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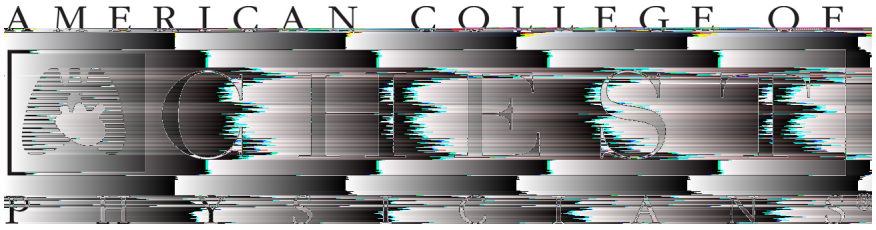

Definitive Care for the Critically Ill During a Disaster: A Framework for Allocation of Scarce Resources in Mass Critical Care*

From a Task Force for Mass Critical Care Summit Meeting, January 26–27, 2007, Chicago, IL

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Background: **Anticipated circumstances during the next severe influenza pandemic highlight the insufficiency of staff and equipment to meet the needs of all critically ill victims. It is plausible that an entire country could face simultaneous limitations, resulting in severe shortages of critical care resources to the point where patients could no longer receive all of the care that would usually be required and expected. There may even be such resource shortfalls that some patients would not be able to access even the most basic of life-sustaining interventions. Rationing of critical care in this circumstance would be difficult, yet may be unavoidable. Without planning, the provision of care would assuredly be chaotic, inequitable, and unfair. The Task Force for Mass Critical Care Working Group met in Chicago in January 2007 to proactively suggest guidance for allocating scarce critical care resources.**

Task Force suggestions: **In order to allocate critical care resources when systems are overwhelmed, the Task Force for Mass Critical Care Working Group suggests the following: (1) an equitable triage process utilizing the Sequential Organ Failure Assessment scoring system; (2) the concept of triage by a senior clinician(s) without direct clinical obligation, and a support system to implement and manage the triage process; (3) legal and ethical constructs underpinning the allocation of scarce resources; and (4) a mechanism for rapid revision of the triage process as further disaster experiences, research, planning, and modeling come to light.**

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Key words: critical care; disaster; ethics; health-care rationing; health-care worker; palliative medicine; posttraumatic stress; triage

Abbreviations: EMCC = emergency mass critical care; SOFA = Sequential Organ Failure Assessment

The Task Force for Mass Critical Care (hereafter called the *Task Force*) proposes use of emergency mass critical care (EMCC) to increase critical care surge capacity for mass critical care events (see "Definitive Care for the Critically Ill During a Disaster: A Framework for Optimizing Critical Care Surge Capacity" and "Definitive Care for the Critically Ill During a Disaster: Medical Resources for Surge Capacity"). However, even with use of EMCC, more patients may require critical care than can be provided with available resources. Limited medical resources may need to be shared or reallo-

cated to other patients with a higher likelihood of survival. Issues that need further clarification include: Who should receive limited resources, and how should they be allocated? Should those with the highest risk of mortality receive intervention? How should their prognosis be determined? Who should make the allocation decisions? Under what conditions will caregivers who participate in reallocation of resources face civil and criminal penalties? This document provides a mechanism of triage and process for allocation of scarce resources in the event of a mass disaster when all resources are exhausted and not even EMCC can be provided for all.

Allocation and rationing of scarce critical care resources are legally, ethically, and emotionally complex. In the event of a catastrophic event, the lack of a plan to address these issues will result in the perception of unjust allocation of resources, or actual injustice may take place. Optimal allocation of scarce resources in a mass casualty event depends on the ability of public health authorities, government officials, institutional leaders, health-care professionals, and the public to embrace the paradigm shift from individual to population-based care, and will be best accomplished in advance of a disaster.[1,2] The full details of the methods for this article have been described elsewhere (see "Summary of Suggestions From the Task Force on Mass Critical Care Summit").

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Operational Requirements for Allocation of Scarce Resources

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.

In order to fairly distribute scarce critical care resources during mass casualties, the Task Force believes the following institutional elements form the necessary foundation of operations by which hospitals should function during an emotionally difficult time.

Government: National, state, and local governments have an obligation to facilitate hospital planning, allocate intelligently, educate openly, and ensure that providers and institutions acting in good faith will not be penalized.

Community: Appropriate risk communication and transparency of the planning process is not merely an institutional mandate, but rather a government responsibility that can be supported and facilitated by community leaders.[3]

Hospitals: Preparedness requires anticipating not only the needs of patients, but also the needs of care providers. Health-care organizations have an obligation to provide the best care possible to patients under the circumstances, and a responsibility to protect their employees.[4] Facilities must minimize harm to staff by doing the following: (1) providing appropriate personal protective equipment, (2) accumulating necessary medications and supplies, (3) changing the scope of practice and responsibilities to expand employee capacity to provide care, (4) training health-care workers for new tasks required by the disaster situation, and (5) establishing supervisory systems that provide necessary support during and after crisis situations.

Individuals: Medical staff in their role as triage officers or as clinicians working with limited resources will be expected to change the paradigm of care. They will need to understand that in decisions made during the event, they must consider a duty to the population, as opposed to the individual.[5] Triage of scarce resources is the most extreme among a range of options; therefore, training and familiarity with the triage and allocation process will be vital.

Although prioritization of health-care workers for influenza vaccine and antiviral treatment during a pandemic is advocated by the US Centers for Disease Control and Prevention[6] in order to maintain the workforce of the health-care system for the

benefit of the community, it is unlikely that similar prioritization of such groups to receive critical care offers community benefit.[7] After extensive consideration, the Task Force does not recommend preferential distribution of critical care resources for any population groups.

Initiation of the Triage Process

Suggestion 4.2: All attempts should be made by the health-care facility to acquire scarce critical 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.

