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Asha Devereaux, Michael D. Christian, Jeffrey R. Dichter, James A. Geiling and Lewis Rubinson

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CHEST Supplement

DEFINITIVE CARE FOR THE CRITICALLY ILL DURING A DISASTER

Summary of Suggestions From the Task Force for Mass Critical Care Summit, January 26–27, 2007*

Asha Devereaux, MD; Michael D. Christian, MD, FRCPC; Jeffrey R. Dichter, MD; James A. Geiling, MD, FCCP; Lewis Rubinson, MD, PhD†

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Key words: alternate standards of care; critical care; critical care assessment teams; disaster critical care; disaster medicine; disaster triage; ethics; health-care worker and disaster; mass casualty; mass casualty critical care; mass casualty respiratory failure; triage; triage teams; mass critical care; psychological impact of disaster

Abbreviation: EMCC = emergency mass critical care

Executive Summary

This Supplement on the management of mass critical care for ill patients represents the consensus opinion of a multidisciplinary panel convened under the umbrella of the Critical Care Collaborative Initiative. Expert recommendations on this subject are needed. Most countries have insufficient critical care staff, medical equipment, and ICU space to provide timely, usual critical care to a surge of critically ill victims. If a mass casualty critical care event were to occur tomorrow, many people with clinical conditions that are survivable under usual health-care system conditions may have to forgo life-sustaining interventions owing to deficiencies in supply or staffing. As a result, US and Canadian authorities[1,2] have called for the development of comprehensive plans for managing mass casualty events, particularly for the provision of critical care. This Supplement includes the following: (1) a review of current US and Canadian baseline critical care preparedness and response capabilities and limitations, (2) a suggested framework for critical care surge capacity, (3) suggestions for minimum resources ICUs will need for mass critical care, and (4) a suggested framework for allocation of scarce critical care resources when critical care surge capacity remains insufficient to meet need. This Supplement is intended to aid clinicians and disaster planners in providing a coordinated and uniform response to mass critical care.

Mass casualty events occur frequently worldwide.[3] Fortunately, the vast majority of these do not generate overwhelming numbers of critically ill victims. Attention to mass critical care, however, has been stimulated by the severe acute respiratory syndrome epidemic of 2002–2003,[4,5] recent natural disasters, concern for intentional catastrophes, and the looming threat of a serious influenza pandemic.[1,6–11] To guide preparedness for such events, the Task Force for Mass Critical Care (hereafter referred to as the *Task Force*) was convened. It comprised 37 experts from fields including bioethics, critical care, disaster preparedness and response, emergency medical services, emergency medicine, infectious diseases, hospital medicine, law, military medicine, nursing, pharmacy, respiratory care, and local, state, and federal government planning and response. Several members of the Critical Care Collaborative (http://www.chestnet.org/institutes/cci/ccc.php) initiated the project and assembled a steering committee for project development and administration. Members of this steering committee included representatives from the organizational members of the Critical Care Collaborative as well as several unaffiliated North American disaster experts. This steering committee then selected members of the broader Task Force on the basis of their expertise and experience.

Methods and Structure

Literature searches with MEDLINE, OVID, and Google databases from January 1966 to November 2006 were performed

*From Sharp Coronado Hospital, San Diego, CA.
†A list of Task Force members is given in the Appendix.
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Correspondence to: Asha Devereaux, MD, MPH, 1224 Tenth St, #205, Coronado, CA 92118; e-mail: ADevereaux@pol.net
DOI: 10.1378/chest.08-0649

using the following search terms: mass casualty medical care, disaster medicine, surge capacity, influenza pandemic, ethics, triage, critical care, disaster, posttraumatic stress, health-care worker, health-care rationing, and palliative medicine. Additional publications and information sources were identified by reviewing bibliographies and federal government planning documents, after-action reports of recent medical responses to catastrophes, and participation in local, state, and federal governmental working groups regarding hospital preparedness. Significant critical care response limitations were readily apparent, and the capabilities and deficiencies guided development of Task Force suggestions for critical care surge capacity and allocation of scarce resources. Outlines of manuscripts—intended to serve as preliminary rough draft documents for the full Task Force meeting—were prepared from the synthesis of information obtained in this evidence-gathering process. The steering committee convened in November 2006 at a 1-day meeting in Salt Lake City, UT, to review and revise each outline. Three draft documents were subsequently developed from the revised outlines as well as a search of MEDLINE updated through December 2006.

