Treatment and triage recommendations for pediatric emergency mass critical care

Michael D. Christian, MD, FRCPC; Philip Toltzis, MD; Robert K. Kanter, MD; Frederick M. Burkle Jr, MD, MPH, DTM, FAAP, FACEP; Donald D. Vernon, MD, FCCM, FAAP; Niranjan Kissoon, MD, FRCP(C), FAAP, FCCM, FACPE; for the Task Force for Pediatric Emergency Mass Critical Care

Introduction: **This paper will outline the Task Force recommendations regarding treatment during pediatric emergency mass critical care, issues related to the allocation of scarce resources, and current challenges in the development of pediatric triage guidelines.**

Methods: **In May 2008, the Task Force for Mass Critical Care published guidance on provision of mass critical care to adults. Acknowledging that the critical care needs of children during disasters were unaddressed by this effort, a 17-member Steering Committee, assembled by the Oak Ridge Institute for Science and Education with guidance from members of the American Academy of Pediatrics, convened in April 2009 to determine priority topic areas for pediatric emergency mass critical care recommendations.**

Steering Committee members established subcommittees by topic area and performed literature reviews of MEDLINE and Ovid databases. The Steering Committee produced draft outlines through consensus-based study of the literature and convened October 6–7, 2009, in New York, NY, to review and revise each outline. Eight draft documents were subsequently developed from the revised outlines as well as through searches of MEDLINE updated through March 2010.

The Pediatric Emergency Mass Critical Care Task Force, composed of 36 experts from diverse public health, medical, and disaster response fields, convened in Atlanta, GA, on March 29–30, 2010. Feedback on each manuscript was compiled and the Steering Committee revised each document to reflect expert input in addition to the most current medical literature.

Task Force Recommendations: **Recommendations are divided into three operational sections. The first section provides pediatric emergency mass critical care recommendations for hospitals that normally provide care to pediatric patients. The second section provides recommendations for pediatric emergency mass critical care at hospitals that do not routinely provide care to pediatric patients. The final section provides a discussion of issues related to developing triage algorithms and protocols and the allocation of scarce resources during pediatric emergency mass critical care. (Pediatr Crit Care Med 2011; 12[Suppl.]: S109–S119)**

KEY WORDS: **critical illness; emergency mass critical care; medical surge capacity; pediatric; resource allocation; treatment; triage**

This paper will outline the Task Force recommendations regarding treatment during pediatric emergency mass critical care (PEMCC) and will also consider issues related to the allocation of scarce resources during PEMCC. Emergency mass critical care (EMCC) as a general concept is an approach to extend supplies and resources in an attempt to provide critical care to the largest number of patients possible during a disaster (1–3). EMCC is, in essence, a surge-response strategy used for responding to major disasters. As such, it should be incorporated into the continuum of surge response from conventional care through contingency care to crisis care (4). However, EMCC is not only a modification of the process of care, but it is also a modification of the standards of care, shifting to crisis or disaster standards. The shift in the standard of care is necessitated by changes in the personnel (staff) used to provide critical care, the places where critical care may be delivered (space), and the supplies available for providing this care (stuff). PEMCC is the application of EMCC in a pediatric context and is accepted as a tripling of pediatric intensive care unit (PICU) capacity for at least 10 days. This paper will outline the Task Force recommendations regarding treatment during catastrophic events, issues related to the allocation of scarce resources, and current challenges in the development of pediatric triage guidelines.

From Canadian Force (MDC), Department of National Defence, Canada; Mount Sinai Hospital/University Health Network, Toronto, ON, Canada; Department of Medicine, University of Toronto, Toronto, ON, Canada; Division of Pharmacology and Critical Care (PT), Rainbow Babies and Children's Hospital, Case Western Reserve University, Cleveland, OH; Department of Pediatrics (RKK), SUNY Upstate Medical University, Syracuse, NY; Harvard School of Public Health (FMB), Cambridge, MA; Department of Pediatrics (DDV), and the Intermountain Injury Control Research Center, University of Utah School of Medicine, Salt Lake City, UT; Vice President, Medical Affairs (NK), British Columbia Children's Hospital and Sunny Hill Health Centre; BCCH and UBC Global Child Health, Department of Paediatrics and Emergency Medicine, University of British Columbia, Child and Family Research Institute, Vancouver, British Columbia, Canada.

The Pediatric Emergency Mass Critical Care Task Force was supported, in part, by the Centers for Disease Control and Prevention.

Disclaimer: The views expressed in this article are those of the authors and do not represent the official position of the Centers for Disease Control and Prevention or the Canadian Forces, Department of National Defence.

Dr. Christian has received grants from the Canadian Institutes of Health Research. The authors have not disclosed any potential conflicts of interest.

For information regarding this article, Email: michael.christian@utoronto.ca

DOI: 10.1097/PCC.0b013e318234a656

The Task Force recommendations presented within this paper were developed from peer-reviewed data, literature reviews, similar guidelines first originated by the Adult Task Force on EMCC (1, 3, 6), and from expert opinion. This approach was taken for a number of reasons. First, it was concluded that, to the degree feasible, maintaining consistency between recommendations from the two task forces would facilitate overall preparedness, particularly among those who provide care to both adults and children, and would foster greater confidence among the healthcare community. Further, the Adult Task Force recommendations have to date enjoyed wide distribution and adoption within the healthcare community, forming a working framework and consensus for a standard of care (7). Finally, the Adult EMCC Task Force, which has been working for several years, has already considered many of the same issues that would be addressed in response to large volumes of critically ill pediatric patients in a surge capacity environment (1, 8, 9).

Recommendations are divided into three operational sections. The first section provides PEMCC recommendations for hospitals that normally provide care to pediatric patients. The second section provides recommendations for PEMCC at hospitals that do not routinely provide care to pediatric patients. The final section provides a discussion of issues related to developing triage algorithms and protocols and the allocation of scarce resources during PEMCC.

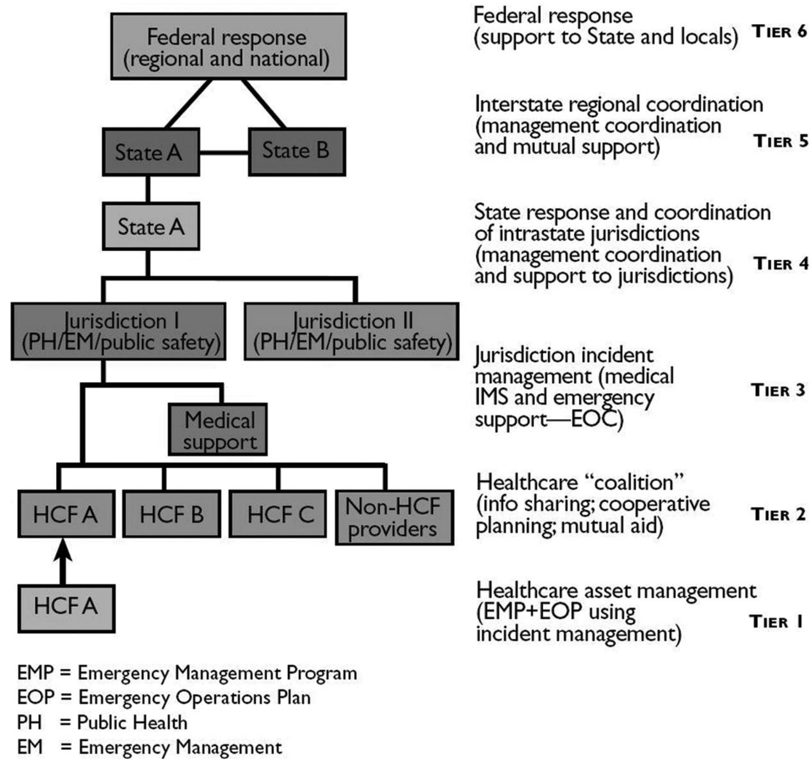

Figure 1. This six-tier construct depicts the various levels of health and medical asset management during response to mass casualty or complex incidents. The tiers range from the individual Health Care Facility (*HCF*) and its integration into a local healthcare coalition, to the coordination of federal assistance. Each tier must be effectively managed internally to coordinate and integrate externally with other tiers. Source: Medical Surge Capacity and Capability: A Management System for Integrating Medical and Health Resources During Large-Scale Emergencies. U.S. Department of Health and Human Services, 2004.