The decision to initiate the triage algorithm and allocation of scarce resources should occur in conjunction with local and regional Medical Emergency Operations Command authority (usually within the public health department). Table 1 outlines the tiered system of critical care response levels. Tables 2 and 3 delineate the necessary elements in order to initiate a triage process to allocate limited resources. Because disasters may be rapid and sudden, all of these elements may occur simultaneously and not sequentially. Figure 1 provides a visual representation of coordinated triage using the committee and support team process at a regional and/or state level. After the critical resource or infrastructure is replaced, the health-care entity in conjunction with the local and regional health authorities can return to the previous level of care.

Defining Triage

Primary and Secondary Triage

Although the primary focus of this document is the triage of critical care resources (tertiary triage), it is essential to view the proposed triage process in the context of the system within which critical care operates rather than in isolation. A critically ill patient has several points of contact with the health-care system prior to reaching the ICU. Each contact point presents an opportunity to assess the patient and triage. When dealing with mass casualty situations, exercising these opportunities to assess and triage patients is essential in order to optimize flow through the system, in addition to protecting downstream resources from being overwhelmed and disabled.[56]

The first point of contact for most critically ill patients is the emergency medical system in the prehospital field. This is the point where primary triage (the first sorting) is conducted by emergency medical systems personnel. Given the environment, skill set of the health-care workers, and setting, the complexity of triage decisions that can be made during primary triage is limited. Triage decisions at this point must rely on a limited set of objective criteria that do not require any laboratory data or other investigations. This would most likely represent a subset of the exclusion criteria outlined in this article.

The second possible point of contact with the system is the emergency department, where secondary triage is conducted by emergency department physicians. The information available at this point is often still limited but some preliminary investigations or additional hospital information may be available, allowing more complex triage decisions to be made. Again, the triage criteria on which these decisions are based would be an expanded version of those used in the prehospital setting.

Tertiary triage is conducted within the hospital and deals with decisions such as disposition to the operating room in trauma scenarios or to critical care areas, as is the focus of this working group. Given that the focus of this working group is on tertiary triage, we do not provide any specific recommendations for primary and secondary triage.

The Triage Process

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: (1) critical care will be rationed only after all efforts at augmentation have been exceeded; (2) limitations on critical care will be proportional to the actual shortfall in resources; (3) rationing of critical care will occur uniformly, be transparent, and abide by objective medical criteria; (4) rationing should apply equally to withholding and withdrawing life-sustaining treatments based on the principle that withholding and withdrawing care are ethically equivalent[8]; and (5) patients not eligible for critical care will continue to receive supportive medical or palliative care.

This triage algorithm is designed to be objective, to be adaptable to regional supply and demand of resources, and to consider disease- or event-specific circumstances. Each region will have to assess and proactively adjust the process as necessary. This process may be imperfect but should serve as a sound foundation to fairly distribute scarce resources during mass critical care. The proposed triage algorithm is

Table 1—*Response Tiers for Critical Care Surge Capacity

Response Tier	Health-Care Participants for Definitive Critical Care Response	Expectation of Functionality if Tier is Sufficient for Event	Risk of Adverse Events for Critically Ill Patients if Tier is Not Sufficient for Event	Risk of Adverse Events for Critically Ill Patients if Tier is Sufficient for Event in Timely Manner	Hospital Emergency Response Obligations Before Increasing to the Next Tier		External Response Obligations Before Increasing to the Next Tier
					Impacted Hospital	Nonoverwhelmed Hospitals	
Tier 0	ICUs	Best-care practices and all institutional critical care policies/ procedures upheld	Minimal	Minimal	Baseline processes	Baseline processes	Baseline processes
Tier 1	Individual hospital	High-intensity critical care for all patients	Low	Minimal	Administrative changes with low likelihood for adverse outcomes (*eg*, slight reduction in patient turning frequency to allow staff to increase capacity)	Baseline processes	Baseline processes
Tier 2	Health-care coalition	High-intensity critical care for all patients	Low	Minimal	Internal disaster declared and hospital-wide concerted effort to rebalance critical care need and resources (*eg*, delaying elective procedures, staff recall)	Administrative changes with low likelihood for adverse outcomes (*eg*, slight reduction in patient turning frequency to allow staff to increase capacity)	All coalition hospitals fully involved in assisting response
Tier 3	All coalition hospitals; jurisdictions utilizing MACC	High-intensity critical care for all patients	Moderate for all impacted hospitals	Minimal	Internal disaster declared and hospital-wide concerted effort to rebalance critical care need and resources (*eg*, delaying elective procedures, staff recall); all coalition hospitals impacted	Not applicable	All coalition hospitals fully involved in assisting response; MACC is activated and actively working to help jurisdiction meet all critical care needs
Tier 4	All coalition hospitals; jurisdictions utilizing MACC; additional intrastate and state health agencies and institutions	High-intensity critical care for all patients	Moderate for all impacted hospitals	Minimal	Internal disaster declared and hospital-wide concerted effort to rebalance critical care need and resources (*eg*, delaying elective procedures, staff recall); all coalition hospitals impacted	Not applicable	All coalition hospitals fully involved in assisting response; MACC is activated and actively working to help jurisdiction meet all critical care needs; formal request for extra state assistance

