

Bioterrorism and Other Public Health Emergencies

Pediatric Terrorism and Disaster Preparedness

A Resource for Pediatricians

Summary

**Agency for Healthcare Research and Quality
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AHRQ's Bioterrorism Research Portfolio

The Agency for Healthcare Research and Quality (AHRQ) is a component of the U.S. Department of Health and Human Services. The Agency's mission is to improve the quality, safety, efficiency, and effectiveness of health care by:

- Using evidence to improve health care.
- Improving health care outcomes through research.
- Transforming research into practice.

AHRQ's investment in bioterrorism research recognizes that community clinicians, hospitals, and health care systems have essential roles in the public health infrastructure. To inform and assist these groups in meeting the health care needs of the U.S. population in the face of bioterrorist threats, AHRQ-supported research focuses on the following:

- Emergency preparedness of hospitals and health care systems for bioterrorism and other rare public health events.
- Technologies and methods to improve the linkages between the personal health care system, emergency response networks, and public health agencies.
- Training and information needed to prepare community clinicians to recognize the manifestations of bioterrorist agents and manage patients appropriately.

Please visit the AHRQ Web site at <http://www.ahrq.gov/browse/bioterbr.htm> to find out more about AHRQ-supported research, tools, and activities related to bioterrorism and public health preparedness.

Introduction

This summary presents highlights from a report prepared by the American Academy of Pediatrics for the Agency for Healthcare Research and Quality (AHRQ). The purpose of the report is to enhance the role and capabilities of pediatricians in planning for and responding to natural disasters and bioterrorist events. The goal is to ensure that the special needs of children are considered and incorporated into local, State, regional, and Federal disaster preparedness planning and response. A list of resources is provided at the end of this summary to help readers access additional information on each of the topics discussed here.

Background

A disaster is a calamitous event that affects a large population and generally results in injury, death, and destruction of property. A disaster can also be thought of as any occurrence that taxes or overwhelms local response resources, including law enforcement, transportation, shelters, and so on. Local resources can be overwhelmed by natural disasters or other events that result in multiple casualties such as earthquakes, fires, large motor vehicle crashes, and terrorist incidents.

Disasters caused by terrorism or accidents (e.g., a multiple car crash on an interstate highway) can occur without warning. In other types of disasters, such as hurricanes, there usually is some time for warning and preparation. Some disasters end quickly, while others can affect large populations over an extended period of time (e.g., a humanitarian disaster involving famine). Disasters can have physical, mental, and emotional effects on a large number of people without regard to age or other factors.

Terrorism is a reality in the United States, and bombs, germs, toxic gases, and the forces of nature do not discriminate between children and adults. Despite our best efforts to shelter and protect them, children remain among the most vulnerable victims of terrorism and natural disasters.

This resource is intended primarily to educate, inform, increase awareness among, and assist pediatricians in recognizing and fulfilling their important roles in disaster preparedness and response. Families and communities turn to pediatricians for anticipatory guidance on all issues involving children. In turn, pediatricians can help families plan their response to disaster and, when disaster strikes, refer them to available resources. Based on their traditional roles in prevention, anticipatory guidance, and advocacy, pediatricians can make a difference in ensuring comprehensive public health planning for disaster.

Children Are Not Small Adults

Many important differences distinguish children from adults and are the origin of the oft-used truism “you can’t treat children as small adults.” Some of these differences are:

- Anatomic differences (e.g., size, more pliable skeleton).
- Physiologic differences (e.g., age-related variations in vital signs, higher relative metabolism).
- Immunologic differences (e.g., immature immunologic system, higher risk of infection).
- Developmental differences (e.g., inability to vocalize symptoms or localize pain, dependence on others for necessities of life).
- Psychological differences (e.g., age-related response to trauma, vulnerability to major psychiatric disorders such as depression).

These differences affect children’s vulnerability to injury and response in a disaster. Failure to account for these differences in triage, diagnosis, and management of children is most often due to lack of knowledge or experience or both. Unfortunately, grave errors can result, increasing the child’s risk of serious harm and even death.

Systems Issues

The widespread injury and devastation associated with disasters can pose difficult problems for health care providers, including triage of mass casualties, disruption of the infrastructure (e.g., loss of power and fresh water), and the need to deal with the mental anguish associated with uncertainty and the loss of loved ones.

The degree of injury, death, and damage caused by disasters is influenced by many factors, including population location and density, timing of the event, and community preparedness (e.g., emergency response infrastructure, local building codes, disaster planning, etc). Similarly, recovery after a disaster is influenced by resources—for example, insurance and relief aid—and by experience, access to information, and preexisting environmental factors, such as season, local infrastructure, and so on. In almost all cases, disasters are associated with mental and physical stress (both during and after the event) that can increase morbidity and mortality over and above that caused directly by the event itself.

Usually, there are many deaths and widespread injury and destruction in the aftermath of a disaster. For example:

- The disruption caused by disasters can result in widespread disease from unhygienic conditions.
- Fuel leaks, live wires, and other hazards can cause injury or start fires.
- The physical and emotional stress associated with the event and cleanup can result in musculoskeletal injuries, mental illness, and other stress-related disorders.
- Displaced wildlife can hamper relief efforts and endanger workers.

- Injuries can also result from improper use of equipment involved in clean-up efforts.

Children are especially prone to injury or poisoning through exposure to debris, chemicals, equipment, and other agents in the aftermath of a disaster. Thus, management after a disaster is critically important to minimize further injuries and destruction.

Responding to a Disaster

There are four basic phases of response to a disaster. They are:

1. Preparedness (including prevention and planning).
2. Actual response to the event.
3. Mitigation.
4. Recovery (short- and long-term).

Preparedness

Although we usually cannot predict disasters, we often can exert some control over their impact through prevention and planning efforts. Prevention through preparedness is probably the most important phase of response in emergency management. During the preparedness phase, governments, organizations, and individuals develop plans to save lives, minimize disaster damage, and enhance disaster response. Such efforts include preparedness and evacuation planning; emergency exercises and training; warning systems; emergency communication systems; public information and education; and development of resource inventories, personnel contact lists, and mutual aid agreements.

Physicians participate in preparedness and prevention in many different ways, including: immunization programs, dietary advice, health education, and safety precautions and planning. As participants in an emergency action plan, physicians need to help formulate ways of preventing incidents from occurring or limiting the consequences from an incident that has already occurred. Physicians need to know what will be expected of them and their hospital in the case of a potential infectious disease outbreak. They should also be prepared with the knowledge and resources needed to help identify the etiology of a problem and to provide timely treatment.

Pediatricians should be proactive in providing input regarding the unique needs of children during disasters and ensure that children's issues are included in all preparedness activities.

Actual Response to an Event

Response activities provide emergency assistance for casualties and speed recovery. They include activating public warning systems, notifying public authorities, mobilizing emergency personnel and equipment, providing emergency medical assistance, manning emergency operation centers, declaring disasters, evacuating the public, mobilizing security forces, providing search and rescue operations, and suspending some laws on an emergency basis.

Mitigation

Mitigation includes actions taken to stop the incident from doing any further damage and to stabilize the situation. Examples include putting out a fire or plugging a leak in a hazardous material incident. Mitigation also plays a role in preparedness through measures such as building codes, tax incentives, zoning and land use management, safety codes, and so on.

Recovery

The objective is to return things to normal or near normal as quickly as possible. Depending on the scope of the incident, the recovery period can range from hours to years. Short- and long-term recovery measures include returning vital life-support systems to minimum operating standards; reconstruction; temporary housing; ongoing medical care; and public information, health and safety education, and counseling.

Regional Response to a Disaster

Although each area of the country differs somewhat in the way emergency responses are handled, all agencies involved in emergency response use some form of an incident management system. Almost all use the National Incident Management System with unified command. Communication and information sharing are key parts of successful incident management—both before and during an actual event. Regional physicians should review community emergency response plans, as well as the collaborative efforts between responders and planners, to ensure that they know what will be expected of them in the event of a disaster and where they can turn for assistance. For example:

- **Emergency medical services (EMS)** — In recent years, the addition and expansion of initial and continuing education in prehospital pediatric trauma care, as well as the provision of expert pediatric medical direction, has greatly enhanced the capabilities of most regional EMS systems. In most regions, injured children can now receive emergency medical assistance comparable to that provided to injured adults.
- **Hospitals** — In mass casualty incidents, including those involving release of biological or chemical agents, both children and adults are likely to be significantly affected. Indeed, children are likely to be disproportionately affected by such an incident, so pediatricians should assist in planning coordinated responses for local hospitals that may have limited pediatric resources. Health care facilities could also be a primary or secondary target. At the very least, hospitals will be caring for large numbers of anxious and worried individuals, including children and parents. In addition, hospitals may be overwhelmed by numerous victims who appear at the facilities without benefit of EMS triage and transport.
- **Surge capacity** — Most of our medical systems are already operating at near capacity, so pre-event planning is essential to develop local capacity to expand health care resources. Surge capacity expressed in terms of beds is not specific enough. Specific pediatric surge capacity that is somewhat intervention-specific is preferable. For example, there may be 1,000 hospital beds available in a large community but only 10 pediatric intensive care unit beds. Regional response to a disaster may involve crossing State lines and tapping emergency services from

many different jurisdictions. Thus, surge capacity needs to be considered from several perspectives, including local, State-wide, and regional facilities and services.

