUs should be developed to deal with infectious and noninfectious patients. For example, a hospital with a single medical-surgical ICU and a coronary care unit (CCU) could designate its medical-surgical ICU as the infectious ICU, and then use its postanesthetic care unit (PACU) to manage noninfectious surgical patients and the CCU for all noninfectious medical patients requiring critical care. When planning alternative critical care locations during a surge, infection control issues must also be considered. One option includes the use of portable high-efficiency particulate air (HEPA) filters to create negative pressure units (41). As discussed earlier, some procedures in the ICU require higher levels of personal protection, given they have the potential to generate aerosols, thus increasing the risk of airborne transmission even for infectious agents that would otherwise typically be transmitted only via droplets. Additional precautions, and possibly the use of special procedure rooms, should be considered for high-risk procedures. A full discussion of infection control practices in critical care is beyond the scope of this chapter, and interested readers should refer to comprehensive articles discussing the transmission of respiratory pathogens (42,43).

A common theme that has been revisited throughout this chapter is the need for real-time data to guide decision making and responses. This is also true for infection control, as was demonstrated during the Ebola virus disease events of 2014–2015 (44) as well as the SARS epidemic. In Toronto, we learned that during a biologic disaster, even more important than the initiation of the response, was the transition from response to recovery. Simply put, how to detect and respond to an outbreak was well understood, but how to end an outbreak was not. The failure to detect an ongoing chain of SARS transmission in a hospital led to a second large wave of infections and deaths after infection control precautions were discontinued. Appropriate surveillance data could have detected and prevented this second wave of illness (45,46).

Critical Care Beds

Guidelines suggest that 20% of general hospital beds are available within 24 hours during conventional disasters, and a several-fold increase can be realized if acute care patients are admitted preferentially (32). Theoretically, if personnel and equipment are available, most of a general hospital can be modified to deliver critical care services. This may require repurposing PACUs, endoscopy suites, and other monitored bed settings. Further capability may arise with expeditious discharge of low acuity patients to home, skilled nursing facility, or even alternate care setting established in the community. This increased availability of normal hospital beds, therefore, will allow movement of “step-down” patients from much needed critical care settings to normal wards (30).

Triage

International law requires an equitable, fair, and transparent triage process that provides the best opportunity for survival to as many victims as possible (2,15,47–50). All patients will be cared for, every human life must be valued, and every human being deserves respect, caring, and compassion (50). When requirements exceed capacity, hospitals and ICUs must surge their capabilities in order to meet demand. As the imbalance progresses, standards of care necessarily change. Hick et al. (51) suggest three categories of capability, depending on capacity:

Conventional capacity: Normal, daily clinical care practices exist.

Contingency capacity: While normal practices must alter, they have minimal impact on usual patient care practices.

Crisis capacity: Normal practices are not feasible but provide “sufficiency” of care given the disaster setting.
Further limits to practices in crisis capacity imply some patients may go without normal care, that is, care becomes triaged. Triage does not guarantee survival, only the best opportunity to survive within the constraints of the available resources (15). In an MCI, especially where there is a scarcity of resources, priority shifts to population-based care. Decision criteria requires that those selected to receive the limited resources must have a likelihood of medical success, yet the selection must not impede the conservation of scarce resources for those equally in need (52). In an MCI, both individual care and population requirements impact each and every triage decision.

**Conventional Mass Casualty Incident Triage**

The vast majority of MCIs involve patients with traumatic injuries, most of whom are not critically injured. These MCIs do not generate large numbers of casualties with respiratory failure, septic shock, or coma, and those that do present usually receive rescue, transportation, stabilization, and definitive critical care using existing local or regional capabilities (32,53–55). The National Disaster Medical System (NDMS) designates the simple triage and rapid treatment (START) as the uniform method for initial field triage in conventional MCIs and disasters (56). START evaluates respiratory, circulatory, and neurologic function and provides four care categories (unsalvageable or dead, major injury, minor injury, and walking wounded). Field emergency care is restricted to the ABCs (airway, breathing, and circulation procedures) (56). A second-phase triage process, termed secondary assessment of victim end point (SAVE), further assesses injuries on the basis of trauma survival statistics to direct limited resources, triage tags, and tracking to victims expected to derive the most benefit from treatment (57). Both methodologies remain the basis for point-of-care (i.e., prehospital or the emergency department) initial evaluation for all-hazards disaster planning documents, and in basic and advanced disaster life-support training aimed primarily at managing traumatic MCIs (2,56).