Table 1—*Continued*

Response Tier	Health-Care Participants for Definitive Critical Care Response	Expectation of Functionality if Tier is Sufficient for Event	Risk of Adverse Events for Critically Ill Patients if Tier is Not Sufficient for Event	Risk of Adverse Events for Critically Ill Patients if Tier is Sufficient for Event in Timely Manner	Hospital Emergency Response Obligations Before Increasing to the Next Tier		External Response Obligations Before Increasing to the Next Tier
					Impacted Hospital	Nonoverwhelmed Hospitals	
Tier 5	All coalition hospitals; jurisdictions utilizing MACC; additional intrastate and state health agencies and institutions; interstate health agencies and medical assets	High-intensity critical care for all patients	Moderate for all impacted hospitals	Minimal	Internal disaster declared and hospital-wide concerted effort to rebalance critical care need and resources (*eg*, delaying elective procedures, staff recall); all coalition hospitals impacted	Not applicable	All coalition hospitals fully involved in assisting response; MACC is activated and actively working to help jurisdiction meet all critical care needs; formal request for extra state assistance (federal and perhaps interstate)
Tier 6	All coalition hospitals; jurisdictions utilizing MACC; additional intrastate and state health agencies and institutions; interstate health agencies and medical assets; federal health agencies and medical assets	High-intensity critical care for all patients	High for all impacted hospitals	Minimal	Internal disaster declared and hospital-wide concerted effort to rebalance critical care need and resources (*eg*, delaying elective procedures, staff recall); all coalition hospitals impacted	Not applicable	All coalition hospitals fully involved in assisting response; MACC is activated and actively working to help jurisdiction meet all critical care needs; formal request for extra-state assistance (federal and perhaps interstate); critical care patients remain at high risk for adverse events owing to resource limitations
Tier 6+	All coalition hospitals; jurisdictions utilizing MACC; additional intrastate and state health agencies and institutions; interstate health agencies and medical assets; federal health agencies and medical assets; possible international assistance; initiation of triage process to allocate scarce resources	EMCC	Catastrophic	High	Internal disaster declared and hospital-wide concerted effort to rebalance critical care need and resources (*eg*, delaying elective procedures, staff recall); all coalition hospitals impacted	Not applicable	All coalition hospitals fully involved in assisting response; MACC is activated and actively working to help jurisdiction meet all critical care needs; formal request for extra state assistance (federal and perhaps interstate); critical care patients remain at high risk for adverse events owing to resource limitations: (1) even with EMCC, very few patients have access to care owing to catastrophic imbalance of need and resources; or (2) nearly 100% mortality even with EMCC; or (3) health risk to caregivers unacceptably high

Table 1—*Continued*

Response Tier	Health-Care Participants for Definitive Critical Care Response	Expectation of Functionality if Tier is Sufficient for Event	Risk of Adverse Events for Critically Ill Patients if Tier is Not Sufficient for Event	Risk of Adverse Events for Critically Ill Patients if Tier is Sufficient for Event in Timely Manner	Hospital Emergency Response Obligations Before Increasing to the Next Tier: Impacted Hospital	Hospital Emergency Response Obligations Before Increasing to the Next Tier: Nonoverwhelmed Hospitals	External Response Obligations Before Increasing to the Next Tier
Tier X	All coalition hospitals; jurisdictions utilizing MACC; additional intrastate and state health agencies and institutions; interstate health agencies and medical assets; federal health agencies and medical assets	Critical care services may be drastically limited or cease to be delivered	Maximal for critically ill patients	Maximal for critically ill patients	Not applicable	Not applicable	Not applicable

*From Rubinson et al, "Definitive Care for the Critically Ill During a Disaster: A Framework for Optimizing Critical Care Surge Capacity" in this Supplement. MACC = multiagency coordinating center.

Table 2—*Potential Triggers To Initiate Triage Algorithm and Allocation of Resources at a Health-Care Facility Under EMCC*

Lack of critical equipment
Mechanical ventilators
Beds
Medical gases (oxygen)
Antibiotics
Vasopressors
Crystalloid
Operating room equipment
Lack of critical infrastructure
Security
Isolation ability
Personal protective equipment
Decontamination equipment
Power
Staff support (food, housing, medication)
Inability to transfer patients to another facility (alternate care site, hospital) that limits ability to perform clinical care
Lack of specialty care (*eg*, burn, surgical, trauma)
Lack of adequate staff

composed of three components: the inclusion criteria, the exclusion criteria, and prioritization of care.

Inclusion Criteria: To be admitted to critical care during a mass critical care crisis, patients must require active critical care interventions (Fig 2). This is identical to the inclusion criteria suggested by Christian et al.[9] Therefore, patients requiring "observation only" should not be admitted to critical care while the triage algorithm is implemented.[10–12]

Exclusion Criteria: Patients will meet exclusion criteria when they have a very high risk of death, little likelihood of long-term survival, and a correspondingly low likelihood of benefit from critical care resources. When patients meet exclusionary criteria, critical care resources may be reallocated to other patients (Fig 2). There are two subcomponents of the exclusion criteria: (1) the Sequential Organ

Table 3—*Conditions Required To Initiate a Triage Process To Allocate Scarce Resources*

Declared state of emergency or incident of national significance
Initiation of national disaster medical system and national mutual aid and resource management
Surge capacity fully employed within health-care facility
Attempts at conservation, reutilization, adaptation, and substitution are performed maximally
Identification of critically limited resources (ventilators, antibiotics)
Identification of limited infrastructure (isolation, staff, power)
Request for resources and infrastructure made to local and regional health officials
Current attempt at regional, state, and federal level for resource or infrastructure allocation