PEMCC in pediatric hospitals

1) Every hospital with a PICU or neonatal intensive care unit (ICU) should plan and prepare to provide PEMCC and should do so in coordination with regional health planning efforts and decisions. This recommendation addresses a number of issues that the Task Force believes to be significant concerns. First, the Task Force strongly believes that all hospitals that provide critical care services to pediatric or neonatal populations have a duty and responsibility to prepare for the delivery of PEMCC in a crisis situation. As outlined in the article, "Pediatric emergency mass critical care: Focus on family-centered care," children are a particularly vulnerable population during disasters, and there are limitations in the number of facilities that are capable of caring for critically ill children due to the regionalized nature of most pediatric systems (10). Further, evidence from modeling exercises suggests that PEMCC combined with coordinated patient distribution would be the most effective means of decreasing excess mortality in a disaster (11).

The second key aspect of this recommendation is the need for hospitals to undertake their preparedness activities in a coordinated fashion. Regional coordination of the healthcare response to a disaster may occur via formalized systems organized by government bodies, such as a local Department of Public Health, or informal networks, such as regional health coalitions, Emergency Medical Services for Children, Pediatric Critical Care Centers, Emergency Departments Approved for Pediatrics, and Standby Emergency Departments Approved for Pediatrics (12). Discussion of system coordination and the role neonatal ICUs can serve as a surge entity in a disaster are presented in detail in the article, "Neonatal and pediatric regionalized systems in pediatric emergency mass critical care"; however, in general, the system should be organized in a hierarchy of tiers as described by Barbera and Macintyre (13), building from the local level up to the national level (Fig. 1).

2) Hospitals with ICUs should plan and prepare to provide PEMCC each day of the response for a total critically ill patient census at least double the PICU bed capacity and at least triple the usual ICU capability. This recommendation was adopted primarily to maintain consistency with the Adult Task Force guidelines. As with the recommendation for adult EMCC, little evidence is available to guide selection of the specific target numbers that should be used to maintain surge preparedness. The United States National Planning Scenarios (14) outline several possible disaster scenarios that would create hundreds to thousands of critically ill adults and children over broad geographical regions. If an event of such magnitude were to occur, critical care surge capability of at least triple the usual PICU capability would be required, even with the institution of PEMCC. Day to day, very little surge capacity exists within the current pediatric critical care system, since most PICUs operate at nearly their total capacity. As discussed in the article, "Supplies and equipment for pediatric emergency mass critical care,"

there are far fewer pediatric than adult critical care beds. The potential surge required may be even higher than that required for adult critical care beds. However, the Task Force recognizes that even the stated recommendation of tripling PICU capability will be a significant stretch for many hospitals. Therefore, at this time, asking hospitals to consider planning beyond this level does not seem feasible. Given that pediatric hospitals face many of the same limitations regarding "staff, stuff, and space" that adult hospitals confront (5, 15, 16), it is reasonable to expect that they too would strive for the same target objectives as adult hospitals. Although each hospital is ultimately responsible for ensuring that adequate preparations have been made for surge management, this does not mean they alone must bear the burden for stockpiling. Hospitals and governments within a region may collaborate on planning and stockpiles.

3) Hospitals should prepare to deliver PEMCC for at least 10 days without sufficient external assistance. When preparing to deliver PEMCC, it is important to recognize that even if external assistance is available, it will likely take several days for external teams and resources to be mobilized. Although a number of disaster response teams exist, such as Disaster Medical Assistance Teams (17, 18), they are predominately geared toward providing primary care and some acute care medical management. The teams do not have the capacity to provide sustained critical care for either adult or pediatric populations (8, 19). To provide support for PEMCC, personnel would have to be mobilized from other pediatric critical care centers, a process that takes substantially longer than deployment of Disaster Medical Assistance Team-type rapid response and may be delayed by logistic issues, such as credentialing. An additional consideration relates to maintaining facility continuity of operations if it experiences infrastructure failure during the disaster, as was experienced during Hurricane Katrina (20, 21). Further, in a pandemic-type scenario where all hospitals in a broad geographic region are impacted, there may be little or no ability to mobilize external resources.

4) PEMCC should include, when applicable, the following:

- Mechanical ventilation
- Intravenous fluid resuscitation
- Vasopressor administration
- Antidote or antimicrobial administration for specific disease
- Sedation and analgesia
- Select practices to reduce adverse consequences of critical illness and critical care delivery
- Other optimal therapeutics and interventions, such as enteral nutrition and renal replacement therapy
- Reducing cold stress
- Age-specific and family-centered care
- Chaplaincy and palliative care

The treatments listed above form the essential components of individual critical care management, although during periods when resources (staff, stuff, and space) are abundant, the care provided to critically ill patients is very complex and involves therapies that go far beyond these basic modalities. During periods of resource scarcity, it is crucial to focus on the core treatments, since this approach guarantees the best opportunity for survivability for the majority of patients. The Task Force's decision to focus on these essential treatments is both practical and pragmatic. In a practical sense, only a limited amount of an organization's resources can be directed toward preparedness activities. These activities, in particular stockpiling, carry with them prohibitive costs in terms of the upfront financial burden of acquiring material, storage, and maintenance for stock, as well as the opportunity cost associated with choosing preparedness over an alternative priority. Thus, one must focus on the essential elements of providing critical care. An even more important consideration in the Task Force's deliberations as to what should be included in PEMCC was the pragmatic consideration of what is operationally feasible during a crisis. Given the limitations imposed by staffing resources in critical care, PEMCC will require clinicians who do not typically work in critical care to assist. With the constraints driven by the limited skill level of those providing care, combined with the limited supply (stuff) and time constraints, it will only be feasible to provide the most essential therapies.

Specific details about the supplies required for providing PEMCC are discussed in the article, "Supplies and equipment for pediatric emergency mass critical care."

5) All communities should develop a graded response plan for events across the spectrum, from multiple casualty incidents to catastrophic critical care events. These plans should clearly delineate what levels of modification of critical care practices are appropriate for the different disaster-specific surge requirements. Use of PEMCC should be restricted to mass critical care events. Surges in demand for pediatric critical care services exist on a continuum that ranges from minor day-to-day peaks in demand, due to routine epidemiologic fluctuations from events such as operating room demand (day of the week), seasonal events, such as traumas or respiratory syncytial virus, to overwhelming mass illness events caused by pandemics. Hicks et al (4) has described this continuum in terms of conventional care, contingency care, and crisis care. Hospitals must have plans in place to deal with all magnitudes of surges. However, to be executed effectively and efficiently in a disaster, it is important to recognize that hospitals cannot stop at the planning phase, but also need to undertake other activities within the preparedness phase, such as staff training and required disaster exercises (22). PEMCC represents a major alteration of the standards of care and should be restricted to catastrophic mass casualty events (crisis care) where surge capacity efforts have either failed or will not be sufficient to meet the system demands (either observed or expected). In these instances, strategies such as PEMCC can be deployed to maximize the provision of critical care services as well as to optimize resource utilization. Despite the potential benefits of using PEMCC in such circumstances, it is important to recognize any potential harms associated with the decision to implement PEMCC. It should be put into action only when necessary and always with the appropriate checks and balances in place to minimize any risk to the population (1, 6, 7).