Restrictive resource limitations and a worsening case definition in a conventional MCI, or an explosive or nuclear event, may require further EOC triage decisions based on inclusion and exclusion criteria and minimal qualifications for survival (MQS) (2,15,58–60).

1. **Inclusion criteria** are the expected management standards that health care providers are trained to meet based on a resource-complete environment. Examples of inclusion criteria are the universally accepted standards for the use of resources for resuscitation and management that are traditionally found in courses for advanced cardiac, trauma, and pediatric life support.

2. **Exclusion criteria** conversely refer to situations where expected resources are limited or lacking and care must proceed without all standards of care and equipment being met.

3. **Minimum qualifications for survival** represents a ceiling on the amount of resource expenditures that will be allocated to any one case, ensuring that maximum benefit of available resources is realized to ensure a population-based best opportunity for survival. Examples are the EOC determining that resource limitations would dictate that high resource maintenance cardiac or respiratory arrest interventions might be limited, as would restrictions on transfusions for traumatic injuries, or in the implementation of criteria protocols for ventilator use in those with a low likelihood of survival. Each MQS diagnosis is subject to change on arrival of surge capacity resources.

The operational level EOC must balance available resources against the best opportunity to survive. The impact of this triage management practice and decisions may not be fully known until the end of the MCI when outcome analyses are performed.

**Bioevent Triage Management**

Bioevents include both naturally occurring and the deliberate release of a biologic agent in a population resulting in a mass illness incident (epidemic or pandemic). Whereas these bioevents have similarities with other MCIs, there are also major differences, especially in the approach to triage management of surge capacity resources (2). Bioevents are characterized by massive numbers of individuals seeking health care (2). Unique to the planning for bioevents is that only 40% to 50% of health care providers are expected to respond or be available, in contrast to conventional MCIs where HCFs are often inundated with health care volunteers (61). A population-based approach requires a shift from the individual care role of clinicians to a population-based decision-making approach of patients. This does not minimize the importance of clinical tasks, but rather adds the dimension of new public health and surge capacity interventions that improve access and availability of limited health resources for the entire population. Individuals within a population experiencing a bioevent share the following (2,62).

- Most have either the same condition or are susceptible to it.
- All have shared health care needs.
- Everyone in the population requires some intervention, which ranges from education to critical care.
- Large-scale bioevents may require a sustained operational response, lasting 12 to 24 months.
- Especially with long-term bioevents, operational continuity of the health care system to manage medical issues other than those related to the involved biologic agent must remain a focus.

Severity, as indicated by rising case fatality rates, occurs dramatically as disease transmission increases and resources become limited. What at first appears to be a static, well-controlled local event can quickly become a regional, national, or international disaster of paralytic proportions (2,15,63).

The central jurisdictional EOC will determine surge capacity requirements for 5 population categories: those susceptible but not exposed (Susceptible category), those exposed but not yet infectious (Exposed category), the infectious (Infectious category), those removed by death or recovery (Removed category), and those protected by vaccination or prophylactic medication (Vaccinated category), termed the SEIRV methodology (2,64,65). The unique requirements and demands of each triage category may mandate that professionals with specific category expertise be assigned to the medical component of the ICS or centralized EOC (26). In turn, the EOC:

- Determines surge capacity requirements for each SEIRV category
- Determines triage criteria, including MQS and exclusion criteria
Consistently between nations, or even clinical settings within a country (69). A partial list of resources commonly triaged includes the following:

- Vaccines
- Protective masks and equipment
- Acute care/ICU beds
- Laboratory support
- Nursing staff
- Housekeeping staff
- Trained volunteers

Critical Care Triage

Normally critical care is offered only to those whose condition is potentially reversible and who have a good chance of surviving with intensive care support (70–72). Since the critically ill are often near death, the outcome of this intervention is difficult, if not impossible, to predict. Many patients still die in the ICU. A prime requisite for admission is that the underlying condition is reversible. Therefore, treatment is merely meant to support the patient, during which time treatments or the natural history of the acute affliction will lead to resolution. Robinson and Toole suggest that a major challenge of MCIs is “to determine when, and on what basis, traditional standards of critical care are modified to accommodate emergency conditions, and when modified standards to focus on key interventions” (73). This model of care is referred to as mass critical care (34). In an MCI, mass critical care is implemented when usual surge protocols such as canceling elective surgery, discharging or transferring patients as soon as possible, and opening up alternative care areas will be insufficient to meet the demands placed on the health care system. Coordination of affected hospitals to facilitate implementation of similar measures in triage management is required (2,73). Furthermore, Farmer and Carlton suggest that shortfalls in critical care that will impact services are as follows (74):

