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**TESTIMONY OF STEVEN KRUG, MD, FAAP  
ON BEHALF OF THE AMERICAN ACADEMY OF PEDIATRICS**

**HOMELAND SECURITY SUBCOMMITTEE ON  
EMERGENCY PREPAREDNESS, SCIENCE AND TECHNOLOGY  
“Emergency Care Crisis:  
A Nation Unprepared for Public Health Disasters”**

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I appreciate this opportunity to testify today before the Homeland Security Subcommittee on Emergency Preparedness, Science and Technology at this hearing, “Emergency Care Crisis: A Nation Unprepared for Public Health Disasters.” My name is Dr. Steven Krug, and I am the Head of the Division of Pediatric Emergency Medicine at Children’s Memorial Hospital in Chicago, Illinois and a Professor of Pediatrics at the Northwestern University Feinberg School of Medicine. Today I am proud to represent the American Academy of Pediatrics, a non-profit professional organization of 60,000 primary care pediatricians, pediatric medical sub-specialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults. I have the privilege of chairing the Academy’s Committee on Pediatric Emergency Medicine.

## **BACKGROUND**

Emergency medical services are the foundation of our nation’s defense for public health disasters. I expect today’s panel members to be unified in communicating a concern shared by emergency care providers and healthcare consumers throughout our nation regarding the ability of a fragmented, over-burdened and under-funded emergency and trauma care system to meet the day-to-day needs of acutely ill and injured persons. As you are aware, the Institute of Medicine recently released a seminal report which indicates that our nation’s emergency care delivery system is in a state of crisis. Without a strong emergency medical services system foundation, we will never be able to build an effective response for mass casualty events, including natural disasters or acts of terror.

In addition to the many concerns raised within the IOM report regarding the overall health of our nation’s emergency medical services – issues that impact the day-to-day ability of pre-hospital and hospital-based emergency care providers to respond to the needs of all Americans -- our emergency care systems also bear some specific and persistent limitations in their ability to meet the medical needs of children.<sup>i</sup> Adding further to this gap in the level of emergency readiness between adult and pediatric care is the long-standing observation that federal, state and local disaster planning efforts have traditionally overlooked the unique needs of children. As a representative of the Academy, and as an advocate for children, my testimony will focus on issues concerning pediatric emergency preparedness so you may better understand the unique challenges faced by emergency medical care professionals as they treat ill and injured children, and so that you may also appreciate the readiness gap in pediatric emergency care.

### **Children Are More Vulnerable Than Adults**

It has been said that children are not little adults, and this is especially pertinent in a medical emergency or during a disaster. Their developing minds and bodies place children at disproportionate risk in a number of specific ways in the event of a disaster or terrorist attack:

- Children are particularly vulnerable to aerosolized biological or chemical agents because they normally breathe more times per minute than do adults, meaning they would be exposed to larger doses of an aerosolized substance in the same period of time. Also, because such agents (e.g. sarin and chlorine) are heavier than air, they accumulate close to the ground – right in the breathing zone of children.

- Children are also much more vulnerable to agents that act on or through the skin because their skin is thinner and they have a larger skin surface-to-body mass ratio than adults.
- Children are more vulnerable to the effects of agents that produce vomiting or diarrhea because they have smaller body fluid reserves than adults, increasing the risk of rapid progression to dehydration or shock.<sup>ii</sup>
- Children have much smaller circulating blood volumes than adults, so without timely intervention, relatively small amounts of blood loss can quickly tip the physiological scale from reversible shock to profound, irreversible shock or death. An infant or small child can literally bleed to death from a large scalp laceration.
- Children have significant developmental vulnerabilities not shared by adults. Infants, toddlers and young children may not have the motor skills to escape from the site of a hazard or disaster. Even if they are able to walk, young children may not have the cognitive ability to know when to flee from danger, or when to follow directions from strangers such as in an evacuation, or to cooperate with decontamination.<sup>iii</sup> As we all learned from Katrina, children are also notably vulnerable when they are separated from their parents or guardians.