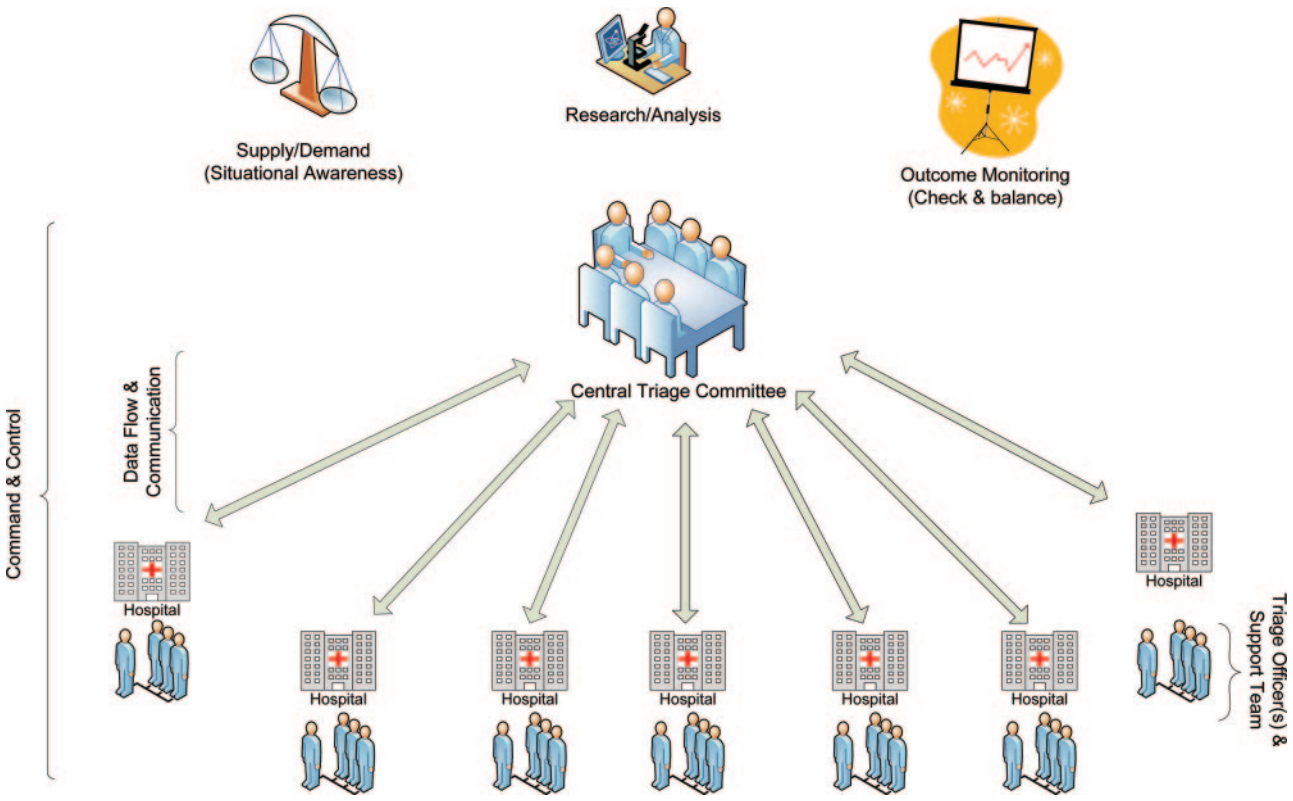

FIGURE 1. Triage infrastructure: the optimal relationship between the state/regional central triage committee and the triage officer(s) at individual hospitals. The central triage committee must have situational awareness (knowledge of supply resources and demands on them), capacity to conduct research in order to develop then modify research protocols, and monitor triage outcomes. A bidirectional communication network between the central committee and hospitals in order to achieve situational awareness, monitor outcomes and communicate modifications to the triage protocols. At the individual hospitals, the triage officers(s) are supported by a staff/team.

Failure Assessment (SOFA) score, and (2) the severity of chronic illness.

The SOFA score is used to assess acute inpatient severity of illness and is to be calculated daily (Table 4). Although several more rigorous scoring systems were reviewed (Table 5), the SOFA score was chosen for several reasons: (1) it primarily assesses daily organ function; (2) the ease of obtaining physiologic parameters; (3) the ease of calculating the SOFA score; (4) simple laboratory tests are used for scoring; and (5) its validation in a wide variety of critical care conditions.[10,13–18]

To meet the exclusion criteria using the SOFA score, a patient has to have at minimum an 80% risk of mortality. The 80% risk was proposed by the Task Force to exclude patients who are imminently near death independent of the care they receive, and not exclude patients who may have a reasonable chance of survival. This mortality level can be reassessed and adjusted in the midst of a mass casualty, based on the severity of the demand placed on resources. Based on published evidence, the following SOFA criteria are highly likely to represent a mortality of at least 80%[17–26]: (1) highest SOFA $\geq$ 15 at any time during the hospital admission[19,20]; (2) mean SOFA score $\geq$ 5 for at least 5 days and with a SOFA trend that is either rising or flat[19,21,22]; (3) any patient that has six or more organ failures at any time.[18]

The exclusion criteria for severe chronic illness has been described previously as the third category of exclusion criteria; this category includes life-limiting illnesses, such as end-stage congestive heart failure, end-stage COPD, and terminal liver disease.[9] Patients should be excluded if they have any one of these exclusion criteria (Table 6).

Other algorithms have recommended that the likely duration of critical care need, also referred to as the *minimum qualification for survival*, should be used to define a limit on the amount of resources utilized by any given patient.[5,9,27] Because the conditions under which the triage process will be triggered implies a severe limitation of resources, a single patient who remains in an ICU for an extended period may use resources that could save the lives of several other