- High-acuity pediatric patients — In large urban areas, there are likely to be multiple pediatric hospitals within a short distance of each other. However, many smaller communities have access to only one regional facility that is capable of handling high-acuity pediatric cases. This means that surge capacity for pediatric disaster victims may be critically limited. Transporting pediatric patients to facilities outside of the region may be required (particularly if a pediatric facility is damaged or incapacitated). Pediatricians should educate and advocate regarding this type of planning. This is similar to the situation for high-end pediatric cardiac surgery, organ transplantation, and burn unit care for which pediatricians already refer to resources outside their region.
- Other facilities — It may be necessary to use facilities other than hospitals to care for unaccompanied but medically stable children or for children with social but no serious physical issues. This will not occur unless pediatricians help the responsible agencies/facilities prepare in advance.

Pediatricians as Planners

There are many ways that pediatricians can participate in regional hospital and community planning to ensure optimum care for children in the event of a disaster. Some examples include:

- Meet with hospital planners to ensure children's needs can be met.
- Help organize the response of community pediatricians to ensure appropriate distribution of pediatric expertise.
- Participate in developing education and assistance packets for family preparedness.
- Work with hospitals and schools to develop decision trees for the initial steps to be taken in decontamination, further triage, transport, and so on.
- Help hospitals develop color-coded triage systems for patients who arrive without previous triage to ensure appropriate levels of care and that children are not separated from their caregivers in a chaotic situation.
- Assist hospital disaster planning teams in developing a protocol for managing pediatric victims who have been separated from their primary caregivers during a disaster.

Triage to the appropriate facility can be critical for a child. Pediatricians should work to ensure that a mass casualty plan is in place that considers the unique needs of children, as well as the importance of not overloading one local facility (whenever possible). While there should be designated facilities for referral of critically injured children, each facility should be able to care for and at least initially stabilize both children and adults. Pediatric skills and equipment should be maintained at all facilities.

Emergency departments and hospitals may be called upon to provide for the both the physical and the medical needs of pediatric patients. They may need to provide children, for the short-term at least, with shelter, clothing, food, supervision, and entertainment, as

well as protection from the media in the critical period immediately after a disaster. These nontraditional functions should be addressed during development of disaster plans.

Biological Terrorism

Biological terrorism is the deliberate use of any biological agent against people, animals, or agriculture to cause disease, death, destruction, or panic for political or social gains. A bioterrorist agent may be a common organism, such as influenza or *Salmonella*, or a more exotic organism such as Ebola virus or variola virus. The following biological agents pose the greatest potential for use in a bioterrorist attack and have been designated as Category A agents:

- Variola major (smallpox).
- *Bacillus anthracis* (anthrax).
- *Yersinia pestis* (plague).
- *Francisella tularensis* (tularemia).
- Botulinum toxin (botulism)
- Filoviruses and arena viruses (viral hemorrhagic fevers [VHFI]).

When there is no other explanation for an outbreak of illness, it may be reasonable to investigate bioterrorism as a possible source. There are a number of clues that should arouse suspicion of a bioterrorist event; some examples include:

- Disease caused by an uncommon organism (e.g., smallpox, anthrax, or VHF).
- A disease identified in a geographic location where it is not usually found (e.g., anthrax in a non-rural area, or plague in the United States).
- Antiquated, genetically engineered, or unusual strains of infectious agents.
- An unexplained increase in incidence of an endemic disease that previously had a stable incidence rate.
- A large number of people presenting with similar illnesses in noncontiguous regions (may be a sign that there have been simultaneous releases of an agent).

Notification

Rapid reporting of a suspected bioterrorist event is essential, since all public health and medical responses to bioterrorism begin at the local level. Pediatricians are front-line health care providers in every community and may become front-line responders in the event of a bioterrorist attack. It is impossible to predict where a child or parent may first seek care for an illness caused by a bioterrorist agent, so primary care pediatricians, as well as those working at secondary and tertiary care facilities, must be prepared to promptly diagnose and isolate a patient who is contaminated or infected with a communicable disease. If the illness is potentially related to bioterrorism, the proper authorities must be notified promptly.

After the initial history and physical examination have been completed, if the pediatrician suspects a disease related to bioterrorism, he or she must notify the proper authorities, including the infection-control practitioner (if one is available at the facility) and local

public health authorities. Each local public health system is organized slightly differently, so pediatricians should know which local public health agency to contact and have the correct phone number at hand.

Laboratory Support

Collecting the appropriate clinical laboratory specimens when a bioterrorism-related illness is suspected is critical for the medical care of the patient, as well as for public health and legal investigations. Specimen collection varies by the agent suspected and should be done in consultation with public health authorities. Local and State public health authorities can advise on specific specimen collection and shipping in each case, and they can consult with the Centers for Disease Control and Prevention (CDC) as needed.

Limiting Spread

Rapid identification and isolation of patients with a communicable illness related to bioterrorism are essential to prevent transmission in health care settings. When such an illness is suspected, the patient should be placed on contact precautions and airborne infection isolation, in addition to standard precautions, until preliminary test results are available and the transmissibility of the infection can be reevaluated.

Agents of bioterrorism generally are not transmitted from person to person. The release of an agent is most likely from a point source. However, smallpox, VHFs, and pneumonic plague may be highly transmissible from person to person via respiratory droplet and, in some cases, by aerosol spread.

All patients in a health care facility and all patients suspected of infection with a Category A bioterrorist agent (anthrax, botulinum toxin, plague, smallpox, tularemia, and VHFs) should be cared for using standard precautions, as well as contact precautions and airborne infection isolation (the highest level of precaution) until preliminary test results are available and the transmissibility of disease can be reevaluated. Standard precautions prevent direct contact with blood, other body fluids, secretions, excretions, nonintact skin/rashes, and mucous membranes; they should be observed during all aspects of patient care. Contact precautions ensure that health care workers and others do not come into direct contact with the patient's skin or indirect contact with surfaces or patient-care items in the patient's environment. Airborne infection isolation requires the patient's room to have certain features (private, negative air pressure room with 6 to 12 air exchanges per hour and other features), places limits on who can enter the room, and necessitates confinement of the patient to his or her room except when it is absolutely necessary to transport the patient to another area of the facility.

Equipment and Supplies

The type of equipment and supplies necessary to diagnose and treat a patient suspected of being infected with a bioterrorist agent varies by the level of care that will be provided at a particular facility. An office-based primary care pediatrician may need to be concerned only with short-term isolation and preliminary stabilization of a patient. Such limited care would require a relatively short list of supplies, usually available in the well-stocked

pediatric medical office. Hospital-based pediatricians may be providing longer term and more complex care to patients and should consult with and advise their hospital administration regarding the hospital's bioterrorist response plan and the response plans of State and local health authorities. Hospital-based pediatricians should know how to access the Strategic National Stockpile in the event of a bioterrorist event (see following section on Strategic National Stockpile).

Pediatric Practices

Community-based pediatricians and their staffs should keep the office running smoothly and provide care to the best of their abilities during and after a bioterrorist event. The first step is for every staff member to have a personal family emergency plan. Once staff members are assured that they and their family members are safe, they will be better able to focus on their professional duties.

Second, every office needs an emergency plan. This plan should include details for handling an emergency, both in the office and in the community. Items that should be included in an in-office emergency plan include the following:

- Isolation of the patient and family.
- Personal protective equipment for staff.
- Backup and safe storage of medical records.
- Plans for a secondary office/practice site.
- Contact information for local public health authorities.
- Phone numbers and instructions for emergency patient transport.

Items that should be included in a plan for an emergency in the community include the following:

- Information sheets and hotline telephone numbers.
- Telephone triage protocols.
- Back-up staffing schedules.

Depending on the situation, dedicated staff may be needed just to handle anxious or worried parents.

The community-based pediatrician should have the following items readily available to evaluate children suspected of having an illness related to bioterrorism:

- An examining room with a door that closes, in which to isolate a patient and accompanying family members.
- Surgical masks.
- Clean, nonsterile gowns.
- Clean, nonsterile disposable gloves.
- Eye protection equipment, such as goggles and face shields.
- The 24/7 phone numbers of local and State public health authorities.