### **Children Have Unique Treatment Needs**

Once children are critically ill or injured, their bodies will respond differently than adults in similar medical crises. Consequently, pediatric treatment needs are unique in a number of ways:

- Children need different dosages and formulations of medicine than adults – not only because they are smaller, but also because certain drugs and biological agents may have adverse effects in developing children that are not of concern for the adult population.
- Children need different sized equipment than adults. In fact, emergency readiness requires the presence of many different sizes of key resuscitation equipment for infants, pre-school and school-aged children, and adolescents. From needles and tubing, to oxygen masks and ventilators, to imaging equipment and laboratory technology, children need equipment that has been specifically designed for their size.
- Children demand special consideration during decontamination efforts. Because children lose body heat more quickly than adults, mass decontamination systems that may be safe for adults can cause hypothermia in young children unless special heating precautions or other warming equipment is provided.<sup>iv</sup> Hypothermia can have a profoundly detrimental impact on a child's survival from illness or injury.
- Children sustain unique developmental and psychological responses to acute illness and injury, as well as to mass casualty events. Compared to adults, children appear to be at greater risk for acute- and post-traumatic stress disorders. The identification and optimal management of these disorders in children requires professionals with expertise in pediatric mental health.<sup>v</sup>
- Children may be developmentally unable to communicate their needs with health care providers. The medical treatment of children is optimized with the presence of parents and/or family members. Timely reunification of children with parents and family-centered care should be a priority for all levels of emergency care.

### **Children Need Care From Providers Trained to Meet Their Unique Needs**

Because children respond differently than adults in a medical crisis, it is critical that all health care workers be able to recognize the unique signs and symptoms in children that may indicate a life-threatening situation, and then possess the experience and skill to intervene accordingly.<sup>vi</sup> As already noted, a child's condition can rapidly deteriorate from stable to life-threatening as they have less blood and fluid reserves, are more sensitive to changes in body temperature, and have faster metabolisms. Once cardio-pulmonary arrest has occurred, the prognosis is particularly dismal in children, with less than 20% surviving the event, and with 75% of the survivors sustaining permanent disability. Therefore, the goal in pediatric emergency care is to recognize pre-cardiopulmonary arrest conditions and intervene before they occur. While children represent 25 to 30% of all emergency department visits in the U.S., and 5 to 10% of all EMS ambulance patients, the number of these children who require this advanced level of emergency and critical care, and use of the associated cognitive and technical abilities, is quite small. This creates a special problem for pre-hospital and hospital-based emergency care providers, as they have limited exposure and opportunities to maintain their pediatric assessment and resuscitation skills. In my practice, a pediatric emergency department located in a tertiary urban children's hospital and trauma center with over 50,000 annual visits, we are able to maintain those skills. However, over 90% of children receive their emergency care in a non-children's hospital or non-trauma center setting. Emergency care professionals in many of these settings, and most pre-hospital emergency care providers, simply may not have adequate ongoing exposure to critically ill or injured children.

This vital clinical ability to recognize and respond to the needs of an ill or injured child must be present at all levels of care – from the pre-hospital setting, to emergency department care, to definitive inpatient medical and surgical care. The outcome for the most severely ill or injured children, and for the rapidly growing number of special needs children with chronic medical conditions, is optimized in centers that offer pediatric critical care and trauma services and pediatric medical and surgical subspecialty care. As it is not feasible to provide this level of expertise in all hospital settings, existing emergency and trauma care systems and state and federal disaster plans need to address regionalization of pediatric emergency care within and across state lines and inter-facility transport as a means to maximize the outcome of the most severely ill and injured children.

I have alluded to the growing number of children with chronic medical conditions. Children with special health care needs<sup>vii</sup> are the fastest growing subset of children, representing 15 to 20% of the pediatric population.<sup>viii</sup> These children pose unique emergency and disaster care challenges well beyond those of otherwise healthy children. Our emergency medical services systems, and our disaster response plans, must consider and meet the needs of this group of children.

### **Pediatric Emergency Care Preparedness**

Our nation's EMS system was developed in response to observed deficiencies in the delivery of pre-hospital and hospital-based emergency care to patients with critical illness or injury, with adult cardiovascular disease and trauma representing the sentinel examples. The Emergency Medical Services Act of 1973 helped to create the foundation for today's EMS systems, stimulating improvements in the delivery of emergency care nationally. Despite those

improvements, significant gaps remained evident in EMS care, particularly within the pediatric population.<sup>ix,x</sup>

These gaps were present because early efforts at improving EMS care did not appreciate that acutely ill and injured children could not be treated as “small adults.” Children possess unique anatomic, physiologic, and developmental characteristics which create vitally important differences in the evaluation and management of many serious pediatric illnesses and injuries. Unique pediatric health care needs make it difficult for emergency care providers to provide optimal care in adult-oriented EMS systems (e.g. personnel training, facility design, equipment, medications).