The full Task Force convened in Chicago, IL, on January 26–27, 2007, to consider all elements of the draft documents. Writing committees were formed to modify the draft documents to reflect the discussions and the most current and relevant medical literature. Only articles written in English were considered. Revised versions of the documents were electronically transmitted to all members of the Task Force iteratively for comment and review. The Task Force writing committees worked on this project from January to December 2007, primarily via telephone conference calls and two face-to-face meetings in June and October 2007. All authors completed disclosure statements, and there were no conflicts of interest. The authors were given complete autonomy by the American College of Chest Physicians and the Critical Care Institute. Because of the revisions and expanding length of the documents, a fourth document was created to serve as an introduction for the following three. The documents are separated as follows:

Document 1: Definitive Care for the Critically Ill During a Disaster: Current Capability and Limitations

This document reviews current mass casualty critical care response capabilities and limitations, and provides the rationale and context for most of the suggestions in the subsequent manuscripts.

Document 2: Definitive Care for the Critically Ill During a Disaster: A Framework for Optimizing Critical Care Surge Capacity

This document provides pre-event guidance for critical care surge preparedness; offers critical care surge capacity goals; defines a framework for modified care, termed *emergency mass critical care* (EMCC), to increase the number of people who can receive sufficient critical care; and suggests a graded health-care system response to match response need with appropriate response activities.

Document 3: Definitive Care for the Critically Ill During a Disaster: Medical Resources for Surge Capacity

This document provides specific quantities and types of critical care equipment/supplies, staffing, and treatment space for EMCC.

Document 4: Definitive Care for the Critically Ill During a Disaster: A Framework for Allocation of Scarce Resources in Mass Critical Care

This document provides guidance for standardized and fair means to distribute scarce critical care resources. Modern health-care experience caring for hundreds or thousands of critically ill and injured victims from civilian catastrophes is limited.[6,7,12] There are few randomized, controlled trials involving the subject matter of this Supplement, so this document is a consensus statement derived from senior-level, experienced, expert opinion rather than an evidence-based guideline. Given the paucity of direct evidence to guide mass casualty critical care practice, all of the suggestions of the Task Force are, at best, extrapolated from rigorous evaluations of everyday ICU care, as well as the related fields of military medicine and critical care transport. Lack of direct evidence does not negate their anticipated beneficial effect for mass casualty critical care situations.[13] Consensus of suggestions was achieved by electronic communication with Task Force members. No disagreements were received on any of the final suggestions. The American College of Chest Physicians Health and Science Policy Committee designates that these suggestions should not be used for performance measurement or for competency purposes because they are not evidence-based. Because the term *suggestion* implies an option to choose among a number of possibilities, the writing committee wishes to emphasize that these suggestions should in fact be considered coordinated proposals to establish a sound foundation for ICU disaster plans.

Summary of Specific Suggestions

Definitive Care for the Critically Ill During a Disaster: A Framework for Optimizing Surge Capacity

Suggestion 2.1: Every hospital with an ICU should plan and prepare to provide EMCC and should do so in coordination with regional hospital planning efforts.

Suggestion 2.2: Hospitals with ICUs should plan and prepare to provide EMCC every day of the response for a total critically ill patient census at least triple usual ICU capacity.

Suggestion 2.3: Hospitals should prepare to deliver EMCC for 10 days without sufficient external assistance.

Suggestion 2.4: EMCC should include, when applicable, the following: (1) mechanical ventilation, (2) IV fluid resuscitation, (3) vasopressor administration, (4) antidote or antimicrobial administration for specific diseases, (5) sedation and analgesia, (6) select practices to reduce adverse consequences of critical illness and critical care delivery, and (7) optimal therapeutics and interventions, such as renal replacement therapy and nutrition for patients unable to take food by mouth, if warranted by hospital or regional preference.