- Insufficient coordination between hospitals and civil/government response agencies (e.g., the NIMS/ICS)
- Insufficient on-site critical care capability
- A lack of portability of acute care processes (e.g., patient transport)
- Education and training shortfalls
- The inability of hospitals to align disaster requirements with other competing priorities

Mechanical ventilator availability most likely serves as the limiting critical care capability in an overwhelm MCI, especially a bioevent. Hick and O’Laughlin (75) provide an operational model for the development of triage criteria for restriction of mechanical ventilation in these situations. Christian et al. (76) and Melnychuk and Kenny (77) provide an expanded critical care pandemic triage protocol for assessment of admission to critical care units during an influenza pandemic. This triage protocol uses the Sequential Organ Failure Assessment score (SOFA), and specifically addresses the importance of a centrally placed province or state EOC-level triage committee to implement critical inclusion, exclusion, and MQS criteria. Also stressed is the central jurisdictional EOC’s “absolute command and control over critical care resources in order to ensure accountability” (76). The EOC must support the critical care triage issues by authoritatively implementing the protocols in all hospitals when appropriate, and then monitoring its effectiveness through maintaining and
analyzing outcome indicators. Both studies emphasize ethical principles and potential pitfalls of their approaches (75,76). Triage for critical care begins in the prehospital setting and extends to the emergency department. Given the complexity of triage for critical care, this coordinated triage process should be performed under the guidance of a trained critical care triage officer and/or critical care leadership of a multidisciplinary triage team. Knowing that many victims will require a critical care admission, a critical care triage officer may be called upon to join the emergency department triage officer or team at the entry site to implement the best means to supply crucial services, whether they be in existing critical care units, in resource expanded ward settings, or at another health care facility, thereby necessitate a transfer. The team approach may prove more efficient and effective, given the many resource variables come into play during the triage decision-making process; no one professional will possibly know the full impact of or what other innovative opportunities for survival are available within the larger response system. These triage decisions are thus only as accurate as the knowledge concerning what is operationally current and the resources available in each triage category. Ultimately, each triage level decision will have a direct effect on clinical decisions at the critical care level (2).

Since the recommended use of SOFA scores in critical care triage was published, its predictability across populations has varied and thus it remains an untested, unvalidated prognostic score. With this caveat, Christian et al. (78) focused recent recommendations on considering thresholds for providing care and resources. As well, implementation requires a defined set of pre-event protocol development and team-based employment during the event.

SUMMARY

Mass critical care requires surging of capability and potentially modification to standards of critical care interventions, personnel staffing, equipment, and triage management to provide an acceptable level of care. At a minimum, hospitals must plan to deliver to critically ill patients a basic mode of the following.

- Mechanical ventilation
- Hemodynamic support
- Antibiotic or other disease-specific countermeasure therapy (i.e., thrombolysis in myocardial infarctions)
- A small set of prophylactic interventions that are recognized to reduce the serious adverse consequences of critical illness

Clearly, the management of an MCI is best undertaken by strengthening local capacity. All intensivists should take the Society for Critical Care Medicine’s Fundamental Disaster Management course, or a similar program. Critical care professionals must raise public awareness, advocate for better education and training, and take the lead in planning and preparing to care for large numbers of critically ill patients that far exceed available ICU beds. This must include issues of health care rationing and the decision process on who will receive mechanical ventilation and other life-saving treatments. As a first step, one need understand the organizational system that drives the policy and operational components of triage management. Only then will the critical care community be able to optimize resource allocation, establish legitimate triage protocols and criteria, and ensure a process that provides the greatest good for the greatest number.

Key Points

- MCI and triage management of critical care patients require unprecedented collaboration, communication, and cooperation of state, national, and international resources.
- HCFs are expected to increase their capacity (staffing, equipment, prioritization of care) by 110% to 120% at a minimum.
- The NIMS and its components (ICS, or HICS for hospitals, Unified Command, and EOC) provide consistent capacity building to best respond to unforeseen complications and demands provoked by MCIs.
- Surge capacity for critical care management will require a focused evaluation of mechanical ventilation, medical oxygen, personnel availability and training, infection control, and critical care beds.
- Critical care triage protocols use population-based data, require elimination of resource competition, and necessitate evidence-based situational awareness and coordination of current capacity.
- Critical care triage currently entails protocols that include inclusion criteria, exclusion criteria, and minimum qualifications for survival, but do not to date have a fully tested and validated prognostic score.
- Critical care triage is compelling and demanding, requiring multidisciplinary management input to decision making to ensure that all victims have the best opportunity for survival.

References