Managing Patients

Treatment consists of supportive care (e.g., fever management, fluid management, nutritional supplementation, ventilatory support, and emotional care) and medical treatment (antibiotics and antitoxins) specific to the bioterrorist agent implicated.

The Department of Health and Human Services has stockpiled vaccine for potential use in an outbreak of smallpox or anthrax. Although these vaccines are not available to the public before a bioterrorist event, they could be made rapidly available to high-risk populations in the event of an attack.

Strategic National Stockpile

The Strategic National Stockpile (SNS) was established in 1999 and is managed by the Department of Health and Human Services (HHS). The SNS is a national repository of antibiotics, chemical antidotes, antitoxins, vaccines, life-support medications, and other medical and surgical items. The SNS maintains a stock of supplies that are specific for the medical needs of children and has received guidance from academic and public health experts in general pediatrics, pediatric infectious diseases, pediatric pharmacology, and pediatric critical care medicine.

The SNS is designed to supplement and re-supply State and local public health agencies in the event of a national emergency anywhere and at any time in the United States or its territories. The SNS is prepared for immediate response by having push packs strategically positioned across the United States. Push packs provide medical supplies for an initial response to a broad range of emergencies and can arrive on site within 12 hours of deployment. If additional supplies are required, they can be shipped within 24–36 hours through vendor-managed inventory. SNS supplies will be dispensed when the governor of an affected State makes a request to CDC or HHS.

Information for Families

In the event of a bioterrorist attack, one of the most important and challenging roles for the local pediatrician will be providing information to families with children. During the anthrax attacks of 2001, public health and medical facilities were inundated with requests for information and medical evaluation. As a result, these same agencies have prepared communication messages and information sheets that can be shared with families before and during a crisis. Parents will want information that is age-appropriate for their children, as well as suggestions for ways to answer their children's questions. Pediatricians may want to consider accessing some of these materials and having them available before an emergency occurs. See the list of resources (including the HHS, AHRQ, and CDC Web sites) at the end of this summary for further information.

Chemical Terrorism

Chemical terrorism is the intentional use of toxic chemicals to inflict mass casualties and mayhem on an unsuspecting civilian population, including children. Such an incident could potentially overwhelm the capacity of regional emergency medical services and pose extraordinary medical management challenges to pediatricians.

Chemical terrorism often refers to the use of military chemical weapons that have been illicitly obtained or manufactured *de novo*. However, additional concerns might include the intentional explosion of an industrial chemical factory, a tanker car, or a transport truck in proximity to a civilian residential community, school, or worksite. These events underscore the need for all pediatricians to expand their working knowledge of the approach to mass casualty incidents involving traditional military chemical weapons and other toxic chemicals that might be used as “weapons of opportunity.”

Chemical weapons can be categorized based on the predominant symptoms they cause:

- Neurologic (nerve agents or cyanide).
- Respiratory (phosgene or chlorine, high-dose riot-control agents, or sulfur mustard with a delay of several hours from time of exposure).
- Mucocutaneous syndromes (vesicants).

Casualties will occur almost immediately after an incident involving chemical terrorism, and the attack will likely be recognized rapidly. First responders will be EMS, police, fire, and paramedic personnel. Decontamination and initial care of small children on-scene will pose enormous management issues for personnel wearing bulky personal protective gear. In addition, many exposed, but not critically injured children, will undoubtedly be taken by parents to hospitals and pediatricians’ offices without prior on-scene decontamination—thus posing similar challenges for and possibly personal risk to pediatric care providers themselves.

Specific Pediatric Vulnerabilities to Chemical Agents

Children have inherent physiologic, developmental, and psychological differences from adults that may enhance susceptibility and worsen prognosis after a chemical agent exposure. Briefly, such physiologic differences include:

- Higher minute ventilation.
- Increased skin permeability.
- Greater body surface area to weight ratio (plays a key role in degree of contamination and in the ability to maintain thermal homeostasis after decontamination).
- Less intravascular volume reserve in defense of hypovolemic shock.
- Shorter stature (which places children nearer to the greatest gas vapor density at ground level).

Children who are pre-ambulatory or pre-verbal or have special needs are less able to evade danger or seek attention effectively. A chaotic atmosphere compounded by rescuers wearing unfamiliar garb may frighten children of all ages and potentially increase the posttraumatic response to stress. Those providing care for children are faced with additional complexities posed by developmental, age, and weight considerations beyond the general scope of the already enormous challenge.

Initial Approach, Decontamination, and Triage

The general treatment of contaminated victims begins with extrication, triage, resuscitation as needed, and decontamination performed by rescue workers or health care providers wearing appropriate personal protective equipment. Even if decontamination has been done in the field, hospitals are likely to repeat decontamination procedures to protect the facility from contamination. Decontamination to limit secondary exposures is especially important in exposures to nerve agents and vesicants. Children and their parents or caregivers should be kept together during decontamination whenever possible.

After decontamination, ambulatory, asymptomatic victims may be able to be discharged from the scene, while those with minimal symptoms may be directed toward local shelters (e.g., American Red Cross stations, local schools, or other sites designated by local or State health departments) for medical observation. These shelters may also serve as sites for reuniting children and families who have become separated, keeping track of all victims, and communicating with law enforcement agencies.

Community Preparedness

In today's world of heightened awareness, many agencies are collaborating to provide coordinated care of pediatric victims, and all pediatricians are encouraged to participate in disaster management training. The need to stock appropriate antidotes, practice decontamination strategies, and learn the use of personal protective equipment is apparent. Although perhaps not every practicing pediatrician needs to be competent in all aspects of disaster response, all in the community should work together to optimize the overall capacity for providing disaster care to chemically exposed children. Successful planning and response to events involving chemical terrorism require strong collaboration and integrated functioning of many agencies and facilities in the public and private sectors.

Radiological and Nuclear Terrorism

Nuclear and radiological weapons pose a significant terrorist threat. In the past, terrorists have attacked discrete locations with explosive materials that are not inherently toxic. However, the tactics and technological sophistication of terrorists are continually evolving. Future attacks with radiological devices are a real possibility that is outside the experience of most local emergency and health officials. Radiological terrorism could include detonation of one or more nuclear weapons, deployment of a radiation-producing device or other isotopic weapon (e.g., "dirty bomb"), or simply placement of a radioactive source (e.g., nuclear waste material) in a public location. The probability and nature of injuries depend on the type of disaster involved.

There are several key public health and safety considerations in managing radiological incidents. These include the potential for both immediate and long-term health effects, depending on the specific radionuclide(s) and method of dispersal involved. Other concerns include protection of first responders (including forensic investigators) and the general public, casualty triage, decontamination, treatment, and management of emotional distress and fear associated with possible exposure to radiation. Key decision

points include evacuation versus sheltering-in-place, and potential restrictions on food and water consumption. Initial response capabilities will be limited unless appropriate expertise, specialized equipment, and supplies are readily available.

Nuclear Weapons

The so-called “dirty bomb” disperses radioactive material and is relatively simple to deploy. A nuclear weapon would be much more difficult to deploy. Nevertheless, the potential for detonation of a nuclear weapon in a major city cannot be dismissed. The destructive action of nuclear weapons is mainly due to blast and heat, as in conventional explosives, but nuclear explosions are hundreds to millions of times more powerful than conventional explosives.

Medical providers need to be prepared to adequately treat injuries complicated by ionizing radiation exposure and radioactive contamination. Medical facilities in the immediate area will be nearly unusable due to heavy physical damage. Medical facilities in adjacent areas may be severely compromised by downed power and phone lines; probable loss of all city utilities; and damage to electronics, communications, and HVAC control induced by the electromagnetic pulse produced by a nuclear blast. Patients requiring more than basic medical care will require transport to functioning medical facilities well outside the immediate area of destruction.

Radiological Dispersal Devices

A radiological dispersal device is designed to spread radioactive material through detonation of conventional explosives or other (non-nuclear) means. These so-called “dirty bombs” blast radioactive material into the area around the explosion, exposing people and buildings. The purpose of a dirty bomb is to frighten people and make buildings or land unusable for a long period of time.

Medical and Industrial Sources of Radiation

Radioactive materials used in medical or industrial settings can produce irradiation or contamination from accidental or intentional misuse. Powerful industrial radiography sealed sources used in the nondestructive testing of oil and water pipelines have caused severe exposures. They are potential terrorist weapons and could present a serious localized radiation threat. Another important medical/industrial source is Cs-137, which is an important decay product resulting from the fission of uranium and plutonium fuels. This isotope is used in both industrial sealed-gamma sources as well as medical therapeutic sealed sources.