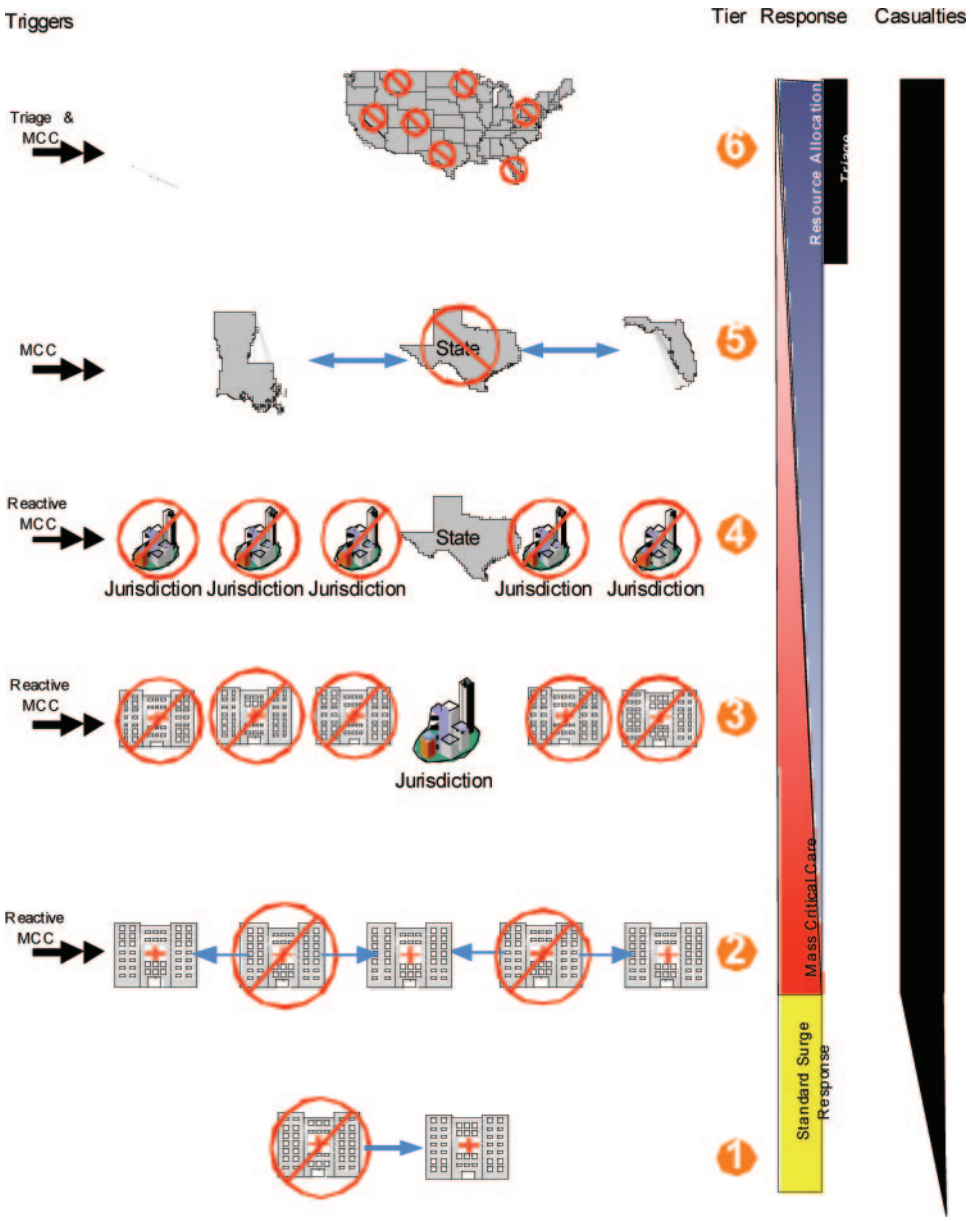

FIGURE 1. Reactive critical care response to mass casualty event. The figure provides an integrated overview of the reactive response to an event producing critically ill or injured individuals. A reactive response is required when there is little or no pre-event warning, thus limiting the ability of the system for augmentation prior to the surge. Working from *left* to *right* in the diagram. Trigger thresholds: these represent points when criteria are met for activation of various tools such as mass critical care (MCC) and triage. Tiers: this graphic component of the diagram describes the tiers of the response. Based on the magnitude of the event, higher tiers will be activated. Graphical figures illustrate hospitals, jurisdictions (*ie*, a city), states, and a nation. The circle and slash denotes that the associated resource is overwhelmed. From *bottom* up: *Row 1*: Individual facility response occurs either early in an event as the first receiving hospitals are impacted or in events with smaller magnitudes. *Row 2*: Health-care coalition response occurs when several local area hospitals are overwhelmed. *Row 3*: Local jurisdictional response occurs when the resources of an entire jurisdiction are drawn on due to direct impact or via mutual aid responses. *Row 4*: State responses are activated to support events occurring in multiple jurisdictions or if the entire state is impacted. *Row 5*: Interstate regional responses draw on the resources of neighboring states as entire states are overwhelmed. *Row 6*: Federal responses are required for large events usually involving a wide geographic area. Response: At tier 1 usual surge strategies are employed including activation of mutual aid agreements with neighboring hospitals. At tiers 2 to 4, as it is recognized that multiple hospitals or jurisdictions are overwhelmed and due to the sudden nature of the event there is insufficient time to decant patients or effectively augment the response in a timely manner, reactive mass critical care strategies may be employed temporarily until either of these are accomplished or 24 h has elapsed, at which time permission may be obtained from the appropriate authorities to continue mass critical care. Should a sudden event overwhelm resources

Suggestion 2.5: All communities should develop a graded response plan for events across the spectrum from multiple casualty to catastrophic critical care events. These plans should clearly delineate what levels of modification of critical care practices are appropriate for the different surge requirements. Use of EMCC should be restricted to mass critical care events.

Definitive Care for the Critically Ill During a Disaster: Medical Resources for Surge Capacity

Suggestion 3.1: EMCC requires one mechanical ventilator per patient concurrently receiving sustained ventilatory support.