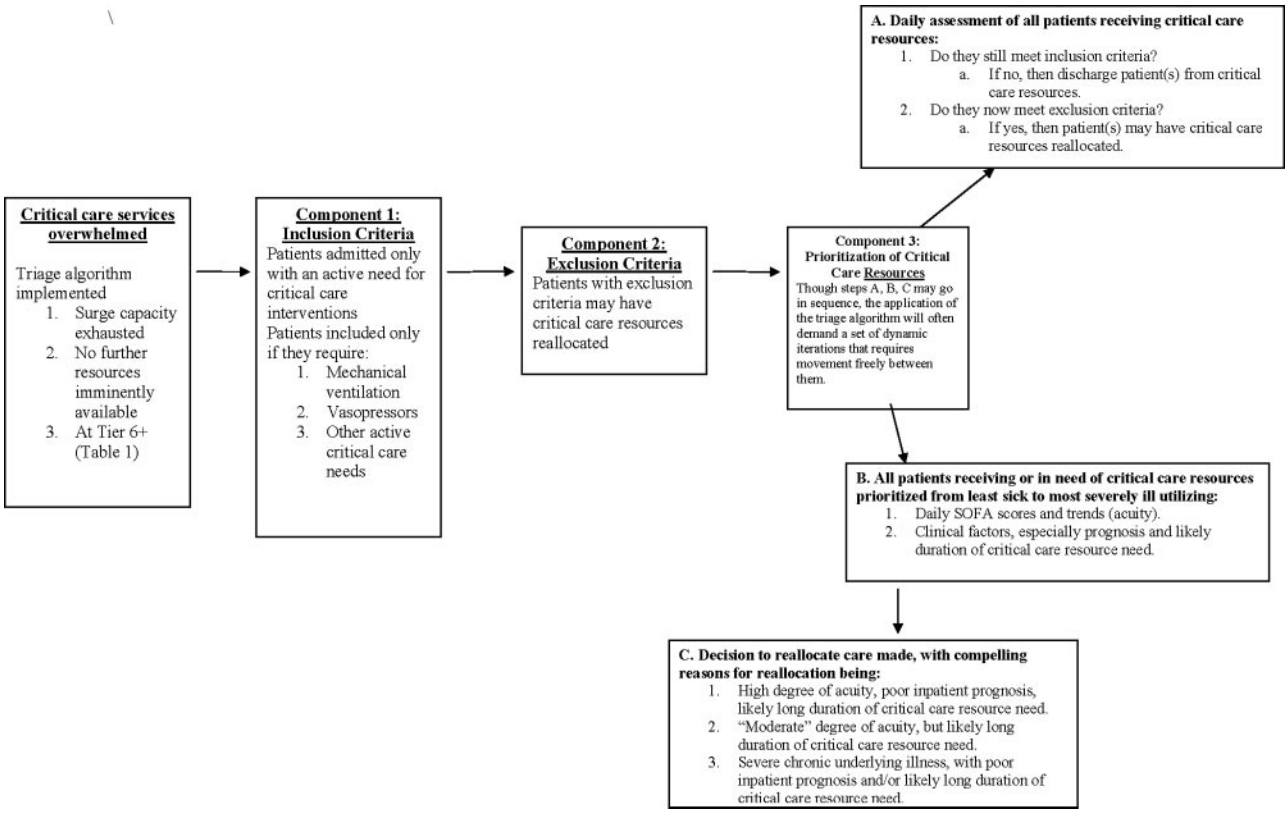

FIGURE 2. Triage algorithm process: components 1 and 2, inclusion and exclusion criteria and prioritization of critical care resources.

patients. This is an important point and must be evaluated in conjunction with the actual demand and shortages during the allocation process.

Prioritization of Patients: Following application of the inclusion and exclusion criteria, patients should be prioritized in a ranking that utilizes the latest SOFA score and daily SOFA trend (Fig 2). Though objective, the SOFA score provides only limited information as to the eventual outcome for any given patient.[19,21] Prioritization of these patients will also require the expertise and judgment of experienced triage officers using the severity of acute and/or chronic illness, prognosis, and projected duration of resource need. Based on this information, the triage officer and team will determine whether there is sufficient basis to warrant reallocating resources. Summarized, the compelling reasons for reallocating critical care resources away from any given patient(s) will include the following circumstances[28]: (1) patients who have the highest SOFA scores and/or a SOFA trend that is flat or rising over several days but do not yet meet formal SOFA exclusion criteria; (2) a high degree of inpatient acuity with a poor chance for survival, and a likely long duration of need for critical care resources; (3) a moderate degree of acuity but a prolonged duration of critical care resource need is expected; and (4) a severe underlying chronic illness that in conjunction with any of the above factors leads a decision maker to feel the prognosis is poor, and/or the patient's likely duration of critical care resource need will be prolonged.

THE TRIAGE OFFICER AND SUPPORT TEAM

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

Triage Officer: There is no applicable model of mass triage resulting from an infectious event, and the data regarding triage and outcome in mass critical care are limited.[11,12,29–32] However, the lessons from mass trauma disasters have proven the benefit of the triage officer (usually a highly experienced surgeon) who oversees the clinical activities at the time of the crisis. The triage officer is in charge, assesses all patients, assigns a level of priority for each, and directs attention to the highest-priority patients. The triage officer may also be in charge of logistics, such as patient transfers or availability of resources, but is often assigned an administrator/

Table 4—*SOFA

Components of System	SOFA Points 1	2	3	4
PaO_2/fraction of inspired oxygen, mm Hg	< 400	< 300	< 200 with respiratory support	< 100 with respiratory support
Platelet count, × $10^3/\mu L$	< 150	< 100	< 50	< 20
Total bilirubin, mg/dL (μmol/L)	1.2–1.9 (20–32)	2.0–5.9 (33–101)	6.0–11.9 (102–204)	>12.0 (> 204)
Level of hypotension or need for vasopressor	Mean arterial pressure < 70 mm Hg	Dopamine level ≤ 5 μg/kg/min, or dobutamine (any dose)	Dopamine < 5 μg/kg/min, or epinephrine ≤ 0.1 μg/kg/min, or norepinephrine ≤ 0.1 μg/kg/min	Dopamine > 15 μg/kg/min, or epinephrine > 0.1 μg/kg/min, or norepinephrine > 0.1 μg/kg/min
Glasgow coma scale	13–14	10–12	6–9	< 6
Creatinine, mg/dL (μmol/L) or urine output	1.2–1.9 (110–170)	2.0–3.4 (171–299)	3.5–4.9 (300–440) or < 500 mL/d	> 5.0 (> 440) or < 200 mL/d

*How to calculate SOFA score: Each of the six components above is assigned a score based on a patient's clinical or laboratory data; the total SOFA score is calculated by adding the score for each of the six components together. MAP = mean arterial pressure. Adapted from Moreno et al.[18]

director for this purpose.[33,34] In larger centers, this individual may report to a superior who has a greater breadth of responsibility.[33–41] The desirable qualities of a triage officer include exceptional clinical expertise, outstanding leadership ability, and effective communication skills.[34] He or she is expected to make decisions that benefit the greatest number of patients given potentially limited resources, even