In 1993, the Institute of Medicine (IOM) released a comprehensive report, “Emergency Medical Services for Children”, on the status of pediatric emergency care. This study identified numerous concerns in several major areas, including gaps in the pediatric training and continuing education of emergency care providers, deficiencies in necessary equipment, supplies and medications needed to care for children, inadequate planning for pediatric emergency and disaster readiness, and insufficient evaluation of patient outcomes and research in pediatric emergency care.<sup>xi</sup>

Over a decade later, last month’s IOM report “Emergency Care for Children: Growing Pains,” demonstrates that while some improvements have been achieved, the pediatric emergency readiness gap still remains, noting:

- Only 6% of emergency departments across the nation have all of the supplies necessary for managing pediatric emergencies.
- Only half of hospitals have at least 85% of those critical supplies.
- Of the hospitals that lack the ability to provide care for pediatric trauma victims, only half have written transfer agreements with hospitals that possess that ability.
- Many medications used in the emergency room setting for children are prescribed “off label,” i.e. without Food and Drug Administration approval for use in children.
- Pediatric emergency care skills deteriorate quickly without practice, yet training is limited and continuing education may not be required for emergency medical technicians (EMTs) in many areas.
- Pediatric emergency treatment patterns and protocols vary widely across emergency care providers and geographic regions.
- Shortages of equipment and devices and deficiencies in pediatric training are exacerbated in rural areas.<sup>xii</sup>
- Disaster preparedness plans often overlook the needs of children even though their needs differ from those of adults.

As stated in the IOM report, “If there is one word to describe pediatric emergency care in 2006, it is uneven.” The specialized resources available to treat critically ill or injured children vary greatly based upon location. Some children have ready access to a children’s hospital or a center with distinct pediatric capabilities while others must rely upon hospitals with limited pediatric expertise or equipment. Some states have implemented pediatric readiness guidelines for hospital emergency departments, but most have not. Some states have organized trauma systems and designated pediatric facilities while others do not. As trauma remains the leading cause of death and disability for children, the absence of a trauma system is particularly problematic for children.

Lastly, state requirements for the pediatric continuing education and certification for EMTs vary widely. As a result, not all children have access to the same quality of care.

Finally, more research is needed in all aspects of pediatric emergency care. Due to the lack of scientifically validated research in this area, most recommendations are the result of expert consensus, not scientific evidence. More study is needed to advance the field and ensure that the measures we are taking are effective.

### **Pediatric Disaster Readiness**

Each of these shortcomings in day-to-day emergency care has major implications for disaster preparedness. Emergency departments and emergency medical services systems that are unable to meet everyday pediatric care challenges are, by definition, unlikely to be prepared to deliver quality pediatric care in a disaster.<sup>xiii</sup>

A unique consideration in pediatric emergency care and disaster planning is the role of schools and day care facilities. Children spend up to 80% of their waking hours in school or out-of-home care. Schools and day care facilities must be prepared to respond effectively to an acutely ill or injured child, and likewise, must be fully integrated into local disaster planning, with special attention paid to evacuation, transportation, and reunification of children with parents.<sup>xiv</sup> Families should also be encouraged to engage in advance planning for emergencies and disasters.<sup>xv</sup>

One key area of deficiency in our current disaster planning is in pediatric surge capacity. Most hospitals have limited surge capacity for patients of any kind. Even if beds may be available, appropriately trained or experienced staff and the necessary equipment, drugs and devices may not be. The use of adult critical care or medical/surgical inpatient beds in hospitals with limited pediatric expertise will likely prove to be an unacceptable option for the needs of many ill or injured children. Optimal outcomes for these children will only be achieved through regionalization of pediatric care and surge capacity.