Nuclear Power Plants

The United States has 104 nuclear reactors licensed to provide electric power, as well as 36 reactors licensed for other uses. The U.S. Nuclear Regulatory Commission has stringent physical protection requirements against sabotage covering both plant design and security protection features. Unlike the design of some foreign reactors, designs for power reactors operating in the United States incorporate a layered system of physical shields and walls, including a potentially pressurized containment vessel. Consequently, there have been relatively few mishaps involving American-designed power reactors.

The primary down-wind hazard from destruction or sabotage of a nuclear reactor is the venting of radioactive iodine gas. Power reactors cannot detonate like a nuclear bomb because reactor fuel does not contain the highly enriched uranium needed for detonation.

Pediatricians may be asked about the safety of consuming milk and other foods after a reactor accident. Iodine-131 fallout on vegetation has an effective half-life of about 5 days. An infant consuming 1 L of milk per day contaminated with 1 microCurie (μCi)/L would receive a total cumulative dose to the thyroid of about 16 rem. Therefore, locally produced milk, fruit, and vegetables should be declared fit for consumption only after clearance by appropriately trained health inspectors.

External Contamination

External contamination with radionuclides can occur in the same settings and situations that cause internal contamination. Any person who passes through a contaminated area without appropriate personal protective equipment or is injured in a contaminated area will become externally contaminated. The largest amount of fallout is on the surface of the ground, so children and crawling infants are particularly prone to pick up this material on their bare skin. However, up to 95 percent of contamination is on the outer clothing and shoes. The body surfaces most likely to be contaminated include the hands, face, lower legs, and oral and nasal cavities.

External contamination with radioactive agents is unlikely to cause acute injury, so emergency resuscitation and treatment of injuries come first. This is in contrast to external contamination with chemical agents, in which rapid decontamination may be more important.

Medical Treatment Unique to Pediatrics

The clinical manifestations of radiation injury in children are generally similar to those in adults. However, a number of characteristics render the pediatric patient uniquely sensitive to the effects of radiation exposure. For example:

- Children have a greater body surface area to weight ratio than adults and skin that is more permeable and less keratinized, making them more vulnerable to both thermal and radiation burns.
- Young children may be unable to shield their eyes, making them more susceptible to ocular injury from blast, radiation, and thermal effects.
- Children have a higher baseline respiratory rate than adults and also exist in a lower breathing zone, making them more vulnerable to both generalized inhalation exposure and particulate exposure from radioactive fallout.
- Children have a lower intravascular volume reserve than adults, making them more susceptible to dehydration from the gastrointestinal losses encountered in acute radiation syndrome.
- Infants and young children are more likely to come in close contact with radioactively contaminated materials in their environment.

- Radioiodine, a common byproduct of nuclear reactor activity, is efficiently transmitted through both human breast milk and cow's milk, which are staples of the childhood diet.

Long-Term Susceptibility

The well-documented long-term effects of radiation exposure to the fetus and child are potentially of even greater concern for the more broadly exposed pediatric population. These effects can occur anywhere from months to years after initial exposure and include:

- Increased incidence of thyroid and hematologic malignancies.
- Increased incidence of breast cancer.
- Higher incidence of mental retardation, microcephaly, and postnatal growth retardation from fetal exposure to radiation.

Psychological Vulnerability

Children involved in a radiation-related incident will be particularly vulnerable to psychological trauma, as in any disaster or terrorist event. Depending on the child's stage of development, this increased vulnerability can manifest as generalized fear and anxiety, developmentally regressive behavior, sleep and appetite problems, altered play, school problems, or greater dependence on caregivers. This latter problem may be exacerbated by physical separation from parents in the chaos of the event. Repetitive television and news broadcasts relating to the event may even traumatize children in areas remote from the actual disaster, convincing them that they also are at risk. Children also experience stress by witnessing the reactions of their parents. Any treatment plan for children exposed to radiation must take these unique vulnerabilities and parental reactions into account.

Immediate Care

The first priority during the care of anyone exposed to radiation is to treat life-threatening injuries before addressing radiation exposure and contamination. In general, evolving injuries such as burns, lacerations, and fractures need to be stabilized before decontamination and subsequent transport to facilities where radiation-specific injuries are to be managed. In most instances, radiation levels will not be known and survey instruments may not be available. Contamination risks to medical responders will be minimal in most cases, unlike biological and chemical exposures. However, simple precautions such as wearing gloves and wrapping victims in sheets or blankets to reduce the spread of contamination should be taken before transport.

Followup Care and Risk of Carcinogenesis

Children are particularly susceptible to the transforming effects of ionizing radiation. This is true for children exposed to radioactive fallout, release of radioactive materials from nuclear power plants, and external beam radiation therapy for medical conditions. External beam radiation therapy, used, for example, in the treatment of Hodgkin's disease or tumors of the central nervous system, is associated with an increased risk of second malignancies, particularly solid tumors arising in the radiation field.

Thyroid nodules and cancers are one of the most frequent late complications of ionizing radiation. Although generally uncommon in children, they are very frequent 10–20 years after radiation exposure. Stable iodine prophylaxis can reduce the risks of thyroid cancer after nuclear disasters or accidents but has no effect against external beam radiation therapy because the latter does not involve radioactive iodine. The World Health Organization and the U.S. Food and Drug Administration recommend stable iodine prophylaxis for exposed populations stratified according to age. Thyroid function tests should be monitored in infants to allow early recognition and treatment of hypothyroidism.

In general, radiation-induced thyroid cancers appear to be more aggressive than spontaneous thyroid cancers and are frequently multifocal. Exposed children should be monitored by serial ultrasound examinations, and suspicious lesions should be removed by total thyroidectomy to eliminate other microscopic foci of disease.

Due to the increased incidence of leukemia in children exposed to high doses of radiation, close followup with regular physical examinations and complete blood counts is warranted. The incidence of breast cancer is also increased in young women, so regular breast examinations should be emphasized. Abnormalities should be evaluated with a high level of suspicion. Enrollment in a high-risk breast clinic may be indicated. The latency period (i.e., the time interval between irradiation and appearance of a malignancy) is shortest for leukemia (5–7 years) but can extend to 45 years or more for solid tumors.

Environmental Issues

The environmental damage from a terrorist incident involving radiation has many potential consequences for children. Response planning should include actions that may be taken to minimize exposure both immediately after and during recovery from a terrorist incident, for example, whether to shelter-in-place or evacuate.

Evacuation is an effective countermeasure to the presence of radiation and may prevent exposure to children. The decision to evacuate should take into account the potential disruption and actual risk. Area evacuations can result in increased risk of exposure if a plume already exists or if evacuation is to a higher risk location. Also, casualties can result from the evacuation process, and negative psychological effects can occur. Ideally, the evacuation would begin before the passage of any radioactive material carried in a dispersal cloud. Evacuation is almost always indicated if the projected average effective dose is likely to be >0.5 Sv (50 rem) within a day.

Sheltering-in-place for protection from radioactive fallout is also an effective countermeasure with little negative impact for short periods of time (hours) and may be done in a fallout shelter, an underground area, or in the middle of a large building. Sheltering generally reduce exposures to external and internal contamination by 5 to 10 times. Sheltering is almost always justified if it will prevent exposures of 0.050 Sv (5 rem) or more.

Earlier recommendations by the Environmental Protection Agency for evacuation were written for a nuclear power plant accident in which the release of radioactive material would occur hours after the initial accident, allowing the population to be evacuated in a plume-free environment. However, a terrorist attack is more likely to release a plume within minutes rather than hours of the event. Therefore, sheltering is likely to be more protective in response to a radiological terrorist event. Sheltering should be performed whenever it is more protective than evacuation.

Blast Terrorism

A 1997 report by the Department of Justice presented an abundance of evidence suggesting that given intent, the knowledge required to build bombs is readily available in print and on the World Wide Web. The raw materials for explosive devices are routinely found in areas of farming and mining activities. Due to the public accessibility of explosive materials and bomb-building knowledge, a domestic terrorist attack would probably take the form of a conventional explosive munitions attack.

Both blast trauma and conventional trauma have aspects of blunt, penetrating, burn, crush, and inhalational injuries. However, victims of a blast may suffer all of these injuries simultaneously, with additional injury caused by the blast wave itself, that is, primary blast injury. Primary blast injuries are lethal, unique, and often subtle.

Many mechanisms of injury are involved in blast injuries:

- Primary blast injury refers to tissue damage by the blast wave itself.
- Secondary injury refers to penetrating or blunt injury that results from the acceleration of shrapnel or debris.
- Tertiary injuries result from acceleration-deceleration forces imposed as the blast wind propels the victim.
- A fourth injury mechanism includes flash and flame burns, inhalational injury, and crush injuries incurred from fires and structural collapse.