Suggestion 3.2: Positive pressure ventilation equipment purchased for surge capacity should at a minimum accomplish the following: (1) be able to oxygenate and ventilate most pediatric and adult patients with either significant airflow obstruction or ARDS; (2) be able to function with low-flow oxygen and without high-pressure medical gas; (3) accurately deliver a prescribed minute ventilation when patients are not breathing spontaneously; and (4) have sufficient alarms to alert the operator to apnea, circuit disconnect, low gas source, low battery, and high peak airway pressures.

Suggestion 3.3: To optimize medication availability and safe administration, the Task Force suggests that modified processes of care should be considered prior to an event, such as the following: (1) rules for medication substitutions; (2) rules for safe dose or drug frequency reduction; (3) rules for conversion from parenteral administration to oral/enteral when possible; (4) rules for medication restriction (*eg*, oseltamavir if in short supply during an influenza pandemic); and (5) guidelines for medication shelf-life extension.

Suggestion 3.4: EMCC should occur in hospitals or similarly designed and equipped structures (*eg*, mobile medical facility designed for critical care delivery, veterinary hospital, or outpatient surgical procedure center). After ICUs, postanesthesia care units, and emergency departments reach capacity, hospital locations for EMCC should be prioritized in the following order: (1) intermediate care units, step-down units, and large procedure suites; (2) telemetry units; and (3) hospital wards.

Suggestion 3.5: Nonmedical facilities should be repurposed for EMCC only if disasters damage regional hospital infrastructure by making hospitals unusable, and if immediate evacuation to alternate hospitals is not available.

Suggestion 3.6: Principles for staffing models should include the following: (1) patient care assignments for caregivers should be managed by the most experienced clinician available; (2) assignments should be based on staff abilities and experience; (3) delegation of duties that usually lie within the scope of some workers' practice to different health-care workers may be necessary and appropriate under surge conditions; and (4) systematic efforts to reduce care variability, procedure complications, and errors of omission must be used when possible.

Definitive Care for the Critically Ill During a Disaster: A Framework for Allocation of Scarce Resources in Mass Critical Care

Suggestion 4.1: All hospitals must operate uniformly and cooperate in order to successfully implement a triage process when resources are scarce and/or unavailable.

Suggestion 4.2: All attempts should be made by the health-care facility to acquire scarce critical care resources or infrastructure, or to transfer patients to other health-care facilities that have the appropriate ability to provide care (state, national, and even international). Critical care will be rationed only after all efforts at augmentation have been exceeded. The Task Force assumes that EMCC has become exhausted and a Tier 6+ level has been attained or exceeded.