6) PEMCC requires one mechanical ventilator per patient concurrently receiving sustained ventilatory support. The Task Force does not feel a suitable substitute for mechanical ventilators exists that would allow appropriate PEMCC to be implemented. Alternative methods for providing ventilation, such as via bag-valve mask, are an essential part of PEMCC in that they serve as a bridge while resources are being mobilized and mechanical ventilators are made available. Manual ventilation has been used successfully via tracheostomy tubes for days in patients with neuromuscular respiratory failure (polio) (23), but this is a

unique situation that cannot readily be extrapolated to settings with other causes of respiratory failure. In these situations, manual ventilation has been used temporarily for hours via endotracheal tubes in the setting of a power failure (24) and weather-related emergencies (25–28). In the patient transport setting, manual ventilation provides similar gas exchange compared to standard mechanical ventilation (29–31). However, evidence generally suggests that manual ventilation with bag-valve masks for prolonged periods is not feasible and carries a higher risk of harm than mechanical ventilation managed by skilled physicians (32).

The specifications for PEMCC mechanical ventilators are discussed in the "Supplies and equipment for pediatric emergency mass critical care" article. Given the expense of mechanical ventilators, individual institutions may not be able to afford to stockpile a sufficient quantity of ventilators to fulfill the stated target of tripling their normal capability. In these circumstances, hospitals should work within their local health coalitions at the regional and/or state levels to develop strategies and stockpiles to meet this target. Further, hospitals should develop and maintain up-to-date inventories of their ventilators so that resources can be efficiently and effectively deployed in the event of a disaster. Beyond the mechanical ventilator itself, a number of consumable supplies are also required to provide mechanical ventilation (e.g., ventilator circuits, endotracheal tubes, suction catheters). Again, further details about these supplies can be found elsewhere in this issue.

7) To optimize medication availability and safe administration, the Task Force recommends that modified processes of care should be considered before an event, such as the following:

- Rules for medication substitutions
- Rules for safe dose or drug frequency reduction
- Rules for conversion from parenteral administration to oral/enteral when possible
- Rules for medication restriction (e.g., oseltamivir if in short supply during an influenza pandemic)
- Guidelines for medication shelf-life extension
- Length-based weight estimates, which should be used if access to scales is limited

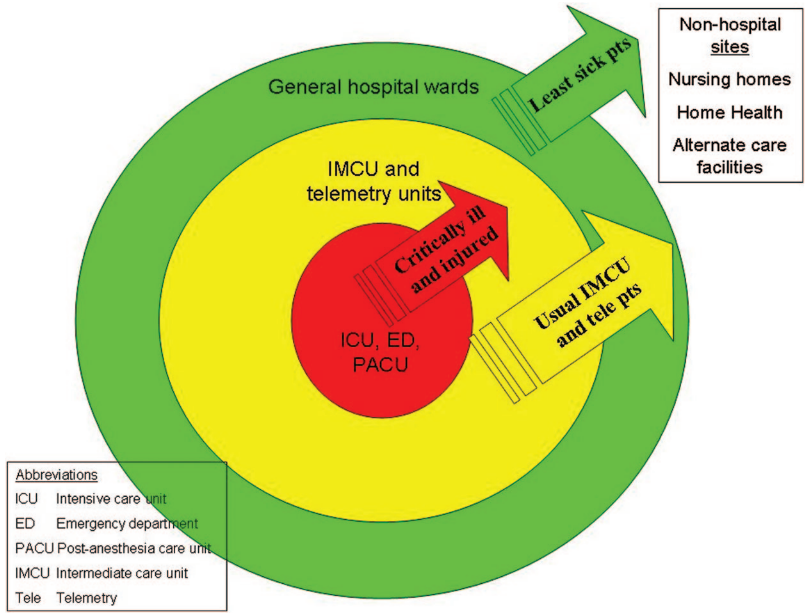

Figure 2. Recommended manner in which to expand critical care areas: initial step. Reprinted with permission from Rubinson et al (3).

During a disaster, particularly a prolonged and/or geographically extensive event, key medications, such as antibiotics and analgesics, may become limited. It is important to establish plans and processes in advance to extend these resources. Substituting an alternative medication from the same class that will provide a similar outcome increases potential options but also facilitates stockpiling by focusing on developing stores of a manageable number of key medications. Converting from parenteral to enteral medications reduces the need for intravenous access, which may present a challenge during PEMCC when noncritical care staffs are required to assist in the provision of care. Shelf-life extensions may become necessary if shortages occur or in the event of supply-chain disruption. However, as with the other recommendations herein, appropriate data, expertise, and evidence are required to safely make these decisions, emphasizing the need for advanced planning. Experts, such as pharmacists, infectious diseases specialists, and pharmacologists, should be consulted when developing such plans. Ideally this consultation will occur at the federal level within agencies, such as the Centers for Disease Control and Prevention and the Food and Drug Administration to provide the appropriate guidance. Finally, during a disaster when time and equipment are limited, the Task Force recommends that length-based weight estimates for drug dosing may allow more efficient patient management.

8) PEMCC ideally should occur in hospitals or similarly designed and equipped structures with experience in providing critical care to pediatric patients (e.g., mobile medical facility designed for critical care delivery or outpatient surgical procedure center). After ICUs, postanesthesia care units, and emergency departments reach capacity, hospital locations for PEMCC 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.

When it becomes necessary to obtain more space for providing critical care, the Task Force recommends that the first areas to convert to additional PICUs should be environments that currently provide care to the highest acuity patients outside of the ICU. This includes functional areas, such as intermediate care units, step-down units, postanesthetic care units, and procedural suites that typically have physical layouts and equipment that can readily allow for conversion to a critical care area. Specifically, they usually have the necessary key infrastructure, such as oxygen, medical gas, and suction. Figures 2 and 3 illustrate the recommended manner in which to expand critical care areas. Unless there has been a disruption of hospital infrastructure, alternative care facilities should be reserved for the lowest

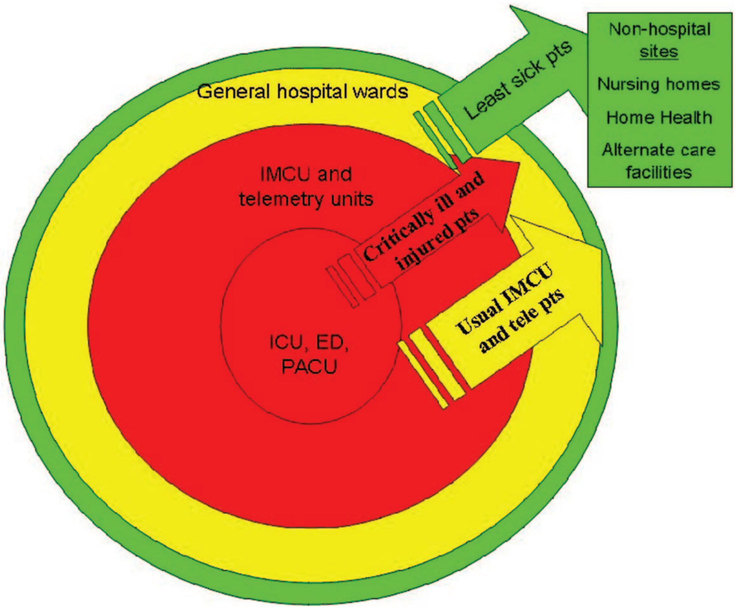

Figure 3. Recommended manner in which to expand critical care areas: progressive step during sustained conditions. Reprinted with permission from Rubinson et al (3).

