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**Abstract:**

This article is part of a collaborative effort by experts in the field of emergency preparedness to complete an overview begun by the late Michael Shannon, MD, MPH, on the current challenges and future directions in pediatric disaster readiness. This particular article, "Challenges Facing Pediatric Preparedness," will review some of the major challenges facing current efforts to enhance pediatric readiness.

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# Challenges Facing Pediatric Preparedness

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**I**t has become increasingly evident that there is a need for pediatric expertise in the development of comprehensive and cohesive systems for disaster management. In both natural disasters and acts of terrorism, children are likely to be affected in numbers at least proportional to their representation in the population at large. It is also possible that children will be affected in numbers exceeding their proportion in the population because of their unique vulnerabilities and patterns of localization within schools and childcare centers. In the setting of a large-scale disaster, pediatric victims require more supervision, higher staffing, specialized equipment, and resources. In a mass casualty event, it is likely that young children and infants will be cared for by providers and systems that do not have significant pediatric experience, mandating the development of policies and procedures for emergent pediatric care that are readily accessible, straightforward, and focus on high-impact assessment and interventions. Challenges facing pediatric preparedness include the determination of what is needed for the care of affected children, the determination of how care and resources are allocated, and the determination of how the required training, research, equipment, and resources are paid for.

## **CHALLENGE I: WHAT IS NEEDED?**

The identification and procurement of requisite resources and expertise for the optimal treatment of children in disasters are a formidable task. Neonatal and pediatric-sized bag and mask setups, ventilator circuits, intravascular catheters, and equipment are essential for optimal care and need to be available to personnel treating children. The most recent multiagency policy statement on equipment for ambulances is an example of a

“stock list” of equipment required for the treatment of children.<sup>1</sup> Medical countermeasures to biohazards are essential to the successful treatment of mass exposure to toxins or infectious agents. Children represent 22% of the US population and are more susceptible than adults to many biohazards, yet readily available countermeasures appropriate for use in pediatric patients are nearly nonexistent. Retrospective reviews of inadvertent administration of adult formulated auto injectors containing oximes or atropine as treatment for nerve gas exposure suggest that these doses are well tolerated in children.<sup>2</sup> The potential benefit of rapid antidote administration may outweigh the risk of relatively minor side effects. Pharmacokinetic data on the use of such adult formulated therapies in children are lacking, and a large percentage of the drugs routinely used as antidotes and treatments for children are most often off-label for use in the pediatric population. These factors prevent the wide-scale preparation and distribution of pediatric antidote kits for biohazards. Current recommendations for pediatric dosing of antidotes are not uniform and leave much margin for inconsistency and error.<sup>3</sup> The recent H1N1 epidemic highlighted the potentially expeditious emergency use authorization process; however, the current absence of Food and Drug Administration approval for most drugs used on a day-to-day basis in children would greatly slow the process unless well-established and accepted dosing recommendations were already in place. Given the lack of adequate and well-controlled clinical trials in children, consensus statements from pediatric expert panels are a source of recommendations that can be broadly applied to pediatric care in disasters. Defining the processes by which this should happen is an area of active investigation. One promising method is the use of the Delphi consensus process, as outlined in a recent article by Kanter, et al<sup>4</sup> in which the allocation of limited personnel and equipment was applied to a scenario of pediatric disaster care. Whether for pandemic flu, nerve gas exposure, or any other biologic agent, the goal of simplified administration of medical countermeasures to children in the event of a mass biohazard exposure has not been met.

Pediatric disaster preparedness extends beyond the provision of appropriate equipment and medications. Children present unique challenges in regard to shelter, nutritional, transportation, and communication needs. Systems for identifying, transporting, and reuniting children with their caregivers are of paramount importance. A large-scale disaster scenario is likely to require the

transport of affected individuals to distant sites to make use of resources that have been locally overwhelmed. The safe transport of children under adequate supervision and with an effective means of tracking pediatric patients is a significant challenge. It should be assumed that children may act in ways counter to their own best interest in a disaster scenario. Hiding, running away, being uncooperative with caregivers, and attempting to remove restraints and medical equipment are developmentally appropriate responses to stressful situations in young children. The recruitment of nonmedical personnel to supervise and provide care to young children may better provide for their psychosocial and emotional needs, minimizing stress and freeing up medical staff for needs requiring their expertise. Procedures by which these ancillary caregivers would be identified, vetted, and supervised need to be in place before the realization of an actual disaster scenario.