Trauma Systems

The medical response to blast terrorism is built on the foundation of the regional trauma system. About 98 percent of all terrorist events worldwide, of which approximately 75 percent are due to blast trauma, involve physical trauma. Therefore, regional emergency management, public safety, and public health agencies should include not only regional child health care experts, but also regional pediatric trauma professionals in planning for mass casualty events that affect children.

Most trauma hospitals are full-service general hospitals that provide the highest level of health care service in their communities. However, modern trauma system design does not rely solely on such hospitals but integrates all health facilities within the region to the level of their resources and capabilities. Thus, the complete trauma system should consist of an integrated network of health care facilities within a region, designed for safe and

rapid transport of injured patients to the health care facilities that best meet their medical needs. Many stand-alone pediatric hospitals also serve as pediatric trauma centers.

Planning and Mitigation

Regional trauma system planning should consider the special needs of children who are injured due to blast terrorism and the special resources necessary to care for them. Children and young adults are at higher risk of serious injury than adults for several reasons. Although blast tolerances in children are poorly defined, there is good reason to believe that children may absorb more blast energy per unit of body mass than adults after blast trauma. This predisposes children to morbidity and mortality rates higher than those of adults as compressive shock waves passing through the body are compacted into a smaller total body mass.

Reports in the literature point out the inadequate state of emergency preparedness for disasters that involve children. They also describe the common problems in pediatric disaster planning and management, such that pediatric professionals involved in disaster planning will be knowledgeable about these problems and can seek to anticipate and avoid them in future disasters. For example, no children were injured in the terrorist attack on the Pentagon on September 11, 2001, principally because the Pentagon daycare center was located on the opposite side of the building from the location of attack. However, issues were subsequently raised on children's hospital disaster preparedness.

Immediately after the attack, the hospital disaster plan was invoked, resulting in the discharge of more than 50 patients and the cessation of all nonurgent activities. Although hospital staff had conducted disaster drills in preparation for Y2K, hospital leaders continued to question their actual state of readiness. Further, emergency preparations were complicated by the fact that all of their news came not from official sources, but from local television, leaving hospital leaders unsure about what to expect.

These experiences highlight the importance of planning and preparedness and raise a number of vitally important issues regarding blast terrorism mitigation in children.

- After a blast, injuries in children are to be expected with most children injured in closed or confined spaces, which greatly increases the magnitude of forces of injury.
- As with blast injuries in adults, most children will either die at the scene or sustain minor injuries. Only a small number of children in the "penumbra" of the blast wind who sustain major injuries will survive to require hospital care. They typically will not begin to arrive at the trauma center until 30–60 minutes after the blast event.
- Most surviving children with major injuries will require early surgery and subsequent care in a pediatric critical care unit, followed by lengthy hospitalization and rehabilitation, both physical and psychological.

Mental Health Issues

Pediatricians and other health professionals who care for children will play many critical roles in identifying and addressing the mental health needs of children and families in a disaster or terrorist event. Indeed, for many, if not most, children affected by a critical event, pediatricians and other health care providers for children will be the first responders. Therefore, pediatricians need to be able to identify psychological symptoms, perform timely and effective triage of mental health complaints, initiate brief supportive interventions, and make appropriate referrals when necessary.

Because children's adjustment depends to a great extent on their parents' own ability to cope with the situation, pediatricians should also attempt to identify parents who are having difficulties adjusting to the event and encourage them to seek support for themselves. Pediatricians can also help families identify and access appropriate supportive or counseling services, and they can help support families who are reluctant to seek mental health services because of misunderstandings related to the nature of the treatment or associated stigma.

Trauma-Related Disorders

Exposure to disasters and terrorism can be direct, interpersonal, or indirect. Children who are physically present during an incident or are an eyewitness to it are directly exposed. Interpersonal exposure occurs when relatives or close associates are directly affected. Indirect exposure occurs through secondary negative consequences of an event such as chaos and disruption in daily activities. Children who are far away from an incident may be remotely affected with fear and generalized distress as they perceive the societal impact of these experiences.

Children may develop psychiatric symptoms and disorders—including posttraumatic stress disorder (PTSD), anxiety, depression, and behavioral problems—after exposure to disasters or terrorist incidents. Grief in these situations can be compounded by the traumatic circumstances associated with the loss. The following factors are associated with an increased risk of posttraumatic symptoms and other adjustment difficulties:

- Children or others close to them are direct victims.
- Children directly witness the event.
- Children perceived during the event that their life was in jeopardy.
- Event results in separation from parents or other caregivers.
- Event results in disruption of regular environment.
- Children have a history of prior traumatic experiences or prior psychopathology.
- Parents have difficulty coping with the aftermath of the event.
- Family lacks a supportive communication style.
- Community lacks the resources to support children after the event.

The essential feature of PTSD is the development of characteristic symptoms after exposure to a traumatic event that arouses intense fear, helplessness, or horror or that

leads to disorganized or agitated behavior. Signs and symptoms are categorized into three clusters:

1. Persistent intrusive re-experiencing (e.g., unwanted memories, nightmares).
2. New onset and persistent avoidance and numbing (e.g., avoiding thoughts about the experience, amnesia).
3. New onset persistent hyperarousal (e.g., sleep difficulties, exaggerated startle response).

Other conditions, especially anxiety and affective disorders, are common after crisis events and may occur independently or together with PTSD. Signs of trauma may be evident in children's behavior, mood, and interactions, and traumatized children may adopt behavior more appropriate of younger children. Girls are more likely to express anxiety and sadness, while boys tend to exhibit more behavior problems.

Although grief is not a mental disorder, it may require professional attention, especially if it is complicated by depression or PTSD. Traumatic deaths are of particular concern, and referral to a pediatric mental health professional is often indicated in these situations.

Assessment and Treatment

Assessment and treatment of children after a disaster vary depending on characteristics of the disaster and the child's exposure, the setting, and the length of time since the event. In the acute-impact and early post-impact phases, supportive interventions should:

- Ensure the child's safety and protection from additional harm.
- Address immediate physical needs.
- Provide reassurance.
- Minimize exposure to traumatic aspects of the event.
- Validate experiences and feelings.
- Restore routine.

Children benefit from accurate information, but it should be age-appropriate and measured. Pediatric mental health professionals may be able to help other health professionals and family members with the process of death notification when needed. Reuniting family members is a priority.

Assessment should include a history of the child's exposure and reactions. When children or their close family members have been directly exposed, the children may require more comprehensive assessment, but children with less direct exposure may also need attention. Observation and the use of projective techniques, such as play and art, aid in assessment and are useful in treatment as well. Children generally should not be forced or coerced to recount the event through repetitive questioning, or to act out the event, or to share their feelings before they are ready.

Treatment should be guided by the child's exposure and reactions. Directly traumatized and bereaved children should be seen individually, but groups are useful for identifying

children in need of more comprehensive evaluation and treatment. Cognitive behavioral therapy and educational information provide structure and support and may be used in individual or group sessions after disasters. Medication is rarely indicated in children after disasters but might be appropriate for those with severe reactions. Consultation with a child psychiatrist is recommended when medication is considered.

The family has a major role in the child's adjustment to trauma, and parents should be included in treatment. Helping parents resolve their own emotional distress can increase their perceptiveness and responsiveness to their children.

School-Based Interventions

Schools are an excellent setting in which to deliver mental health services to children and families after a disaster. They provide access to children, encourage normalcy, and minimize stigma.

PTSD and associated symptoms are likely to emerge in the school setting. For example, intrusive thoughts and difficulty concentrating may interfere with academic performance and social adaptation. Therefore, school consultation about the consequences of trauma and the recovery process may be indicated. School-based interventions, which can include curricular materials and activities, should be appropriate for the setting and should not supplant efforts to identify and refer children in need of more intensive individual evaluation and treatment.

Explaining Death to Children

Children's understanding of death may be very different from that of adults. Children have had far less personal experience of loss and have accumulated less information about death. They also may have difficulty understanding what they have seen and what they have been told, unless they are helped to understand the basic concepts related to death.

When providing explanations to children, use simple and direct terms. Be sure to use the words "dead" or "died" instead of euphemisms that children may find confusing. If young children are told that the person who died is in "eternal sleep," they may expect the deceased to later awaken and be afraid to go to sleep themselves. Religious explanations can be shared with children of any age, but adults should appreciate that religious explanations are generally very abstract and therefore may be difficult for young children to comprehend. It is best to present both the facts about what happens to the physical body after death (e.g., "After a person dies, the body stops working, and the person no longer can see or hear or feel pain, which is why the body can be buried), as well as the religious beliefs that are held by the family.