acuity patient from a hospital while the highest acuity patients, including the critically ill, should be managed within the hospital. Multiple factors limit the ability to effectively and safely provide critical care in temporary alternative care settings. First, key infrastructure, such as oxygen and suction, are difficult to provide in adequate amounts within temporary facilities for more than brief periods. Even if the infrastructure necessary to provide critical care is available, the management of critically ill patients often requires various consultative services or interventions, such as surgery and radiology, which will not be available at the alternate care site. Therefore, it is most appropriate to manage critically ill patients within a hospital where these services are close at hand and use alternative care sites to manage less acute patients.

9) Principles for staffing models should include the following:

- Strategies to achieve and maintain adequate staffing levels should be developed.
- Patient care assignments for units should be managed by the most experienced clinician available.
- Assignments should be based on staff abilities and experience.
- Delegation of duties that usually lie within the scope of some workers' practice to different healthcare workers may be necessary and appropriate under surge conditions.
- Systematic efforts to reduce care variability, procedure complications, and errors of omission must be used when possible.

To expand critical care capacity during PEMCC, the model of care provision must be modified (3, 8). Because critical care human resources are limited (33–35), it will be necessary to employ staff who typically work outside of critical care in the provision of PEMCC. The fundamental principle underlying this recommendation is that it is important to focus on skills rather than job titles. By focusing on the skills that are required to perform PEMCC and matching that with the skills various healthcare workers possess, it is much easier to identify which staff can be redeployed to assist with PEMCC.

One approach to maintain safe practice yet still allow staff expansion through the integration of noncritical care workers is the use of care teams. In the care team model, experienced critical care providers work in partnership with providers who possess certain skills to perform aspects of PEMCC but who do not routinely work in PICUs. For example, instead of the typical 2:1 or 1:1 critical care nurse-to-patient ratio, in PEMCC two critical care nurses may work with three nurses from other areas, such as postanesthesia care or step-down units, for a total of six or seven patient coverage by a care team. The critical care nurses can supervise the noncritical care patients and perform tasks that lie outside the skill set of the other nurses. This model is not all that dissimilar from how residents, fellows, and staff work in teaching hospitals. Project XTREME (Cross-Training Respiratory Extenders for Medical Emergencies) provides an example of how this type of approach can be applied to respiratory therapy needs in disaster response by training healthcare providers to function as "respiratory therapy extenders" capable of managing mechanical ventilators under supervision (36).

PEMCC in nonpediatric hospitals

1) All hospitals must plan for the care of some children:

- Hospitals with neonatal ICUs will need to manage pediatric patients beyond their typical age limits.
- Adult hospitals should provide stabilization of critically ill pediatric patients pending transfer.
- Adult hospitals should plan to provide care for noncritically ill pediatric patients other than infants (children with special needs may be an exception).
- Adult ICUs, during a mass casualty event, should keep adolescent patients without consultation and patients older than 5–8 yrs following consultation with pediatrics.

This is likely the most novel and most important recommendation that the Task Force has made. During the review of the current data and during its deliberations, the Task Force recognized that, given the organizational system for pediatric care and the limitations in capacity discussed earlier, the only way to effectively save children's lives would be to draw upon the proportionally larger pool of resources within nonpediatric hospitals. The implications of the regionalized model for the delivery of pediatric care and the ethical issues related to the allocation of resources between adults and children during a disaster are both discussed in detail elsewhere in this publication. The current discussion will focus on the recommendations for providing PEMCC in nonpediatric hospitals.

When considering how to safely engage nonpediatric hospitals in the care of children during a disaster, the fundamental principle used to guide the Task Force's recommendations is that the most complex and most acutely ill children should be managed at pediatric hospitals that have the most experience in treating such patients. Thus, nonpediatric hospitals should only be asked to manage less acutely ill children or critically ill children that are the least physiologically different from adult patients (i.e., adolescents). Nonpediatric hospitals should include a pediatrician or pediatric medical liaison in those committees responsible for disaster planning, appeals, and determining when crisis standards of care should be implemented. New York State has published guidance for nonpediatric hospitals to manage pediatric patients during a disaster (http://www.omh.state.ny.us/omhweb/disaster_resources/pandemic_influenza/hospitals/bhpp_focus_ped_toolkit.html).

An equally important rationale prompting the Task Force to make this recommendation is evidence indicating that the majority of victims will self-extricate from the site of the disaster and present to any hospital, often the closest, but not necessarily the hospital that authorities direct patients to use (37). As a result, many nonpediatric hospitals may be faced with critically ill pediatric patients presenting at their doors, particularly if entire families are affected as a unit. Under normal circumstances, most nonpediatric hospitals have plans and processes to provide initial resuscitation or stabilization of pediatric patients in the emergency departments but then proceed with very early transfer of the pediatric patient to a pediatric facility. In the event of a large-scale disaster, rapid transfer may not be feasible. First, given their resource limitations, pediatric hospitals will likely be overwhelmed very quickly and therefore may not be able to accept transfers. Additionally, transportation may not be available depending on the nature of the disaster. In many circumstances, emergency medical services resources will be fully committed to the on-scene response, negating any interfacility transfers. Finally, the transport of critically ill patients is very staff intensive and takes nurses, respiratory therapists and physicians away from areas of need (5).

2) During a disaster, it may be more efficient to transfer skilled pediatric critical care teams to nonpediatric centers to support those facilities in providing care to critically ill pediatric patients. However, if healthcare workers are going to be moved between institutions, then hospitals and government authorities must be prepared to credential incoming teams expeditiously. When it is not feasible or efficient to transfer individual pediatric patients for management at a pediatric facility, an alternative consideration would be to dispatch teams of pediatric providers to nonpediatric facilities to support them in managing pediatric patients there. Not only does this approach relieve the pressure on the pediatric sites, it also likely provides for safer care of pediatric patients in nonpediatric centers and provides a "force-multiplier" effect similar to the care team model discussed above. Finally, the transportation of the pediatric teams to the nonpediatric hospital does not require a vehicle fitted for patient transport. Other modes of emergency or nonemergency transportation can be used. This is particularly effective if the nonpediatric hospital already has a store of the necessary pediatric equipment on site. Equipment recommendations for nonpediatric hospitals are presented in the New York State guidance mentioned earlier (http://www.omh.state.ny.us/omhweb/disaster_resources/pandemic_influenza/hospitals/bhpp_focus_ped_toolkit.html). If nonpediatric hospitals do not have the pediatric equipment needed to sustain critically ill patients, pediatric critical care teams may need to take their own equipment.