Parents and adult caregivers who have been separated from their children are likely to be frantic for reunification and may inadvertently introduce more chaos into a disaster scenario and impede efforts to care for patients. Community preparedness requires the dissemination of information to caregivers about the process for reunification with their children in the event of a disaster and, ideally, the confirmation that the information has been reviewed.

Effective immediate care requires pediatric training and expertise. Young children make up a small fraction of emergency medical service runs; thus, it is difficult to retain best-practice pediatric-specific skills in first responders. Pediatric triage guidelines remain in the early stages of development. The Therapeutic Intervention Scoring System, Jump-START, Pediatric Triage Tape, and Careflight have all been evaluated with no consensus on the best instrument and no consistency in their use by first responders or medical centers. The ability to triage pediatric patients in a consistent and meaningful way across all levels of care delivery is a necessary foundation of pediatric disaster preparedness. Pediatric patient assessment and airway management skills are particularly critical because most pediatric arrests are due to respiratory embarrassment rather than hemodynamic compromise. Compounding the paucity of pediatric experience and training for most acute care providers is the lack of specific training in pediatric mass casualty events. In a 2005 survey of nearly 4000 emergency medical services, only 13.3% had pediatric-specific mass casualty plans and only 19% had a pediatric-specific triage plan.<sup>5</sup> It may be appropriate to develop a

system whereby personnel without extensive pediatric training or experience can provide care using algorithms and care paths under the direction and supervision of pediatric acute care providers.

## CHALLENGE II: DISTRIBUTION OF LIMITED CARE AND RESOURCES

Changing the paradigm of medical treatment in pediatric disasters is a potentially enormous challenge. Disasters are characterized by an overwhelming increase in the medical, social, and psychologic needs of a population in the face of inadequate or limited resources. The provision of care in a disaster scenario requires consideration of the allocation of therapies, staffing, and supplies in a manner that provides the most benefit to the largest number of patients. It is not clear how the most benefit is to be defined and by whom. A multilevel comprehensive system including bedside clinicians and local and federal agencies is likely to be unduly complex and may not be sufficiently streamlined to permit effective care in a crisis. The importance of identifying, training, and authorizing medical leadership during a disaster is not to be underestimated.

The shift from current standards of care with a focus on optimizing individual outcomes to a standard that optimizes population outcomes is a radical change. In adults, several strategies for the allocation of resources have been proposed.<sup>6-10</sup> The decision to limit, withhold, or withdraw resources that are to the benefit of a particular child to better garner resources for the larger pediatric population is problematic on ethical, social, and legal grounds. The fact that best practices of resource allocation under one paradigm are contradictory to best practices in another mandates clear, consistent, and readily available guidelines for priorities and limitations of care to children in disasters. Health care providers are vulnerable to short- and long-term stress, burnout, fatigue, and threats to their own psychologic health under any setting of disaster care, but the stress of limiting, withholding, or withdrawing treatment to injured or sick children is likely to pose an increased threat to provider well-being.

A final but no less important challenge to pediatric disaster preparedness is the need for financial resources. Care facilities, equipment, staffing, transport, and other requisite factors are all dependent on financial support. The Stafford Act (Public Law 93-228) is one source of federal disaster funding, but it is clearly not enough. Optimizing the

use of available community resources is a potential means to reduce costs but requires a great deal of coordination between schools, daycares, their employees, private physicians, civic leaders, families, community centers, retail stores, and hospitals. Community support of care and resources for children is generally quite strong, and the integration of community resources would be, with health care resources, a powerful alliance for pediatric disaster preparedness.

The challenges for pediatric preparedness range from drug development to safe transportation, from the identification of funding strategies for facilities and equipment to the provision of resources for the management of situational stress in children and caregivers. Strong pediatric leadership, governmental support, and community investment are the best tools available to provide optimal care to children in disasters. □

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