Children's Reactions to Personal Loss

Similar to adults, children may be reluctant to talk about a death. They may at first be shocked by the news or fail to understand its implications. Even in the setting of a natural disaster or terrorist event, children may still wonder if they were in some way responsible for the death. After a traumatic death, such guilt feelings may increase posttraumatic

symptoms and complicate the grieving process. Often such feelings of guilt are irrational. “If only I hadn’t gone to school that day, my dad would never have gone to the office and wouldn’t have been killed by the bomb,” “I was mean to my father yesterday, and that’s probably why he died,” and so on. Children often are reluctant to share their guilt feelings with adults, and adults may not anticipate these feelings (or be burdened with their own guilt feelings). It may therefore be helpful to reassure children of their complete lack of responsibility, even if they do not express feelings of guilt and there is no logical reason why you might anticipate they would feel guilty.

At the time of a traumatic loss, children often think first about their own needs. Parents should be warned that this self-centeredness is not a sign that children are selfish. More likely, it is a sign that they are under considerable stress and in need of more support and assistance.

Indications of the Need for Referral

Not every child who has experienced the death of a family member or friend requires professional counseling and, in the setting of a major disaster or terrorist event, such resources are unlikely to be available. It is generally helpful though for children who have experienced the death of a family member or friend to speak with someone outside of the immediate family who understands child development and can attend to the child’s needs without being burdened with his or her own grief. This person may be their pediatrician or a school counselor or social worker. When a community disaster or crisis has occurred, it is important to help establish access to supportive services within community sites, such as schools, to provide services to larger numbers of children.

Children who have extreme reactions (e.g., anxiety, posttraumatic symptoms, depression, or thoughts of suicide), atypical reactions (e.g., appearing happy or disinterested), or prolonged reactions (e.g., prolonged sleep problems or somatization) should be evaluated by their pediatrician and likely referred to a mental health professional experienced in the management of pediatric bereavement. Children who are having difficulty returning to their normal daily routines several weeks after the death or are demonstrating the new onset or worsening of problems in interacting with peers should also be referred.

School Crisis Response

Most children will benefit from receiving supportive services in the aftermath of a disaster or terrorist attack. Pediatricians can play a vital role in advocating for, consulting for, and actively participating in school crisis response teams to ensure that such supportive services can be provided to children within schools and other community sites.

School administrators, teachers, and other school staff will be affected by the same crisis event that is affecting their students. During such times, organizing and implementing an effective crisis response can be difficult if not impossible. It is therefore imperative that schools begin planning for potential crisis events before they occur, to avert disasters whenever possible and to decrease the negative impact on students and staff when disasters cannot be prevented.

The school crisis response plan should include generic protocols for the following:

- Notification of team members, school staff, students, and parents of a crisis event.
- Delivery of psychoeducational services and brief crisis-oriented counseling, such as through support rooms or short-term support groups.
- Memorialization and commemoration.
- Follow up to ensure appropriate steps are taken.

In addition, the crisis response plan should include guidelines on the following:

- Crisis team membership and roles of members.
- Protocols for delivery of crisis intervention services.
- Specific guidelines for responding to unique situations, such as large-scale natural disasters or a terrorist attack.
- Physical safety and security.
- Rapid dissemination of accurate and appropriate information.
- Attention to the emotional impact of the events and the crisis response.

The structure provided by a preexisting plan can be very comforting in times of crisis and helps to ensure that key issues are considered, appropriate steps are taken, and necessary resources are in place.

Delivery of supportive services to children during a crisis can be demanding work for school staff and community mental health providers working within the schools. Community groups such as the American Red Cross and the Salvation Army have programs that can be brought into schools to assist in this effort. Plans should also include mechanisms to ensure that supportive services for staff are included as a key component of crisis response.

Impact on Health Care Providers

Very often, first responders and other adult service providers show signs of distress and emotional disruption after responding to stressful situations involving trauma, disaster, or a terrorist event. Pediatricians may be approached by a colleague, a fellow worker, or any health care provider in distress. Apply some basic common sense rules to help:

- Make psychological contact.
- Assess the individual's level of coping.
- Explore possibilities for getting further help.
- Assist in taking action.
- Provide followup.

Integrating Terrorism and Disaster Preparedness Into Your Pediatric Practice

Emergency preparedness should be exercised at all organizational levels, and office-based physicians (either in a hospital or free-standing practice) should understand their specific role in the general system response to disasters. Ideally, office-based policies and

procedures should be specific to the location of the practice and its characteristics and be consistent with the policies of affiliate institutions and public and governmental agencies.

Preparedness for disaster by office-based physicians can be subdivided into two broad categories:

- Internal operations of the practice.
- External operations related to communication and coordination with other agencies, institutions, and the community.

Office Readiness

A comprehensive, child-oriented emergency care system aligns with the concept of systematic intervention in response to disasters while viewing the needs of the child in the context of family and community. This framework is particularly suited to the office-based physician who attends to the whole child. Pediatric health care professionals possess knowledge about responses and needs of children involved in disasters, and they should work across public systems to deliver effective medical, educational, and community interventions. The objective is to ensure that the biological and psychological needs of children are addressed before, during, and after trauma.

Office-based physicians should be aware of the particular vulnerabilities of free-standing practice buildings based on geographic location, and their practices should comply with strict building code regulations and be equipped with back-ups for emergency systems. In the event of structural damage to the practice, there should be a plan for its relocation (e.g., by planning to share facilities with another practice).

Offices should have pre-assembled emergency kits that contain water, a substantial first-aid kit (including thermometer, blood pressure cuff, and stethoscope), radios, flashlights, batteries, heavy-duty gloves, food, sanitation supplies, and medical reference books and cards. Emergency supplies should be located both on- and off-site. Lack of refrigeration for medications and vaccines is a likely scenario in a disaster. Back-up generators are important in case of outages. Back-up communication systems—such as cellular phones, direct telephone lines that are not part of the regular telephone system, two-way radios, beepers, and ham radios—should be considered.

Records

The Health Insurance Portability and Accountability Act (HIPAA) mandates that copies of records be stored off-site (some experts recommend at least 50 miles away) in case of catastrophe. This includes copies of patient charts and other vital records, even if most records are stored electronically. In addition to patient charts, other records—such as copies of licenses, insurance policies, and real estate leases—also should be stored off-site.

Contact List

A confidential contact list of all physicians, nurses, and other staff that includes home, cell, and emergency contact phone numbers should be kept by designated individuals. The contact list should also include back-up providers. This confidential list should be

kept in multiple places (e.g., the practice, an outside location, and/or with the designated individuals). Practices should consider keeping a list of technologically dependent children who, during a disaster or emergency situation, may need specific planning (e.g., availability of back-up generators) and where these children and families should go in case their equipment fails.

Staff Responsibilities

Staff should be made aware that they have a professional responsibility to discuss their availability in case of disasters. This would include calling in to check where their services are needed and the feasibility of responding based on previously discussed office-readiness plans. Discussion with staff of their multiple responsibilities for their own families, work, and the community will help to alleviate concerns and anticipate problem areas. Staff should prepare a Family Emergency Plan so that they will be assured that the needs of their own families will be addressed while they are performing critical health care duties.

The roles of the physician, nurse, and support staff should be agreed upon and documented. For example, everyone should know who will contact the police or fire department, who will aid in evacuation, who will reschedule patients, and so on. Staff members need to know where to go to access credible and up-to-date information during a crisis. Often, such information can be found online, and Web addresses for pertinent sites should be identified and posted in advance for easy access.

The office-based physician may be the first contact for an individual who is the victim of a biological agent and may be called on to treat or answer questions with regard to chemical and radiation exposure. Pediatricians should understand the following:

- The classification and qualities of possible biological agents.
- The natural history and management of biological, chemical, and radiological injuries and exposures.
- Chemical agents that may be used and their properties.
- Types of radiological terrorism.
- Decontamination procedures, especially those specific to children.
- Availability of antidotes and other therapeutics.

The procedure and numbers for alerting the proper authorities (e.g., the Department of Health, CDC, etc.) should be part of the office's preparedness plan.

Office-based physicians may be unsure of their role or feel that they do not have a role in disaster planning or management, yet emergency pediatricians may need to draw on community pediatricians to provide the best possible management of children. The office-based physician may be asked to help hospital-based pediatricians determine which pediatric patients can be discharged or transferred to another hospital. They also will need to triage their own patients who show up at the practice to determine whether they need to go to the hospital or can be safely managed without emergency care. In addition, office-based pediatricians play a critical role in screening children and their family members for medical and psychological distress.

Communication and Coordination with Other Agencies

The office-based physician should determine how the practice will link and coordinate efforts with affiliate hospitals, schools, daycare centers, local response teams, the local department of health, and other entities at the city, State, regional, and Federal levels. Electronic communication, when circumstances permit, is a useful tool for communicating with multiple entities. The chain of command established by the practice should include the points(s) of contact within the organizational structure for communication with the various larger agencies. Ideally, a list of all the relevant agencies should be developed in advance with contact numbers listed (e.g., local and regional hospitals, city fire department, utilities, pharmacies, shelters, and so on).