A significant limitation of this approach, and a problem frequently faced in disaster response, is the difficulty associated with credentialing (9, 38, 39). For such an approach to work, a system for rapid credentialing or advanced credentialing would be required. Government bodies and professional colleges can prepare for disasters by developing programs to credential healthcare workers in advance, such as the Emergency System for Advance Registration of Volunteer Health Professionals and Medical Reserve Corps/National Disaster Medical System (http://www.medicalreservecorps.gov/File/ESAR_VHP/ESAR-VHPMRCIntegrationFactSheet.pdf). One possible alternative to avoid these difficulties is to use telemedicine technologies to provide pediatric support to nonpediatric hospitals (See the article, "Pediatric emergency mass critical care: The role of community preparedness in conserving critical care resources").

3) A referral network for pediatrics consultation or transfers should be established to support hospitals that do not normally receive pediatric patients. With adult hospitals providing care for some pediatric patients during a disaster, consultation and pediatrician support will be required for these facilities. While most adult centers see children in their emergency departments and thus have some experience with transferring such patients to a pediatric referral center, such transfer arrangements are often of an informal, *ad hoc* nature; therefore, it is prudent to provide adult hospitals with a plan for referral and consultation in advance of a disaster. When developing this referral network, it is important to consider all pediatric resources within a region and not academic centers only. There may in fact be nonacademic centers near the affected hospital that can quite capably provide advice and/or management.

4) Nonpediatric hospitals should preidentify hospital staff (physicians, nurses, nurse practitioners, physicians assistants) with experience in care of pediatric patients (may include emergency medicine, anesthesia, otolaryngology, trauma surgery, general surgery, and certain medical specialties or nurses with past experience in pediatrics), create key positions in which these individuals would serve (including job action sheets), and integrate them into the hospital's plan to manage pediatric patients. It is important to remember that, even in an adult hospital, there may be staff who have experience working with pediatric patients. These staff members can form a cadre from which to draw in the event of a disaster involving many critically ill children.

Triage

For centuries, many have struggled with the issue of how to manage situations where healthcare resources (supplies) do not meet the demands. Although present to some degree in many healthcare systems on a daily basis, resource allocation decisions often become most apparent and pressing during acute surges in demands, such as disasters. When faced with a shortfall of resources, a number of potential options exist for allocating the available resources. The default option would be to do nothing and just continue practice as normal on a first-come, first-serve basis until all the available resources are used. Although this approach requires the least deviation from normal practice, excess mortality is the likely result, and the public and healthcare professionals tend to consider it an unacceptable response to crisis situations. Further, this approach may exacerbate preexisting discrepancies in access to healthcare based on economic, social status, or other factors. As an alternative, one may consider a lottery approach for the allocation of scarce resources (40). If conducted properly, this approach to triage would overcome the issues of perpetuating various discriminations in access, but it is not feasible because of logistic issues, the most significant being that it is impossible to know in advance who is going to be injured or fall ill and require a medical resource.

Faced with similar challenges during the 1700s, the Surgeon General of Napoleon's army issued the first rules of triage (French for "to sort") whereby he directed that the wounded should be treated in priority of their injuries rather than their rank or status. From this point onward, triage has become the primary method for allocating scarce resources and has evolved to have two functional components: the first to sort or prioritize patients, and the second to ration resources to optimize their availability so they may be directed to the patients who are most likely to benefit from them. This concept of triage is based on utilitarian principles and is the most common, but it is not the only approach that can be taken. Alternative perspectives, such as that of egalitarianism whereby resources would be directed to those most in need, could also be taken. The ethics of triage have been extensively discussed elsewhere (40–43).

Regardless of the particular goals used to guide the development of triage, the process of triage is an iterative one that occurs at multiple points along the continuum of care: primary triage (prehospital decisions concerning priority for referral to health facilities, such as hospitals or alternate care sites); secondary triage (emergency department decisions concerning initial priority for primary treatment); and tertiary triage (decisions regarding priority for definitive management and critical care). Critical elements of triage at any level, when using a utilitarian approach, are knowledge of the demand on the system, knowledge of the supply of resources, and the ability to predict which patients will or will not benefit from the resources. Systems-level triage also occurs at command and control levels concerned with how resources will be distributed at the macro level via the health emergency operations center (44).

In addition to the variability in the possible goals of tertiary triage (e.g., utilitarian vs. egalitarian principles), the process of undertaking tertiary triage also varies greatly. Traditionally, primary and secondary triage has been conducted by a sole triage officer (or multiple, independently functioning triage officers) based on either protocols (typical for primary and secondary triage) (45–48) or expert experience and judgment (tertiary triage in trauma settings). Although protocols have been developed for primary and secondary triage, virtually none of these are evidence based or have validated outcomes of their performance in real-time disasters (49). However, with the development of proposed adult tertiary triage protocols (6, 50, 51), some groups (52) have suggested the use of a triage panel or committee. While this may be beneficial in diffusing responsibility and the pressure of decision making from any one individual, committee-based decision making is cumbersome under the best of circumstances and unlikely to be feasible or efficient in the midst of a disaster, particularly for time-sensitive decision-making. The Adult EMCC Task Force has considered these issues in detail (6).

The original intent of the Task Force Steering Committee was to propose a protocol for allocating scarce pediatric critical care resources (tertiary triage) during a disaster. Currently, the Task Force is unable to identify a pediatric prognostic scoring system, a critical factor required for the development of a tertiary triage protocol that would be appropriate for use. Although several pediatric prognostic scores are used for research purposes (Table 1), their performance characteristics limit their utility in directing resource allocation. The proposed adult tertiary triage protocols use prognostic scoring systems to identify patients who have an excessively high mortality despite critical care therapy, thereby allowing resources to be directed to patients who are most likely to benefit (6, 43, 50). The current pediatric scoring systems fail to sufficiently discriminate between those who are likely to survive and those who are not. The Pediatric Risk of Mortality II score, for example, has been used extensively since it was introduced in 1988, but has had waning reliability in predicting mortality over the past decade, and has never performed well among populations with particular conditions and from selected locations outside of North America. Its successor, the Pediatric Risk of Mortality III, has improved discrimination and is continually being refined with newer and larger patient datasets, but to date remains proprietary. Studies (53–61) describing the Pediatric Index of Mortality II score have documented good discrimination between PICU survivors and nonsurvivors, but the score has been tested primarily in Australia, New Zealand, and the United Kingdom, and its performance in broader populations remains uncertain. Additional to these considerations, given the physiologic resiliency that children possess, mortality rates even in the most critically ill children are still very low compared to the adult ICU population. Thus, pediatric triage algorithms driven solely by tools that predict a high risk of mortality are unlikely to have a significant impact on the allocation of PICU resources, since only a very small proportion of children are likely to reach the probability-of-mortality threshold at which resources will be withheld or withdrawn.

Recently, several pediatric protocols have been proposed that use exclusion criteria based on preexisting conditions for the use of life support in pediatric patients during a catastrophic event. Unfortunately, the Task Force concluded that it could not endorse these protocols. Although the Task Force did not outright reject the principle of exclusion criteria, the primary difficulty with the proposed exclusion criteria is that they would exclude so few patients that no significant impact on resource availability is likely to be appreciated. The inability of the Task Force to recommend a tertiary triage protocol unfortunately does not negate the potential need for resource allocation decisions to be made if a major disaster were to occur. While the necessary development activities are undertaken to create the components for a pediatric tertiary triage protocol, the Task Force offers the following considerations in the event that resource scarcities occur. The approaches are divided into considerations for sudden-impact disasters and sustained-impact disasters (1).