One federal program provides a clear example of the general neglect of children's issues in disaster planning. The National Bioterrorism Hospital Preparedness Program (NBHPP), administered by the Health Resources and Services Administration (HRSA), is tasked with providing funds to states and localities to improve surge capacity and other aspects of hospital readiness. In the most recent grant guidance, HRSA required that all states establish a system that allows for the triage, treatment, and disposition of 500 adult and pediatric patients per 1 million population. While pediatric patients are referenced, it is unclear whether they are required to be represented in proportion to their numbers in the state's population. A state could arguably plan for 499 adults and 1 child and satisfy the guidance. Moreover, that guidance removed critical language that stated that NBHPP funds must not supplant funding received under federal Emergency Medical Services for Children grants and that strongly urged the incorporation of behavioral health and psychosocial interventions for adults and children into facility drills and exercises. Outside the pediatric mention in the benchmark for bed surge capacity, children's issues are essentially absent from the NBHPP guidance.<sup>xvi</sup>

Equipment and devices, as noted above, are a crucial component of readiness. Because "children" encompass individuals from birth through adolescence, it is often insufficient to have a

single size device to serve all children. In the case of respiratory masks, for example, different sizes are needed for infants, young children, and teenagers. Both individual facilities and large-scale programs, such as the Strategic National Stockpile, must take this into account and provide for these needs.

Similarly, drugs and antidotes must be available in appropriate formulations and dosages for children. Infants cannot be expected to take pills. Needles must be provided in smaller sizes. In many cases, dosages for children should be determined not by age but by weight. A simple device known as a Broselow tape can allow health care providers to calculate dosages quickly and accurately. However, one study showed that 46% of Disaster Medical Assistance Teams were lacking these tapes, in addition to other critical pediatric equipment.<sup>xvii</sup>

Training is vital to pediatric preparedness. Many health care providers have few, if any, opportunities to use critical pediatric resuscitation and treatment skills. Skills that are not exercised atrophy quickly. Presently, there is great variation in state standards for required pediatric training and continuing education for pre-hospital care providers and other first responders. Regular training and education is central to ensuring that health care providers will be able to treat children in a crisis situation. The same holds true for facility and community emergency exercises and drills.

The issues of family reunification and family-centered care in evacuation, decontamination and in all phases of treatment are frequently overlooked. In the event of a disaster, both evacuation and treatment facilities must have systems in place to minimize family separation and methods for the timely and reliable reunification of children with their parents. In addition, facilities must take into account the need for family-centered care in all stages of care. Infants and young children are typically unable to communicate their needs to healthcare providers. Children of all ages are highly reliant upon the presence of family during an illness or periods of distress. Nearly all parents will be unwilling to be separated from their children in a crisis situation, many even willing to forego emergency treatment for themselves to be with their child. Hospitals must be prepared to deal with these situations with compassion and consistency.<sup>xviii</sup>

It has been a source of great frustration for many of my pediatric and emergency medicine colleagues that our repeated calls for improved pediatric emergency preparedness have gone unheeded for the better part of a decade. As long ago as 1997, the Federal Emergency Management Agency raised the concern that none of the states it had surveyed had pediatric components in their disaster plans.<sup>xix</sup> That same year, the American Academy of Pediatrics issued its first policy statement entitled, “The Pediatrician’s Role in Disaster Preparedness,” with recommendations for pediatricians and communities.<sup>xx</sup> In 2001, the American Academy of Pediatrics formed its Task Force on Terrorism and issued a series of detailed recommendations on various aspects of chemical, biological, radiological and blast terrorism.<sup>xxi</sup> In 2002, Congress created the National Advisory Committee on Children and Terrorism to prepare a comprehensive public health strategy related to children and terrorism. In 2003, the federal government sponsored a National Consensus Conference on Pediatric Preparedness for Disasters and Terrorism which, again, issued a laundry list of dozens of specific recommendations.<sup>xxii</sup> Just last month, the IOM issued its report on the pediatric aspects of the emergency care system.<sup>xxiii</sup>

Despite all of this, progress in pediatric preparedness has been slow, fragmented, disorganized, and largely unmeasured and unaccountable.