Suggestion 4.3: The Task Force offers a uniform approach to triaging patients during allocation of scarce resources based on objective and quantitative criteria with the following underlying principles as a foundation for this process:

Suggestion 4.3A: Critical care will be rationed only after all efforts at augmentation have been exceeded.

FIGURE 1. (continued) to the tier 5 or tier 6 level, mass critical care will likely be required. Resource allocation strategies will be employed as part of mass critical care strategies in tiers 1 to 5, but critical care triage protocols should only be employed if resources are overwhelmed beyond the tier 5 level. Casualties: This is an illustrative graphic of critically ill casualties generated by an event. The impact of an event is not solely dependant on the absolute number of casualties but also the specific medical needs of the casualties and the available resources.

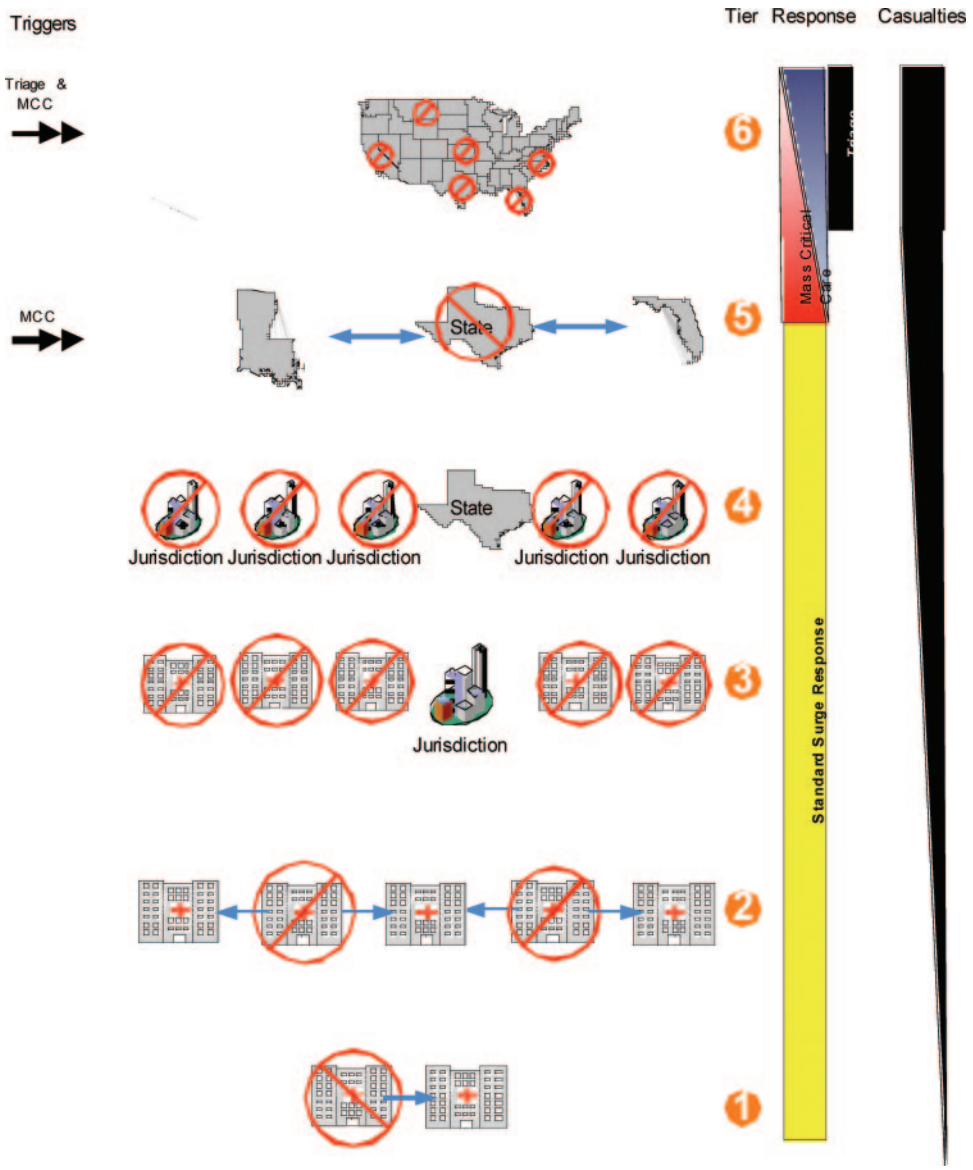

FIGURE 2. Critical care response to an expected or slowly evolving mass casualty event. The figure above provides an integrated overview of the reactive response to an expected event producing critically ill or injured individuals. Examples of an expected or slowly evolving event include an influenza pandemic or widespread radiation exposure. In such an event, there is adequate lead time to allow the system to take actions to prepare for the impending surge of critically ill patients. Working from *left* to *right* in the diagram. Trigger thresholds: These represent points when criteria are met for activation of various tools such as mass critical care and triage. Tiers: This graphic component of the diagram describes the tiers of the response (moving upwards). Based on the magnitude of the event, higher tiers will be activated. Graphical figures illustrate hospitals, jurisdictions (*ie*, a city), states, and a nation. The circle and slash denotes that the associated resource is overwhelmed. From *bottom* up: *Row 1*: Individual facility response occurs either early in an event as the first receiving hospitals are impacted or in events with smaller magnitudes. *Row 2*: Health-care coalition response occurs when several local area hospitals are overwhelmed. *Row 3*: Local jurisdictional response occurs when the resources of an entire jurisdiction are drawn on due to direct impact or via mutual aid responses. *Row 4*: State responses are activated to support events occurring in multiple jurisdictions or if the entire state is impacted. *Row 5*. Interstate regional responses draw on the resources of neighboring states as entire states are overwhelmed. *Row 6*: Federal responses are required for large events usually involving a wide geographic area. Response: Given the advanced preparations it is anticipated that standard surge strategies will be employed as tiers 1 to 4 are impacted. Mass critical care strategies should only be employed if resources at or beyond tier 5 will be overwhelmed and critical care triage protocols should only be used when resources beyond tier 5 will be overwhelmed. Casualties: This is an illustrative graphic of critically ill casualties generated by an event. The impact of an event is not solely dependant on the absolute number of casualties but also the specific medical needs of the casualties and the available resources. See Figure 1 legend for expansion of abbreviation.