Table 5—*Comparison of Four Severity of Illness Scoring Systems*

SOFA Score*	Applied Physiology and Chronic Health Evaluation II Score†	Mortality Probability Model II Score‡	Simplified Acute Physiology II Score§
1. PaO_2/fraction of inspired oxygen	1. Vital signs (temperature, mean arterial pressure, heart rate, respiratory rate	1. Coma or deep stupor	1. Age
2. Platelet count	2. Alveolar-arterial oxygen pressure difference or PaO_2	2. Heart rate ≥ 150 beats/min	2. Heart rate
3. Total bilirubin	3. Arterial pH	3. Systolic BP ≤ 90 mm Hg	3. Systolic BP
4. Level of hypotension	4. Sodium	4. Chronic renal failure	4. Temperature
5. Glasgow coma scale	5. Potassium	5. Cirrhosis	5. If receiving mechanical ventilation or pulmonary artery catheter present: PaO_2/fraction of inspired oxygen
6. Creatinine or urine output	6. Creatinine	6. Metastatic neoplasm	6. Urine output
	7. Hematocrit	7. Acute renal failure	7. BUN
	8. WBC	8. Cardiac dysrythmia	8. WBC
	9. Glasgow coma scale	9. Cerebrovascular accident	9. Potassium
	10. Age	10. GI bleeding	10. Sodium
	11. Chronic health points	11. Intracranial mass	11. Serum bicarbonate
		12. Age	12. Total bilirubin
		13. Cardiopulmonary resuscitation prior to hospital admission	13. Glasgow coma scale
		14. Mechanical ventilation	14. Chronic diseases (AIDS, metastatic cancer, hematologic malignancy)
		15. Medical or unscheduled surgery admission	15. Type of admission (medical, scheduled surgical, unscheduled surgical)

*From Vincent et al.[17]
†Adapted from Knaus et al.[13]
‡From Lemeshow et al[14] Higgins et al.[15]
§From LeGall et al.[16]

Table 6—*Exclusion Criteria*

1. SOFA score criteria: patients excluded from critical care if risk of hospital mortality ≥ 80%
   A. SOFA > 15
   B. SOFA > 5 for ≥ 5 d, and with flat or rising trend
   C. ≥ 6 organ failures
2. Severe, chronic disease with a short life expectancy
   A. Severe trauma
   B. Severe burns on patient with any two of the following:
      i. Age > 60 yr
      ii. > 40% of total body surface area affected
      iii. Inhalational injury
   C. Cardiac arrest
      i. Unwitnessed cardiac arrest
      ii. Witnessed cardiac arrest, not responsive to electrical therapy (defibrillation or pacing)
      iii. Recurrent cardiac arrest
   D. Severe baseline cognitive impairment
   E. Advanced untreatable neuromuscular disease
   F. Metastatic malignant disease
   G. Advanced and irreversible neurologic event or condition
   H. End-stage organ failure meeting the following criteria:
      i. Heart
         a. New York Heart Association class III or IV heart failure
      ii. Lungs
         a. COPD with FEV_1 < 25% predicted, baseline PaO_2 <55 mm Hg, or secondary pulmonary hypertension
         b. Cystic fibrosis with postbronchodilator FEV_1 < 30% or baseline PaO_2 < 55 mm Hg
         c. Pulmonary fibrosis with vital capacity or total lung capacity < 60% of predicted, baseline PaO_2 < 55 mm Hg, or secondary pulmonary hypertension
         d. Primary pulmonary hypertension with New York Heart Association class III or IV heart failure, right atrial pressure > 10 mm Hg, or mean pulmonary arterial pressure > 50 mm Hg
      iii. Liver
         a. Child-Pugh score ≥ 7
   I. Age > 85 yr
   J. Elective palliative surgery

though these decisions may not necessarily be best for any individual patient.[5,27,34,39,42] To optimize effective functioning in a crisis, the triage officer must be well prepared and trained in advance by means of disaster drills or simulation testing.[27,34,42,43]

For the ICU, the triage officer will review all patients for inclusion and exclusion criteria, and facilitate discharge from critical care for patients no longer requiring it. The triage officer will evaluate daily all patients receiving critical care, and evaluate those requested to be considered for critical care as they arise. The triage officer will review necessary patient data by chart review and discussion with the clinical team if needed. The triage officer is not expected to examine patients, except under circumstances where this information may be crucial in reaching a triage decision. However, patients who have a significant change in clinical status (such as a cardiac arrest and resuscitation) may need to be reassessed more than once daily.

The triage officer has the ultimate responsibility and authority for making decisions as to which patients will receive the highest priority for receiving critical care, and is empowered to make decisions regarding reallocation of critical care resources. The triage officer will share decisions with the attending clinician, who will then inform affected patients and family members. The triage officers' decisions are final and there will be no appeals process. This is consistent with recommendations regarding the function of the triage officer from the trauma literature.[5,27,34,39,42]

Triage Team Composition: The team will be composed of an experienced critical care nurse, respiratory therapist, and/or clinical pharmacist. Their role as triage team members is to provide information to the triage officer and to help facilitate and support his/her decision-making process. A representative from hospital administration may also be a part of the team to help with organization resources and to serve as a liason with hospital leadership.

The triage officer and team members should function in shifts lasting no longer than 12 to 16 h. Therefore, there must be at least two shifts to fully staff the triage function. Triage officers may require nonclinical (secretarial or administrative) support personnel for their data-gathering activities, documentation, and record keeping. Their decisions and supporting documentation should be reported daily to hospital leadership.

Command Structure in Large Hospitals: In larger facilities, it may be necessary to have more than one triage officer and team, with each officer/team assigned a designated ICU or hospital area. Each of the triage officers will then need to report to the Medical Operations Section Chief (Hospital Incident Command System) within the Hospital Incident Command Center (Fig 3) in order to maintain communication and coordinate resources, but retains autonomy in resource allocation to individual patients. This communication responsibility may be delegated to the administrative liaison, but the main function of assessing internal and external resources and interacting with government authorities falls to leadership in the hospital command center.

Documentation: Maintaining transparency of the triage process is crucial, and the triage officer and team must document decisions regarding all patients assessed, whether care is limited, provided, or not provided. Table 7 highlights key points for the medical record.