### **The Emergency Medical Services for Children (EMSC) Program**

The federal government has a crucial role in assuring pediatric emergency and disaster preparedness through a variety of agencies and programs, including the Department of Homeland Security, the Federal Emergency Management Agency, the Centers for Disease Control and Prevention, HRSA's National Hospital Bioterrorism Preparedness Program, and others. Perhaps the most important and successful federal program in improving emergency health care providers' ability to provide quality care to children has been HRSA's Emergency Medical Services for Children (EMSC) program. Created in 1984, the EMSC program was established after data and clinical experience showed major gaps between adult and pediatric emergency care at all levels. The program has funded pediatric emergency care improvement initiatives in every state, territory and the District of Columbia, as well as national improvement programs.

Despite a modest budget allocation, EMSC has driven significant improvements in pediatric emergency care, including disaster preparedness. To its credit, EMSC has managed to effect these changes despite the lack of pediatric emphasis in other related government programs. EMSC has funded the development of equipment lists for ambulances and hospitals, pediatric treatment protocols, and handbooks for school nurses and other providers that would be critical in the event of an emergency. EMSC supports training for emergency medical technicians and paramedics who often have little background in caring for children, and has underwritten the development of vital educational materials and treatment guidelines. In the 21 years since the program was established, child injury death rates have dropped by 40%.

As outlined in the IOM report, the EMSC program's resources and over 20 years of effective leadership and collaboration with key stakeholders have indeed led to important changes in pediatric emergency care at the state level:

- 44 states employ pediatric protocols for online medical direction of pre-hospital care at the scene of an emergency;
- 48 states have identified and require all EMSC essential equipment on EMS advanced life support ambulances;
- 36 of 42 states with state-wide computerized data collections systems now produce reports on pediatric care;
- 20 states have pediatric emergency care laws or pediatric emergency care related rules or regulations; and
- 12 states have adopted and disseminated pediatric guidelines that characterize the facilities that have trained personnel and equipment, medications and facilities to provide pediatric care.

EMSC supports a National Resource Center (NRC) which acts as a clearinghouse for educational resources on pediatric emergency care, enabling countless communities to learn from each other's experience and adopt proven models. EMSC also supports the National EMSC Data Analysis Resource Center (NEDARC) which assists EMSC grantees and State EMS offices to improve their ability to collect, analyze, and utilize data to improve the quality of pediatric care.



EMSC has also been a very important source of funding for grants that have contributed to increasing evidence-based care for acutely ill and injured children. Research is an essential element in the development of an evidence-based practice of medicine. The practice of evidence-based pediatric emergency medicine is needed to provide the best treatment for acutely ill or injured children. Unfortunately, in many situations, emergency care providers must rely upon limited or anecdotal experience, or an extrapolation from adult care standards when treating children, because reliable research studies involving acutely ill and injured children are few. In recent years, EMSC has funded the establishment of the Pediatric Emergency Care Applied Research Network (PECARN), the only network of its kind supporting pediatric emergency care research. PECARN is providing the infrastructure for critical research on the effectiveness of interventions and therapies used in pediatric emergencies.

The recent IOM report contained a strong endorsement of the EMSC program: “the work of the EMSC program today remains relevant and vital.” The report acknowledged the need to address the serious gaps that remain in pediatric emergency care and stated that “The EMSC program, with its long history of working with federal partners, state policy makers, researchers, providers and professional organizations across the spectrum of emergency care, is well positioned to assume this leadership role.”<sup>xxiv</sup>

The American Academy of Pediatrics fully endorses the IOM’s comments regarding the value of the EMSC program. While enormous strides have been made in pediatric emergency care, much more remains to be done. The program should be reauthorized and funded at or above the level recommended by the IOM, which we hope would allow EMSC to pursue pediatric emergency and disaster preparedness thoroughly and aggressively.

### **POLICY RECOMMENDATIONS**

The American Academy of Pediatrics has specific recommendations for all policymakers regarding children and emergency and disaster preparedness:

- If our nation’s over-burdened emergency and trauma care systems are to respond effectively to a significant mass casualty event, we must invest in creating effective local, state and federal disaster response systems involving a healthy, adequately-funded, well-coordinated and functional emergency medical services system.
- Standards for pediatric emergency readiness for pre-hospital and hospital-based emergency services, and regionalization of pediatric trauma and critical care, should be developed and implemented in every state.
- Evidence-based clinical practice guidelines for the triage, treatment and transport of acutely ill and injured children at all levels of care should be developed.
- Pediatric emergency care competencies should be defined by every emergency care discipline and professional credentialing bodies should require practitioners to achieve the level of initial and continuing education necessary to maintain those competencies.
- Primary care pediatricians and pediatric medical and surgical subspecialists should be included in emergency and disaster planning at every organizational level – at all levels of government, and in all types of planning.
- Emergency preparedness efforts should use an “all-hazards” model that allows for holistic planning and multipurpose initiatives, and should support family-centered care at all levels of treatment.