Suggestion 4.3B: Limitations on critical care will be proportional to the actual shortfall in resources.

Suggestion 4.3C: Rationing of critical care will occur uniformly, be transparent, and abide by objective medical criteria.

Suggestion 4.3D: Rationing should apply equally to withholding and withdrawing life-sustaining treatments based on the principle that withholding and withdrawing care are ethically equivalent.

Suggestion 4.3E: Patients not eligible for critical care will continue to receive supportive medical or palliative care.

Suggestion 4.4: The Task Force suggests that a triage officer and support team implement and coordinate the distribution of scarce resources.

Suggestion 4.5: The Task Force suggests a systematic, retrospective review of the decisions of the triage team by a review committee.

Suggestion 4.6: Palliative care is a required component of mass critical care.

Suggestion 4.7: The Task Force believes a strong commitment to the ethical considerations outlined in the article is necessary in implementation of the triage process and allocation of scarce resources.

Suggestion 4.8: Providers should be legally protected for providing care during the allocation of scarce resources in mass critical care when following accepted protocols.

Conclusion

Although the critical care system has significant limitations in responding to mass casualty events with large numbers of critically ill patients, preevent planning can help avoid crisis decision making in order to optimize outcomes, given capacity limits. Successful response to such overwhelming situations depends largely on having an effective conceptual and operational framework, such as EMCC.

Unfortunately, in some circumstances EMCC will not be sufficient to allow critical care to be provided to all those who are critically ill. In such cases, it is necessary to target the resources available to those who are most likely to benefit in order to maximize overall survival. This is accomplished through triage, a complex process balancing available resources with the demands on those resources at a population level rather than at the individual patient level, where health-care workers typically focus. In short, the goal is to do the greatest good for the greatest number. In some situations, optimal triage will have enormous impact on overall mortality. Obviously, such decisions are very complex, fraught with ethical dilemmas that require thoughtful consideration well in advance of their use in an emergency. Failure to perform optimal triage carries with it significant consequences because either overtriage or undertriage will likely increase mortality for the entire critically ill and injured population.