Communicating with Children and Families

During a disaster or terrorist event, children and families will receive good and bad information from a multitude of sources, including friends, media, and public officials. A well-educated and available pediatrician who can appropriately respond to numerous and varied questions can be of great service. Families view pediatricians as their expert resource, and most expect pediatricians to be knowledgeable in areas of concern. Providing expert guidance entails both educating families in anticipation of events and responding to questions during and after actual events.

Pediatricians can play a central role in helping families develop a disaster and terrorism preparedness plan. Family preparedness may include training in cardiopulmonary resuscitation, rendezvous points, lists of emergency telephone numbers, and an out-of-state friend or relative whom all family members can contact after an event to report their whereabouts and conditions. Family members should know the safest place in the home, make special provisions, know community resources, and have a plan to reunite.

Medications for chronic illness and resources for children who depend on technological means for survival should be included in the family preparedness plan. Pediatricians can advise parents on the need for a power of attorney, living will, advance directive, and other important legal documents. In addition, pediatricians should advise parents and other family members to:

- Notify utility companies to provide emergency support for technologically dependent family members during a disaster.
- Maintain a supply of medications and equipment in case availability is disrupted during a disaster.
- Know how to obtain additional medications and equipment during times of a disaster.
- Learn how they can assume the role of in-home health care providers who may not be available during a disaster.
- Keep an up-to-date emergency information form to provide health care workers with the child's medical information in case the regular care provider is unavailable.
- Know back-up hospitals/providers in the region in case primary hospital/specialists/providers cannot be used.

Terrorism and Disaster Preparedness for Hospital-Based Pediatricians

In mass casualty incidents, including those involving chemical and biological agents, casualties among children and adults could be significant. Because children are likely to become victims in most disaster events, pediatricians should assist in preparedness planning to ensure coordinated responses of local hospitals that in some cases may have limited pediatric resources.

It is important to remember that health care facilities could themselves be primary or secondary targets. Also, facilities may be overwhelmed by massive numbers of anxious individuals and families. Pediatricians working in or supporting hospitals can play a vital role in ensuring the enhanced care of the pediatric disaster victim by participating in all levels of disaster preparedness planning.

Emergency Department Readiness

Pediatricians working in or supporting hospitals should interact with the planning committee to ensure adequate training and preparation of supplies and treatment areas in the emergency department. Pediatricians working in hospitals can be key facilitators between emergency department services, critical care services, and regular inpatient services. Coordination with the local community should involve primary/prehospital/infrastructure response (e.g., EMS, fire, police, regional poison centers, and so on) with liaison planning to State and Federal agencies and community/citizen response (e.g., schools, daycare centers, service groups, and so on). Planners should take into consideration the fact that usual referral patterns may not typically include accepting pediatric patients.

Inpatient Service Readiness

Anticipating surge capacity for inpatient care is vital in preparedness planning and perhaps represents the greatest contribution of pediatricians working in hospitals. Issues that should be considered include the following:

- Increasing the number of inpatient beds within a community (e.g., by converting cafeterias and meeting spaces into ward capacity or making arrangements with other community hospitals). Local hotels, school gymnasiums, etc., may be converted into low- or mid-acuity medical facilities with some planning. Parallel pediatric services have been documented to improve quality and efficiency in the care of children.
- Making contingency plans for acquiring or maintaining essential services (e.g., water, electricity, portable oxygen, garbage disposal, etc.).
- Planning for stockpiling or readily acquiring medical supplies such as vaccines, antitoxins, and antibiotics (in dosages, formulations, etc., appropriate for pediatric patients). In addition, pediatric-specific supplies and equipment in a full range of sizes to accommodate children of various ages should be available.

- Networking community resources to organize volunteers who can become proxy caretakers for orphaned children.

Hospital Infrastructure Needs

Essential components of hospital preparedness include crisis drills, infection control plans, quarantine procedures, and staff training. For example:

Crisis drills: Hospital and community-wide drills need to be done on both a wide scale and with a narrow focus. Drills should include not only the initial triage and decontamination stages, but also the 48-72 hours after impact to measure readiness with all provider and support services that will be needed. Specific drills should be planned and practiced for evacuation in response to fire or other disasters.

Infection control plans: These plans closely parallel quarantine procedures in the community and on a public health basis. In-hospital infection control plans involve quarantine or isolation and control measures to limit spread of infection to staff and other patients.

Quarantine procedures: Children who become ill following a disaster or terrorist event may require isolation to prevent spread of disease to other patients and health care providers. The exact nature and severity of quarantine will depend on the specific hazard involved. Close coordination with the public health service, CDC, and local poison control centers is essential in both the planning and execution of quarantine procedures.

Staff training: Staff training should include the following:

- Use of protective gear.
- Orientation to all aspects of the plan from the disaster site to the emergency department to hospital floors, as well as to rehabilitation and rebuilding in the community.
- Staff preparedness for notification, transportation to treatment sites, self-preparedness (e.g., emergency packages of personal items), strategies for coping with family demands, psychological demands, and plans for personal health and hygiene.
- Support for families of health care workers so that they are available to provide services.
- Mechanism for tracking resources.
- Media/public communication issues.

Working with Government Agencies

The challenge of dealing with the threat of terrorism in the United States is daunting not only for disaster planners, but also for our medical system and health professionals of all types, including pediatricians. All possible forms of terrorism must be considered, including chemical, biological, explosive, radiological, and nuclear events. Pediatricians must be able to respond to concerns of patients and families, recognize signs of possible exposure to a weapon of terror, understand first-line response to such attacks, and

sufficiently participate in disaster planning to ensure that the unique needs of children are satisfactorily addressed in the overall process.

The Federal government provides significant funding for disaster preparedness and response and to a large extent establishes the framework that is then followed by States, regions, and communities. Volunteer organizations, such as the Red Cross and Salvation Army, also have key roles in disaster response. A successful response to a disaster requires the interaction of personnel and resources from multiple agencies in an organized and coordinated manner according to a well-formulated plan. While overall planning has increased significantly in recent times, attention to the unique needs of children and the inclusion of pediatric expertise in the planning phases continue to be insufficient.

Local governments are the first line of defense in emergencies and are primarily responsible for managing the immediate response to most disasters. When a local government receives a warning that an emergency could be imminent, its first priorities are to warn citizens and to take whatever actions are needed to minimize damage and protect life and property. The emergency operations plan is at the center of comprehensive emergency planning. This plan spells out the scope of activities required for community response. Historically, these documents have not focused much attention on pediatric considerations, and only rarely have pediatricians been part of the planning process.

All States have laws that describe the responsibilities of the State government in emergencies and disasters. The State emergency management office follows procedures specified in the State emergency operations plan to respond to virtually all serious emergencies, including disasters and terrorist events. These plans rarely include child-specific guidelines. To remedy this, pediatricians need to be involved in State emergency planning committees to ensure that pediatric considerations are included in State plans and the plans of individual agencies, as well as a component of funding for disaster and terrorism preparedness.

At the Federal level, planning and preparedness for disasters and terrorist events are coordinated by the Federal Emergency Management Agency (FEMA). FEMA uses the interagency Federal response system, also called the Federal Response Plan (FRP), to oversee and coordinate the response and activities of other Federal departments and agencies. The FRP describes the basic mechanisms and structures by which the Federal Government mobilizes resources and conducts activities to augment State and local response efforts. It is important to understand the Federal role and the provisions of the FRP, in that most States use it as a basis for the structure and some content of their own emergency operations plans. In turn, local emergency operations plans are based to some extent on State plans.

On a larger scale, we also should recognize the need for public health preparedness. This requires the existence of a strong public health system. To allow for rapid and efficient response, both a central organization, as specified by Federal planning and State

implementation, and the decentralization of some resources, such as diagnostic capabilities, are necessary. Pediatricians should understand the importance of public health and their relationship to departments of health at various organizational levels. This includes their role in public health, reporting requirements and mechanisms, and mechanisms for receiving and soliciting information from departments of health.

Advocating for Children and Families in Preparedness Planning

Properly informed and motivated pediatricians are essential advocates for children to ensure they receive appropriate attention in preparedness planning at the local, State, and Federal levels. The role of pediatricians can take several forms. Grass roots advocacy can include efforts to ensure legislation and funding to support an emphasis on children in disaster planning at every level. Pediatricians can serve as expert advisors to local, State, and Federal agencies and committees. They also can serve as strong advocates for children through their involvement in boards, community groups, and professional associations, including national organizations.