Sudden-Impact Disasters. Sudden-impact disasters are unexpected and involve trauma from either natural or man-made kinetic events. In such cases, the existing primary and secondary triage protocols are most relevant and should be used. Effective use of primary and secondary triage may mitigate the need for tertiary triage by limiting overtriage (59) and ensuring the most efficient use of available critical care resources. In the event that efforts at surge management,

Table 1. Pediatric prognostic scores

Score	Year introduced	Components	When calculated	Intended use	Performance[a]	Comments
PRISM II (53)	1988	14 component variables: vital signs, lab results, neurologic assessment	Within first 24 hrs of PICU admission	Front-end predictor of mortality	Area under the ROC 0.80–0.94, variable calibration	Largely supplanted by more recent scores
PRISM III	1996	17 physiologic components plus diagnostic categories	Within first 24 hrs of PICU admission	Front-end predictor of mortality	Area under ROC >0.90, variable calibration	Improved performance compared with PRISM II, being constantly recalculated, but requires fee for use
Paediatric Logistic Organ Dysfunction (PELOD) score (54)	2003	Function of 7 organ systems	Final score is tallied by choosing the most abnormal value throughout PICU stay	Outcome measure	Limited calibration	Each organ is scored 0, 1, 10, or 20, depending on degree of dysfunction, rendering the score noncontinuous
PIM II (55)	1997	8 variables: reason for PICU admission, underlying condition, pupillary response, PaO_2 and FIO_2, base excess, blood pressure, need for mechanical ventilation	Within the first hour of presentation	Front-end predictor of mortality	Area under the ROC 0.80–0.92, limited calibration	Supplanted by PIM2
PIM2 (56–58)	2003	10 variables: readily available components of physical exam, admission lab values, diagnostic categories	Within the first hour of presentation	Front-end predictor of mortality	Area under the ROC approaches 0.9, variable calibration	Easy to use

PICU, pediatric intensive care unit; PRISM, Pediatric Risk of Mortality; PIM, Pediatic Index of Mortality.

[a]Performance of a prediction score is commonly measured by "discrimination" (the ability of the score to distinguish subjects regarding a dichotomized outcome, such as life versus death) and "calibration" (the score's ability to predict outcome in a population independent of the one used to develop the score). Discrimination is usually quantified by measuring the area under the receiver operating curve (ROC), where area under the ROC = 0.5 indicates that the score has no better predictive power than chance alone; the greater the area under the ROC, the better the discriminatory power.

including PEMCC, are insufficient to meet the demand, tertiary triage should be conducted by experienced trauma surgeons and/or intensivists (pediatric or adult) using their best medical judgment as is the current standard of practice. As with any triage circumstance, the degree of rationing should be proportional to the expected or realized shortfall in resources, and should be conducted within the framework of an incident management system under the command and control of a regional health authority to ensure all possible resources are mobilized.

Sustained-Impact Disasters. Sustained-impact disasters occur over a prolonged period of time and/or large geographic area and are most likely to result from bioevent disasters, such as a pandemic or bioterrorism event. Unlike sudden event disasters where the vast majority of the patients would be the result of the surge event itself, in a sustained-impact disaster, patients for critical care would be a mixed group comprising patients related to the surge event as well as those with other critical illness/injury conditions. In a sudden-impact disaster (lasting for hours to days at most), the baseline demand for intensive care will result in a proportionately smaller number of patients compared to the numbers generated by the surge event. The baseline demand will be further decreased during a sudden event disaster when elective procedures are all cancelled. As a result, triage decisions are essentially all disease specific (e.g., trauma). In a sustained-impact disaster, the cumulative number of patients as a result of baseline demands for critical care is proportionally much higher. Further, in a sustained-impact disaster it is not possible to stop all surgical procedures or other treatments to focus only on the surge event. As a result, triage must address all patients with a variety of illness or injuries, making disease-specific triage protocols (particularly those designed for trauma) of limited utility. Triage at the primary and secondary levels remains important, but tertiary triage becomes much more important and complex.

In the event of a sustained-impact surge when critical care resources are scarce, hospitals should consider withholding or withdrawing care from patients who have do-not-resuscitate orders, experience cardiac arrest, or have intractable hypotension not responsive to vasopressors, or other conditions where critical care is considered futile (60, 61). Under normal circumstances, many of these patients are not admitted to ICU, so it is recognized that these actions are unlikely to significantly impact resource availability and that resources are not squandered unnecessarily. In the event that a critical care resource (e.g., a ventilator) is available, then physicians/hospitals would consider a trial of critical care to identify if the patient will respond to therapy, and would consider withdrawal of life support if the patient does not respond. However, the Task Force is unable to offer any specific recommendations regarding duration for appropriate time trials or markers of response. These issues would fall simply to expert opinion. In the event that there are multiple patients for a single-resource hospital, physicians must decide between using a first-come, first-serve approach or an expert-based (nonprotocolized, nonevidence-based) triage opinion from an experienced physician. Neither situation is ideal and both are fraught with pitfalls. At this juncture, the Task Force cannot recommend one option above the other.

Despite the current inability to propose a tertiary triage protocol for use in pediatric populations, the Task Force continues to support the need for such a protocol to be developed and recommends that researchers work to develop an appropriate scoring system for use in tertiary triage. This effort is likely best coordinated by a collaboration of professional societies (particularly pediatric critical care) supported by government agencies that hold responsibility for emergency management.

The Task Force recommends that a tertiary triage score for use in pediatrics take a different approach than what has been applied in the adult critical care field. Since a PICU allocation algorithm based exclusively on predicting a high likelihood of mortality is unlikely to have a significant impact on resources, ideally a pediatric triage protocol would identify both those patients who are unlikely to survive, regardless of whether they receive critical care, as well as those children likely to require an extended duration of critical care to achieve survival. Using a combination of these outcomes and cumulative incidence, restricting critical care from patients who are unlikely to survive, or who will require a prolonged ICU course, would allow physicians to optimize resource utilization. To have a significant impact on resources, a pediatric triage protocol would have to identify both those children with high predicted mortality (e.g., 80%, as suggested for the adult protocol) and additionally predict excessive resource utilization (e.g., mechanical ventilator utilization) among those with lesser mortality. The thresholds for diverting critical care resources from critically ill children would be fluid, depending on the relative scarcity of those resources. To date, no scoring system, either adult or pediatric, has been developed to perform in this manner.

The Task Force recognizes that critical care is but one element in a health system that is attempting to provide the best opportunity for survival to all those who might benefit. Discipline-directed triage management protocols will only be as important as the manner in which these tertiary level algorithms can be integrated into a larger, system-wide triage scheme that begins at the primary triage care level and ends with whatever additional resources a regional support system can mobilize. Many "uncomfortable but real" decisions that have not, to date, been operationalized at the local level will, out of necessity, be made. Triage management requires an infrastructure, such as health emergency operations centers (as outlined in the article, "Pediatric emergency mass critical care: The role of community preparedness in conserving critical care resources"), central triage committees, data collection/analysis, and triage officer education. Although attempts to provide independent hospital-centric plans are noble, they do not solve what ultimately requires an integrated, population-based, system-wide solution.

CONCLUSION

Disasters producing overwhelming numbers of critically ill children are rare. However, rather than diminishing the importance of planning and preparation, this fact serves to increase the importance of having preparations in place to respond when they do occur, since clinicians have no routine experience in responding to them. This paper presents recommendations for the provision of critical care to large numbers of children and considerations for resource allocation.