- Pediatric health care facilities (e.g. children’s hospitals, pediatric emergency departments, and pediatricians’ offices) should be included in all aspects of preparation because they are likely to become primary sites for managing child casualties.
- Financial support should be provided to health care facilities to address pediatric preparedness, including maintaining surge capacity and creating specialized treatment areas for children, such as isolation and decontamination rooms.
- Schools and day care facilities must be prepared to respond to emergencies and must be fully integrated into local, state and federal disaster plans, with special attention paid to evacuation, transportation, and reunification of children with parents.
- Federal, state, and local disaster plans should include specific protocols for the management of pediatric casualties, including strategies to:
  - Minimize parent-child separation and implement systems for the timely and reliable reunification of families;
  - Improve the level of pediatric expertise on disaster response teams (e.g. Disaster Management Assistance Teams);
  - Improve access to pediatric medical and surgical subspecialty care and to pediatric mental health care professionals;
  - Address the care requirements of children with special health care needs; and
  - Ensure the inclusion of pediatric mass casualty incident drills at both federal and state planning levels.
- More research is needed regarding all aspects of pediatric emergency planning, response, and treatment to support the development of effective emergency therapies, prevention strategies, and evidence-based clinical standards in pediatric emergency medicine.
- The Emergency Medical Services for Children (EMSC) program should be reauthorized and funded at the level of \$37.5 million per year, as recommended by the Institutes of Medicine report, to support the continued improvement in pediatric emergency and disaster preparedness.

### **Other Issues of Concern**

In addition to hospital surge capacity and emergency room preparedness, a number of other critical issues continue to be neglected in the area of pediatric readiness.

*Government organizational issues:* Pediatric concerns must be represented in all aspects of disaster planning and at all levels of government, including issues such as evacuation strategies and large-scale protocols.

*Federal systems issues:* Children’s needs must be taken into account in various federal systems. The Strategic National Stockpile must contain equipment, devices and dosages appropriate for children. Disaster Medical Assistance Teams must include individuals with appropriate pediatric expertise. Pediatric casualties should be simulated in all disaster drills.

*Special disasters:* Children have unique needs in certain types of disasters. For example, in the event of a radioactive release, children must be administered potassium iodide as quickly as possible and in an appropriate form and dosage to prevent long-term health effects.<sup>xxv</sup>

*School and day care issues:* Children spend up to 80% of their waking hours in school or out-of-home care. Schools and day care facilities must be integrated into disaster planning, with special attention paid to evacuation, transportation, and reunification with parents.<sup>xxvi</sup>

*Credentialing.* Health care providers are critical volunteers in time of disaster. A comprehensive system for verifying credentials and assigning volunteers appropriately is vital. HRSA's Emergency System for Advance Registration of Volunteer Health Professionals (ESAR-VHP) must be supported and accelerated.

*Psychosocial concerns:* Children's reactions vary greatly depending on the child's cognitive, physical, educational, and social development level and experience, in addition to the emotional state of their caregivers. This presents unique challenges to providing quality mental health care.<sup>xxvii</sup>

*Evacuation and shelter issues:* A top priority must be placed on not separating parents from children in evacuations. In shelters, special arrangements must be made for pregnant women and children with special health care needs, as well as for the safety and security of all children.

## **CONCLUSION**

In conclusion, the American Academy of Pediatrics greatly appreciates this opportunity to present our views and concerns related to pediatric emergency care and disaster preparedness. While great strides have been made in recent years, with many of these improvements the direct result of the federal EMSC program, much more remains to be done. America's children represent the future of our great nation, our most precious national resource. They must not be an afterthought in emergency and disaster planning. With focused, comprehensive planning and the thoughtful application of resources, these goals can be achieved. The American Academy of Pediatrics looks forward to working with you to protect and promote the health and well-being of all children, especially in emergency and disaster situations.

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