As experts in the care of children, pediatricians should be prepared to:

- Advocate for inclusion of the needs of children in all Federal, State, and local disaster planning.
- Advocate for research on the pediatric aspects of biological, chemical, and radiological terrorism, including mechanisms, pathophysiology, and treatment, as well as the availability of appropriate medications and antidotes.
- Work with disaster medical assistance teams to ensure that they are equipped and trained for the care of children.
- Assist in developing hospital disaster plans that ensure the proper care of children.
- Provide on-site emergency and primary health care at emergency shelters.
- Be involved in emergency medical services (e.g., develop proficiency in cardiopulmonary resuscitation and first aid, train first responders in pediatric assessment, assist in development of prehospital pediatric protocols, help establish protocols for consent to treat and identification of minors, and ensure the availability of pediatric resources).

At the local and community levels, pediatricians should:

- Work with local police, fire, and EMS departments to ensure their plans and equipment are prepared for children.
- Be involved with local and community emergency preparedness task forces and committees.
- Work with schools, child care centers, and other facilities where children spend their time to ensure that they have adequate emergency plans.

Similarly, at the State level, pediatricians should:

- Ensure that State emergency management, department of health, and EMS advisory committees have pediatric expertise as part of their membership.

- Advocate to ensure that all State disaster and terrorism education and funding require incorporation of children's needs.

Conclusion

This summary focuses on the very important role of pediatricians in disaster planning. This includes advocating for the needs of children during the development of preparedness plans, the provision of care during and after a disaster or terrorist event, and the mitigation of suffering in the aftermath of a disaster.

Lessons Learned

As a Nation, we have learned some painful lessons about the need for preparedness from recent disasters, in particular Hurricane Katrina. For example:

- The initial response to mitigate the impact of Katrina on New Orleans and surrounding areas was inadequate at many levels.
- A large part of the problem was insufficient coordination and planning for the magnitude of the destruction, the need to evacuate large numbers of people, and the long-term displacement of people from their homes and schools.
- In disasters, State and Federal aid is always going to take some time to arrive.
- Local and regional authorities, as well as individual families, should have an effective plan in place that includes immediate efforts to be undertaken before distant assistance can arrive.
- Communities need a realistic evacuation plan that provides for quickly setting up emergency shelters, providing food, managing water sanitation, and providing medical and mental health care services for large numbers of people.

Following Katrina, parallel services spontaneously evolved and were found to be readily accepted by providers, decisionmakers, and patients. For example:

- When a pediatrician is invited to command center meetings, children's issues are resolved more appropriately, efficiently, and effectively.
- Well-meaning volunteers will appear, and some organization of their efforts is essential. Some will be untrained; they have proven to be helpful when appropriately managed. For professionals, emergency credentialing and licensing processes aided in more appropriate use of volunteer skills.
- Payment issues for meaningful and necessary services need to be resolved.

Here are some issues for pediatricians and other planners to consider as they develop and refine emergency response plans for their communities. These are issues that directly affect children and families, and they deserve attention.

Vulnerable populations: In a disaster, the most vulnerable are going to suffer the most. Clearly, vulnerable populations include the poor, the infirm, individuals with mental illness, the elderly, and children. In addition, these situations highlight the need for including large numbers of technologically dependent patients, many of whom require

highly specialized regionalized care, in planning efforts to mitigate the impact of a disaster.

Separation of children from families: In the event of a disaster or terrorist event, it is likely that numerous children will be separated from their parents or other caregivers. Several national organizations—including the National Center for Missing and Exploited Children and the Red Cross—work to help separated family members find each other. This issue deserves more attention in preparedness and mitigation planning. For example, pre-disaster identification of children (e.g., name tags, other forms of ID, etc.) -- especially for those who are not verbal or cannot give their own name, a parent's name, or other critical information -- should be considered. Neonates and their mothers are purposefully given matching ID bracelets in hospitals immediately after delivery so the identity of the maternal-child pair is never in doubt. Similar identification of parent-child pairs at the time of separation (e.g., during rescue or evacuation) could greatly aid in the identification of the child and more accurately track and reunite children separated from their parents.

Sheltering families: The immediate first responses to a disaster may be the need to mobilize and evacuate a community or large region. Subsequently, those displaced from their homes, schools, and neighborhoods will require basic necessities (e.g., food, clean water, medical care). The unique needs of children in shelter situations include special food needs (e.g., formula), clothing and sanitation needs (e.g., diapers), and sleeping accommodations (e.g., cribs). Planning for special medical needs and for mental health care that focuses on a child's unique developmental stages is also critical.

The frustration to staff and evacuees caused by a crying infant or an obstreperous 2-year-old is predictable and needs to be anticipated. In addition, some shelters will not accept a pregnant female. This also should be anticipated, and alternate arrangements should be in place in advance of a disaster.

Providing urgent care to large numbers of displaced children: There is a need for pediatric specialists in disasters, and it may be necessary to set up a temporary pediatric clinic to care for large numbers of injured and/or displaced children. Some lessons learned that should be taken into consideration in future planning include:

- Physicians and nurses who are trained and experienced in the emergency care of children should always be included, even at the most basic level, when planning for and responding to a disaster.
- Access to local tertiary pediatric care resources should be arranged for in advance, and tertiary care providers should be involved in planning, including pharmaceutical, central supply, and respiratory personnel.
- While volunteerism is essential in the event of a mass casualty, guaranteed staffing of medical facilities, including temporary clinics, should be a priority.
- The appropriate allocation of physician and nursing resources is vitally important to patient flow.
- Cooperation with regional disaster command is essential.
- Choosing an appropriate venue for the staging of disaster response is critical.

- Mental health care and social services should be made available to the evacuated population as early as possible.
- A centrally located, functional phone, cell phone, and/or radio are crucial.
- A command center should be designated.
- There should always be a planned exit strategy.

A Final Word

Timely response and appropriate medical management are essential to minimizing injuries and maximizing survival when a disaster occurs. Being prepared ahead of time is the key to timely and appropriate medical care. Children and other vulnerable populations have special needs that must be considered in the course of planning for a mass casualty event.

Pediatricians can play a very important and unique role in advocating for the needs of children and families who seldom receive enough attention in disaster planning. Response resources dedicated to pediatric populations remain unavailable or extremely limited for most emergency medical response activities related to disasters, even though victims often include children. To address this shortcoming, it is vitally important that pediatricians and other representatives of special populations take part in local, State, regional, and Federal disaster planning to ensure appropriate care for the most vulnerable populations.

Additional Resources

The following telephone and online resources are provided to assist you in locating additional information on the topics discussed in this summary.

Department of Health and Human Services

For materials to educate families about bioterrorism, go to <http://www.os.dhhs.gov/> and select “Disasters and Emergencies.”

Agency for Healthcare Research and Quality

For a variety of resources on bioterrorism and emergency preparedness and response, go to <http://www.ahrq.gov> and select “Public Health Preparedness”

Centers for Disease Control and Prevention (CDC)

CDC home page, which includes links to information for families at <http://www.cdc.gov/index.htm>.

Emergency consultation and assistance to clinicians and to State and local health agencies is available 24/7; call 770-488-7100 to reach the Director’s Emergency Operations Center.

The Clinician Information Line at 877-554-4625 operates 24/7 to provide guidance on management of patients suspected of having bioterrorism-related illnesses.

Physicians can go to <http://www.bt.cdc.gov/clinregistry/index.asp> to register to receive real-time CDC updates about preparing for and responding to terrorism and other emergency events.

For public health bioterrorism planning documents, go to <http://www.bt.cdc.gov/>

Go to <http://www.bt.cdc.gov/stockpile/index.asp> for information on the Strategic National Stockpile.

For a listing of State health department Web sites, go to <http://www.cdc.gov/other.htm#states>

For a listing of State epidemiologists, see http://www.cste.org/members/state_and_territorial_epi.asp

For information about infection control, go to http://www.cdc.gov/ncidod/dhqp/gl_isolation.html

For a video on the history of terrorism, see <http://www.bt.cdc.gov/training/historyofbt/index.asp>

Health Resources and Services Administration

Go to <http://www.hrsa.gov/healthconcerns/default.htm> and select “Emergency Preparedness” for materials related to bioterrorism and disaster preparedness, including materials specific to children and adolescents.

Substance Abuse and Mental Health Services Administration

Go to <http://www.nctsnet.org> to access resources developed by SAMHSA’s National Child Traumatic Stress Network. Resources include materials on disaster and terrorism preparedness for parents and caregivers, educators, professionals, and the media.

American Academy of Pediatrics

General information and tools, available at <http://www.aap.org/terrorism>
Family Readiness Kit, available at <http://www.aap.org/family/frk/frkit.htm>
Emergency Information Form for Children with Special Needs, available at <http://www.aap.org/advocacy/blankform.pdf>
Links to Federal bioterrorism-related materials,
http://www.aap.org/terrorism/resources/federal_resources.html