ACKNOWLEDGMENTS

The Pediatric Emergency Mass Critical Care Task Force thanks the American Academy of Pediatrics and its Disaster Preparedness Advisory Council for their review and contributions to the issue.

REFERENCES

1. Devereaux A, Christian MD, Dichter JR, et al: Summary of suggestions from the Task Force for Mass Critical Care summit, January 26–27, 2007. *Chest* 2008; 133:1S–7S
2. Rubinson L, Hick JL, Curtis JR, et al: Definitive care for the critically ill during a disaster: Medical resources for surge capacity: From a Task Force for Mass Critical Care summit meeting, January 26–27, 2007, Chicago, IL. *Chest* 2008; 133:32S–50S
3. Rubinson L, Hick JL, Hanfling DG, et al: Definitive care for the critically ill during a disaster: A framework for optimizing critical care surge capacity: From a Task Force for Mass Critical Care summit meeting, January 26–27, 2007, Chicago, IL. *Chest* 2008; 133:18S–31S
4. Hick JL, Barbera JA, Kelen GD: Refining surge capacity: Conventional, contingency, and crisis capacity. *Disaster Med Public Health Prep* 2009; 3:S59–S67
5. Christian MD, Devereaux AV, Dichter JR, et al: Definitive care for the critically ill during a disaster: Current capabilities and limitations: From a Task Force for Mass Critical Care summit meeting, January 26–27, 2007, Chicago, IL. *Chest* 2008; 133:8S–17S
6. Devereaux AV, Dichter JR, Christian MD, et al: 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. *Chest* 2008; 133:51S–66S
7. Institute of Medicine: Guidance for Establishing Crisis Standards of Care for Use in Disaster Situations: A Letter Report. Washington, DC, The National Academies Press, 2009
8. Rubinson L, Nuzzo JB, Talmor DS, et al: Augmentation of hospital critical care capacity after bioterrorist attacks or epidemics: Recommendations of the Working Group on Emergency Mass Critical Care. *Crit Care Med* 2005; 33:2393–2403
9. Rubinson L, O'Toole T: Critical care during epidemics. *Crit Care* 2005; 9:311–313
10. Kanter RK, Moran JR: Hospital emergency surge capacity: An empiric New York statewide study. *Ann Emerg Med* 2007; 50:314–319
11. Kanter RK: Strategies to improve pediatric disaster surge response: Potential mortality reduction and tradeoffs. *Crit Care Med* 2007; 35:2837–2842
12. Courtney B, Toner E, Waldhorn R, et al: Healthcare coalitions: The new foundation for national healthcare preparedness and response for catastrophic health emergencies. *Biosecur Bioterror* 2009; 7:153–163
13. Barbera JA, Macintyre AG: Medical and Health Incident Management (MaHIM) System: A Comprehensive Functional System Description for Mass Casualty Medical and Health Incident Management. Washington DC, Institute for Crisis, Disaster, and Risk Management, The George Washington University, 2002
14. U.S. Department of Homeland Security: National Preparedness Guidelines. Washington DC, 2007
15. Barbisch DF, Koenig KL: Understanding surge capacity: Essential elements. *Acad Emerg Med* 2006; 13:1098–1102
16. Kaji A, Koenig KL, Bey T: Surge capacity for healthcare systems: A conceptual framework. *Acad Emerg Med* 2006; 13:1157–1159
17. Mace SE, Jones JT, Bern AI: An analysis of Disaster Medical Assistance Team (DMAT) deployments in the United States. *Prehosp Emerg Care* 2007; 11:30–35
18. Nufer KE, Wilson-Ramirez G, Shah MB, et al: Analysis of patients treated during four Di

saster Medical Assistance Team deployments. *J Emerg Med* 2006; 30:183–187
19. Franco C, Toner E, Waldhorn R, et al: The national disaster medical system: Past, present, and suggestions for the future. *Biosecur Bioterror* 2007; 5:319–325
20. Berggren R: Hurricane Katrina. Unexpected necessities–inside Charity Hospital. *N Engl J Med* 2005; 353:1550–1553
21. Henderson GS: Hurricane Katrina. Finding supplies. *N Engl J Med* 2005; 353:1542
22. Christian MD, Kollek D, Schwartz B: Emergency preparedness: What every health care worker needs to know. *CJEM* 2005; 7:330–337
23. West JB: The physiological challenges of the 1952 Copenhagen poliomyelitis epidemic and a renaissance in clinical respiratory physiology. *J Appl Physiol* 2005; 99:424–432
24. O'Hara JF Jr, Higgins TL: Total electrical power failure in a cardiothoracic intensive care unit. *Crit Care Med* 1992; 20:840–845
25. Barkemeyer BM: Practicing neonatology in a blackout: The University Hospital NICU in the midst of Hurricane Katrina: Caring for children without power or water. *Pediatrics* 2006; 117:S369–S374
26. Eggertson L: Critical care doctors want escalated pandemic planning. *CMAJ* 2009; 181: 253–254
27. Nates JL: Combined external and internal hospital disaster: Impact and response in a Houston trauma center intensive care unit. *Crit Care Med* 2004; 32:686–690
28. Norcross ED, Elliott BM, Adams DB, et al: Impact of a major hurricane on surgical services in a university hospital. *Am Surg* 1993; 59:28–33
29. Gervais HW, Eberle B, Konietzke D, et al: Comparison of blood gases of ventilated patients during transport. *Crit Care Med* 1987; 15:761–763
30. Hurst JM, Davis K Jr, Branson RD, et al: Comparison of blood gases during transport using two methods of ventilatory support. *J Trauma* 1989; 29:1637–1640
31. Johannigman JA, Branson RD, Johnson DJ, et al: Out-of-hospital ventilation: Bag–valve device vs transport ventilator. *Acad Emerg Med* 1995; 2:719–724
32. Santhanam I, Sangareddi S, Venkataraman S, et al: A prospective randomized controlled study of two fluid regimens in the initial management of septic shock in the emergency department. *Pediatr Emerg Care* 2008; 24:647–655
33. Angus DC, Kelley MA, Schmitz RJ, et al: Caring for the critically ill patient. Current and projected workforce requirements for care of the critically ill and patients with pulmonary disease: Can we meet the requirements of an aging population? *JAMA* 2000; 284:2762–7270
34. Cramer CL, Orlowski JP, DeNicola LK: Pediatric intensivist extenders in the pediatric ICU. *Pediatr Clin North Am* 2008; 55: 687–708, xi–xii
35. Vernon DD: The future of pediatric critical care: *In*: Current Concepts in Pediatric Critical Care. Poss WB, Rowin ME (Eds). Mount Prospect, IL, Society of Critical Care Medicine, 2009
36. Hanley ME, Bogdan GM: Mechanical ventilation in mass casualty scenarios. Augmenting staff: Project XTREME. *Respir Care* 2008; 53:176–188; discussion 189
37. Auf der Heide E: The importance of evidence-based disaster planning. *Ann Emerg Med* 2006; 47:34–49
38. Cone DC, Weir SD, Bogucki S: Convergent volunteerism. *Ann Emerg Med* 2003; 41: 457–462
39. Kaji AH, Lewis RJ: Hospital disaster preparedness in Los Angeles County. *Acad Emerg Med* 2006; 13:1198–1203
40. Moskop JC, Iserson KV: Triage in medicine, part II: Underlying values and principles. *Ann Emerg Med* 2007; 49:282–287
41. Baskett PJ: Ethics in disaster medicine. *Prehosp Disaster Med* 1994; 9:4–5
42. Domres B, Koch M, Manger A, et al: Ethics and triage. *Prehosp Disaster Med* 2001; 16:53–58
43. Powell T, Christ KC, Birkhead GS: Allocation of ventilators in a public health disaster. *Disaster Med Public Health Prep* 2008; 2:20–26
44. Burkle FM Jr, Hsu EB, Loehr M, et al: Definition and functions of health unified command and emergency operations centers for large-scale bioevent disasters within the existing ICS. *Disaster Med Public Health Prep* 2007; 1:135–141
45. Benson M, Koenig KL, Schultz CH: Disaster triage: START, then SAVE–a new method of dynamic triage for victims of a catastrophic earthquake. *Prehosp Disaster Med* 1996; 11: 117–124
46. Iserson KV, Moskop JC: Triage in medicine, part I: Concept, history, and types. *Ann Emerg Med* 2007; 49:275–281
47. Robertson-Steel I: Evolution of triage systems. *Emerg Med J* 2006; 23:154–155
48. Romig LE: Pediatric triage. A system to JumpSTART your triage of young patients at MCIs. *JEMS* 2002; 27:52–53, 60–63
49. Jenkins JL, McCarthy ML, Sauer LM, et al: Mass-casualty triage: Time for an evidence-based approach. *Prehosp Disaster Med* 2008; 23:3–8
50. Christian MD, Hawryluck L, Wax RS, et al: Development of a triage protocol for critical care during an influenza pandemic. *CMAJ* 2006; 175:1377–1381
51. Hick JL, O'Laughlin DT: Concept of operations for triage of mechanical ventilation in an epidemic. *Acad Emerg Med* 2006; 13: 223–229
52. Frolic A, Kata A, Kraus P: Development of a critical care triage protocol for pandemic influenza: Integrating ethics, evidence and effectiveness. *Healthc Q* 2009; 12:54–62
53. Pollack MM, Patel KM, Ruttimann UE: The Pediatric Risk of Mortality III–Acute Physiology Score (PRISM III-APS): A method of assessing physiologic instability for pediatric intensive care unit patients. *J Pediatr* 1997; 131:575–581
54. Leteurtre S, Duhamel A, Grandbastien B, et al: Paediatric logistic organ dysfunction (PELOD) score. *Lancet* 2006; 367:897
55. Ozer EA, Kizilgunesler A, Sarioglu B, et al: The comparison of PRISM and PIM scoring systems for mortality risk in infantile intensive care. *J Trop Pediatr* 2004; 50:334–338
56. Slater A, Shann F, Pearson G: PIM2: A revised version of the Paediatric Index of Mortality. *Intensive Care Med* 2003; 29:278–285
57. Eulmesekian PG, Perez A, Minces PG, et al: Validation of pediatric index of mortality 2 (PIM2) in a single pediatric intensive care unit of Argentina. *Pediatr Crit Care Med* 2007; 8:54–57
58. Wolfler A, Silvani P, Musicco M, Salvo I. Pediatric Index of Mortality 2 score in Italy: A multicenter, prospective, observational study. *Intensive Care Med* 2007; 33: 1407–1413
59. Frykberg ER: Medical management of disasters and mass casualties from terrorist bombings: How can we cope? *J Trauma* 2002; 53:201–212
60. Consensus statement on the triage of critically ill patients. Society of Critical Care Medicine Ethics Committee. *JAMA* 1994; 271:1200–1203
61. Guidelines for intensive care unit admission, discharge, and triage. Task Force of the American College of Critical Care Medicine, Society of Critical Care Medicine. *Crit Care Med* 1999; 27:633–638