Although intended to save lives and optimize system performance during times of crises, the decision to employ either EMCC or critical care triage should never be taken lightly or in isolation. Both EMCC and critical care triage represent a deviation from providing usual, current state-of-the-art critical care and depriving some individuals the optimum treatment for the good of the collective society. Thus, such actions are justifiable only in very specific circumstances and must occur within a response framework as outlined in Figures 1, 2. These figures illustrate how the various concepts in this Supplement are integrated within a comprehensive response framework. Hospitals should ensure that their critical care staff understand and are able to use the tools of EMCC and triage within an integrated response should they ever be called on to respond to an overwhelming number of critically ill or injured victims. This Supplement therefore serves as a necessary beginning in this planning process. It is expected that as hospitals practice, drill, and achieve surge capacity, these suggestions will require modification.

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Appendix

Task Force Members in Alphabetical Order

Capt. Dennis Amundson, MD, USN, San Diego, CA; Capt. Michael B. Anderson, RN, MHA, CNAA, Department of Homeland Security, Washington, DC; Robert Balk, MD, Rush University Medical Center, Chicago, IL; Tom Baudendistel, MD, California Pacific Medical Center, San Francisco, CA; Ken Berkowitz, MD, VHA National Center for Ethics in Health Care, New York, NY; Michael Bourisaw, BS (Steering Committee), American College of Chest Physicians, Northbrook, IL; Dana Braner, MD, Doernbecher Children's Hospital, Portland, OR; Suzanne Burns, RN, MSN, RRT, University of Virginia Health System, Charlottesville, VA; Michael Christian, MD, FRCPC (Steering Committee), University of Toronto, Toronto, ON, Canada; J. Randall Curtis, MD, MPH, Harborview Medical

Center, Seattle, WA; Asha Devereaux, MD (Steering Committee), Sharp Coronado Hospital, San Diego, CA; Jeffery Dichter, MD (Steering Committee), Presbyterian Hospital, Albuquerque, NM; Nancy Dubler, LLB (Steering Committee), Montefiore Medical Center, Bronx, NY; Brian Erstad, PharmD (Steering Committee), University of Arizona Medical Center, Tucson, AZ; J. Christopher Farmer, MD, Mayo School of Graduate Medical Education, Rochester, MN; James Geiling, MD (Steering Committee), VA Medical Center, White River Junction, VT; Dan Hanfling, MD, Inova Fairfax Hospital, Falls Church, VA; John Hick, MD (Steering Committee), Hennepin County Medical Center, Minneapolis, MN; Capt. Ann Knebel, RN, DNSc, Department of Health and Human Services, Washington, DC; John Krohmer, MD, Department of Homeland Security, Washington, DC; Capt. Deborah Levy, PhD, MPH (Steering Committee), Centers for Disease Control and Prevention, Atlanta, GA; Henry Masur, MD, National Institutes of Health, Bethesda, MD; Justine Medina (Steering Committee), RN, MS, American Association of Critical Care Nursing, Aliso Viejo, CA; Nicki Pesik, MD (Steering Committee), Centers for Disease Control and Prevention, Atlanta, GA; Jim Pile, MD, The Cleveland Clinic, Cleveland, OH; Tia Powell, MD, New York State Task Force on Life and the Law, New York, NY; Lewis Rubinson, MD, PhD (Steering Committee), Harborview Medical Center, Seattle, WA; Christian Sandrock, MD, MPH, University of California-Davis, Davis, CA; Richard Serino, BS, Boston Emergency Medical Services, Boston, MA; Lewis Soloff, MD, New York City Department of Health and Mental Hygiene, New York, NY; Daniel Talmor, MD, MPH, Beth Israel Deaconess Medical Center, Boston, MA; Alvin Thomas Jr, MD Howard University Hospital, Washington, DC; Richard Waldhorn, MD, University of Pittsburgh Medical Center, Baltimore, MD; Mark Woodhead, MD, Respiratory Infections, Manchester, UK; Robert Wise, MD, The Joint Commission, Chicago, IL; Randy Wax, MD, Mount Sinai Hospital, Toronto, ON, Canada; Kevin Yeskey, MD (Steering Committee), Department of Health and Human Services, Washington, DC.

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