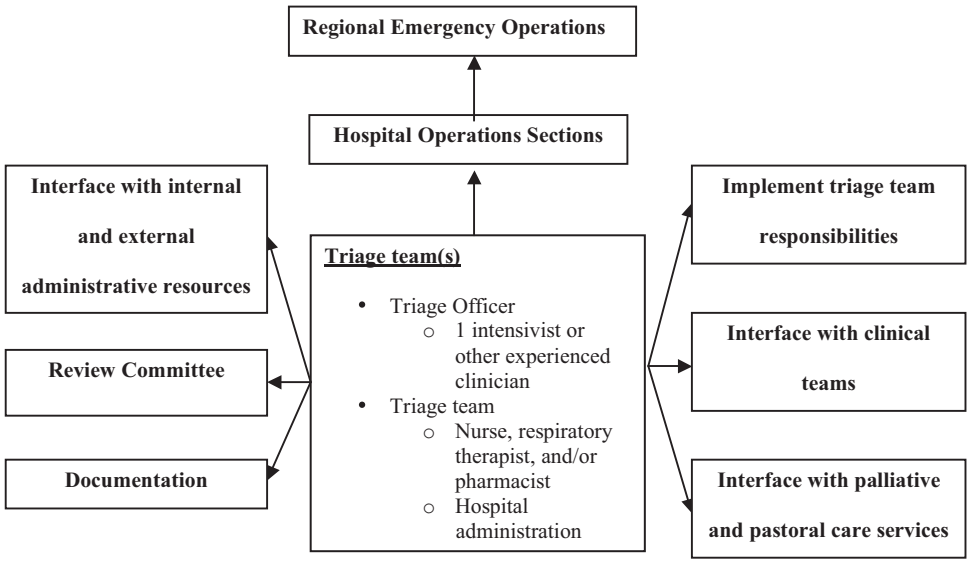

FIGURE 3. Triage team functions.

TRIAGE OVERSIGHT

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

The review committee may be composed of experienced professionals who typically no longer provide direct care, such as the chief nursing officer, chief medical officer, chief respiratory therapy supervisor, infection control director, or legal counsel. We recommend a small group of no more than three individuals.

The purpose of the review committee is to bring to the attention of the triage officer any concerns about the application of the triage algorithm, providing a chance to reflect on these concerns in approaching future decisions. The review committee does not have the authority to change a decision made by the triage officer. According to the New York State Department of Health and New York State Task Force on Life and the Law,[7] an appeals process could create the potential for unworkable delays in the midst of a crisis.

PALLIATIVE CARE

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

Under normal medical circumstances, symptom relief plays a complementary role to curative measures until it is decided to transition to palliation as the primary goal. In a mass disaster with limited life-sustaining resources, more individuals may be denied curative treatment and the primary treatment focus for them will shift to palliation. As occurred in the aftermath of Hurricane Katrina, health-care professionals may encounter difficult decisions as they try to relieve suffering.[44] During challenging times, it is imperative to uphold the ethical commitment to alleviate discomfort without intentionally hastening death; euthanasia is not acceptable. Thus, it is mandatory that mass disaster preparation anticipates palliation for large numbers of individuals.

Once resources become limited and individuals enter a triage process, some patients will be allowed access to ongoing curative attempts, while others will be allocated to a comfort-only pathway. For both groups, care should include alleviation of discomfort. Detailed discussion of palliative care in the critically ill is beyond the scope of this article and can be found elsewhere.[45–50]

ETHICAL COMMITMENTS

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

In order to approach the equitable allocation of scarce resources, the Task Force used the following ethical commitments to serve as a framework in establishing the preceding triage process (see below).

Limitation of Individual Autonomy: The fair and just rationing of scarce resources requires public health decisions based on objective factors, rather than on the choice of individual leaders, providers, or patients. All

Table 7—*Medical Record Documentation Suggestions*

In the event of EMCC, patient records should include specific notations highlighting the following:

1. A state of declared emergency exists, and the emergency response system of the facility has been activated.
2. All existing resources and surge capacity of the institution and the region have been overwhelmed and/or exhausted.
3. No obvious resource capability is imminent, and a mass triage strategy has been instituted per hospital instruction that will result in rationing of care.
4. A triage officer/team has made the assessment to withhold a resource and is acting in a nondiscretionary manner and with the approval of the regional incident commander and in concert with state emergency declarations and enacted legal protections.
5. All existing medical modalities for supportive care and for alleviation of suffering will be instituted or continued.

Internal records (by triage committee) should include:

1. All patients receiving critical care services for whom reallocation of critical care resources is seriously considered, whether those resources are reallocated or not. There should be an explanation and rationale for why patients who had their critical care resources reallocated were selected, compared with those who were not.
2. All patients seeking critical care services who are not already receiving them, the priority ranking of these patients, and which patients ultimately are admitted to critical care.

individuals should receive the highest level of care given the resources available at the time.[1]

Transparency: Governments and institutions have an ethical obligation to plan allocation through a process that is transparent, open, and publicly debated.[30] Governmental honesty about the need to ration medical care justifies institutional and professional actions of withholding and withdrawing support from individual patients. These restrictive policies must be understood and supported by medical providers and the public, ideally with reassurances that institutions and providers will be acting in good faith and legally protected in their efforts.

Justice/Fairness: The proposed triage process relies on the principle of maximization of benefit to the population served. The triage process treats patients equally based on objective, physiologic criteria, and when these criteria do not clearly favor a particular patient, "first come, first serve" rules will apply. The triage process addresses only those in the acute hospital setting in need of the scarce resource and will not apply to individuals with long-term reliance on the scarce resource (*ie*, long-term mechanical ventilation) in a long-term care facility prior to the mass casualty event. Communities and states may have different approaches to these patients.[7] These individuals will be subject to the triage process should they need acute hospitalization, and resources will be allocated according to predefined criteria.

In order to ensure "procedural justice," a standardized and equitable practice that conforms to the rules in place, any triage operation should be regularly and repeatedly evaluated to guarantee that the process has been followed fairly.[51] This evaluation process will promote medical provider compliance; eliminate administrator, governmental, or physician overrule (special pleadings or "favors"); and facilitate consistency. Owing to the critical illness of patients and the limitations of the scarce resource(s), this evaluation process will need to be efficient and frequent. Direct appeals to the triage procedure may be impractical based on the urgency with which the allocation decision must be made. Individual physicians, administrators, or government officials should not be able to overrule a "good faith" decision made by a triage officer in compliance with the triage process. Because all patients will share the same pool of resources, the standard of care and triage process should apply to all patients, whether their condition is directly attributable to the mass casualty event or results from other underlying pathology or circumstances. If there is a challenge to procedural justice (*ie*, the process was not followed according to established criteria), then an appeal is indicated.