APPENDIX

Task force members in alphabetical order

Terry Adirim, MD, MPH, Department of Homeland Security, Washington, DC; Michael Anderson, MD, FAAP, Rainbow Babies and Children's Hospital, Cleveland, OH (Steering Committee); Andrew Argent, MD, University of Cape Town Red Cross War Memorial Children's Hospital, Cape Town, South Africa; Armand H. Antommaria, MD, PhD, University of Utah School of Medicine, Salt Lake City, UT; Carl Baum, MD, Yale-New Haven Children's Hospital, Woodbridge, CT; Nancy Blake, RN, MN, American Association of Critical Care Nurses, Los Angeles, CA; Desmond Bohn, MB, The Hospital for Sick Children, Toronto, Ontario, Canada (Steering Committee); Dana Braner, MD, Oregon Health and Science University, Portland, OR; Debbie Brinker, RN, MSN, American Association of Critical Care Nurses, Spokane, WA (Steering Committee); James Broselow, MD, University of Florida, Hickory, NC; Frederick Burkle, MD, MPH, DTM, FAAP, FACEP, Harvard School of Public Health, Cambridge, MA (Steering Committee); Jeffrey Burns, MD, MPH, Children's Hospital Boston, Boston, MA (Steering Committee); Michael D. Christian, MD, FRCP(C), University of Toronto, Toronto, Ontario, Canada (Steering Committee); Sarita Chung, MD, Children's Hospital Boston, Boston, MA; Edward E. Conway Jr, MD, MS, FAAP, FCCM, Beth Israel Medical Center, New York, NY (Steering Committee); Arthur Cooper, MD, MS, FACS, FAAP, FCCM, FAHA, Columbia University Medical Center, New York, NY; Steven Donn, MD, FAAP, CS Mott Children's Hospital, Ann Arbor, MI (Steering Committee); Andrew L. Garrett, MD, MPH, Department of Health and Human Services, Washington, DC; Marianne Gausche-Hill, MD, FACEP, FAAP, Harbor-UCLA Medical Center, Torrance, CA (Steering Committee); James Geiling, MD, VA Medical Center, White River Junction, VT; Robert Gougelet, MD, New England Center for Emergency Preparedness, Lebanon, NH; Robert K. Kanter, MD, SUNY Upstate Medical University, Syracuse, NY (Steering Committee); Niranjan Kissoon, MD, FRCP(C), The British Columbia Children's Hospital, Vancouver, BC (Steering Committee, Chair); Steven E. Krug, MD, FAAP, Northwestern University's Feinberg School of Medicine, Chicago, IL (Steering Committee); Maj. Downing Lu, MD, MPH, FAAP, Walter Reed Army Medical Center, Washington, DC; Robert Luten, MD, University of Florida, Jacksonville, FL; Lt Col (USAFR) Michael T. Meyer, MD, FAAP, Wilford Hall Medical Center, Lackland AFB and Medical College of Wisconsin, Milwaukee, WI; Jennifer E. Miller, MS, Bioethics International, New York, NY (Steering Committee); W. Bradley Poss, MD, University of Utah, Salt Lake City, UT; Tia Powell, MD; Montefiore-Einstein Center for Bioethics and Einstein-Carodoz Masters of Science in Bioethics, Montefiore Medical Center and Albert Einstein College of Medicine, Bronx, NY; Dave Siegel, MD, National Institutes of Health, Bethesda, MD; Paul Sirbaugh, DO, Texas Children's Hospital, Houston, TX; Ken Tegtmeyer, MD, FAAP, FCCM, Cincinnati Children's Hospital Medical Center, Cincinnati, OH (Steering Committee); Philip Toltzis, MD, Rainbow Babies and Children's Hospital, Cleveland, OH (Steering Committee); Donald D. Vernon, MD, University of Utah, Salt Lake City, UT (Steering Committee); Jeffrey S. Upperman, MD, Children's Hospital Los Angeles, Los Angeles, CA (Steering Committee).