Legal Implications for Health-Care Professionals

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

Given the profound circumstances under which the algorithm would be activated, government action is needed to reassure providers and ensure consistent allocation of critical care resources across institutions.[52] The legal "standard of care" for medical malpractice arises from multiple sources (including evidence-based guidelines and customary medical practice) but is not generally a matter for government comment. This case should be different. As this algorithm is untested (and unprecedented outside of battlefield conditions), it might not guarantee that a judge or jury sitting in a malpractice case would exonerate a provider who acts in accordance with the suggested framework.[53] Nor can publication of a triage protocol block a criminal action where state law could be interpreted to criminalize provider compliance with the algorithm.[54] Therefore, government endorsement of an algorithm process ideally would shield from liability practitioners and institutions acting in good faith.

Algorithm Compliance: While a proposed algorithm may need to be revised once the conditions of the mass casualty event are better understood, such revisions should be made uniformly, ideally by an expert group at the state or federal level that can integrate emerging data into the algorithm. *Ad hoc* departures from the algorithm are ethically and legally unwise.

Establishing a triage algorithm as the standard of care during a mass casualty thus raises the issue of how to address noncompliance. It is essential to maintain the integrity of the triage process by preventing deviations from the algorithm, whether they deny treatment to patients who should receive it or provide or maintain treatment for patients who should not receive it. As a legal matter, if a triage algorithm constitutes the standard of care during a mass casualty event, then a patient "next in line" for a ventilator might pursue a claim against the provider for failure to treat. One proposed law, the Model State Emergency Health Powers Act, contemplates revising state medical licensing requirements during a public health emergency to compel provider compliance with emergency treatment requirements.[55] Whether such a provision would be appropriate for enforcing the provision of critical care in accord with triage allocation of scarce resources warrants further discussion.

Future Areas of Research

Although significant strides have been made in developing protocols for critical care triage in overwhelming mass casualty events, we remain in the very early developmental stages of preparing for triage situations. Much of the work done to date relies on the extrapolation of research findings not intended for use in triage, as well as expert opinion. Given the importance of the decisions being made in the triage process, further research is required in the domains of science, process, ethics, and law.

The first priority of research regarding the science of triage is to rigorously assess the operational and outcome validity of the currently suggested processes and protocols for triaging critically ill adults. Current clinical practice should be assessed to determine if the variables included in the suggested protocol are routinely recorded. Further, the impact of triage protocols must be studied both to determine the impact the protocol can have on making available resources and, most importantly, to thoroughly describe the consequences for those who are excluded from critical care. A variety of methods, including retrospective database analysis and computer modeling, can be used to answer various aspects of these questions.

Looking forward, there is a need to refine or redefine the illness severity scoring systems used in critical care triage protocols. The protocols proposed to date have used the SOFA score.[8,9] The SOFA score is not ideal for triage in an emergency. Future research should attempt to validate the use of pulse oximetry in place of the Pao_2. Further, it may be possible to identify a select subset of the variables included in the SOFA score that are predictive for use in triage, thus improving the ease of use of the scoring system in the setting of limited resources. Ideally, researchers will be able to develop an illness scoring system specifically for use in triage, incorporating only the information that will be readily available during an emergency, such as vital signs and other simple physiologic findings (*eg*, anuria, high oxygen requirements). The area most desperately in need of future study is pediatric triage, with few scoring systems available for critical care triage (Table 8).

Research opportunities exist to study all process aspects of triage protocols from conception through implementation and communication. The development of critical care triage protocols has been undertaken primarily by health-care professionals. Most of those involved in triage protocol development agree that there is a need for public consultation and input.[9,56,57] Studies assessing various mechanisms for soliciting manageable and meaningful public input would be of great value to those charged with developing triage protocols. In the past, triage has primarily been conducted in military or paramilitary structures with clear command and control processes.[58] In the community, critical care triage will be conducted primarily by civilian health-care workers practicing in either the public or private sector. Further investigation is necessary to better

Table 8—*Pediatric Triage Topics in Need of Further Study*

1. Improving the availability of pediatric specific medications and equipment prior to the disaster.
2. Improving a system of regionalization of pediatric critical care during a mass casualty disaster.
3. Designing a system whereby clinicians trained in pediatric critical care may supervise and instruct personnel not so trained.
4. Designing a system to insure that families with pediatric casualties may be kept together or reunified when pediatric critical care services are no longer required.
5. Designing key systems to be adaptable to the needs of children; for example, decontamination showers that do not result in hypothermic issues for children and that are large enough for both the child and caregiver.
6. Designing systems to effect rapid, effective, family-focused evacuation from schools and other areas where large numbers of children congregate.

understand how these cultures function during emergencies and what processes will be required to facilitate triaging. These investigations can employ various sociologic methodologies during both real disasters and disaster exercises. Finally, much work is still required to provide advice regarding the appropriate strategies to teach triage to those who will be doing it, communicating triage principles to the public, and finally, how best to communicate triage decisions to the families of the patients involved.

The final areas requiring further exploration are ethics and the law. Much work has already been done to outline the ethical considerations related to triage in general.[57] However, this work must be reassessed to see if the same considerations apply to critical care triage, particularly in settings such as pandemics and in health-care systems in which preexisting inequities exist. The above discussion, although far from exhaustive, highlights the work that remains to be done to adequately prepare society for responding to mass casualty events. Clearly, with this amount of work still to be done, there is no time to be complacent or assume that the triage protocols outlined in this paper and elsewhere will be sufficient to address resource shortfalls in a mass casualty event.

Appendix

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Definitive Care for the Critically Ill During a Disaster: A Framework for Allocation of Scarce Resources in Mass Critical Care: From a Task Force for Mass Critical Care Summit Meeting, January 26 27, 2007, Chicago, IL

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