Building Surge Capacity for Disasters and Other Public Health Emergencies Involving Children

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Outline

- **Children and Surge Events**
- Vulnerabilities in Children
- PreHospital Preparedness for Children
- Pediatric Considerations for Hospital Surge

Children in the US

- 73.6 million Children in the US
- 20 million Children under the age of 6
- Up to 10% of EMS ambulance patients
- Up to 30% of emergency department visits
  - 90% in non-children's hospitals or non-trauma center settings
- 15-20% of pediatric population are children with special healthcare needs

Surge Events involving Children

- Mass Casualty Event and Public Health Emergency involving both adults and children
- Events involving only children
  - 80% of children's waking hours are in school or out of home care
- Events that start with children and spread
  - Influenza

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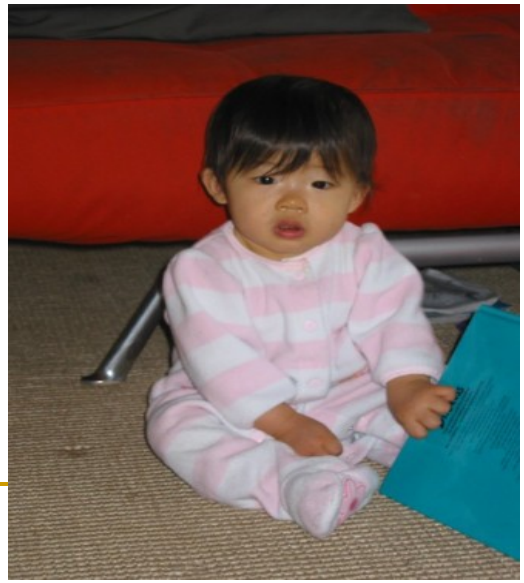
Vulnerabilities in Children

- Anatomical
- Developmental
- Physiological
- Psychological
- Infections

Anatomical Differences of Children

- Pliable Skeleton – greater risk for multiple internal organ injuries after blunt trauma
- Large Head to Body Ratio: Children are more likely to sustain traumatic brain injuries

Seen in Israeli experience with Mass Casualty Events.



Waismen Y, et al. Clinical PEM 2005;7(1) 52-58.

Developmental Differences of Children

- Immature Motor Skills
  - Not be able to flee
- Immature Cognitive Skills
  - Does not understand the danger
  - May run towards the problem
  - Less cooperative and may “melt down”

Physiological Differences in Children

- Vital signs (HR, RR, BP) vary with age making assessment difficult
- Faster respiratory rates and breathing zone closer to ground increases injury from fire, biological or chemical attack
- Thinner skin— less protection and greater absorption of toxic chemicals
- Large skin to body mass ratio and less fat— at risk for hypothermia
- Less fluid reserve— small amounts of fluid loss can be devastating

Psychological Differences in Children

- More vulnerable when separated from the caregivers
- Developing anxiety attacks over separation
- Greater risk of developing post traumatic stress disorder
- Greater risk of developing persistent behavioral disturbances

Infections: Influenza

- After exposures, children will exhibit symptoms earlier and causes subsequent spread
- Real time surveillance data from 2000-2004
  - When there was an increase of preschool children (3-4 years) presenting to Massachusetts emergency departments with respiratory symptoms
  - This was followed by an increase in mortality in the general population from influenza
- Current recommendations are for annual influenza vaccination for children < 5.
- Latest Pandemic flu planning involves closing of schools, daycares, etc. in an attempt to lessen effects of pandemic waves

Mandl K, et al. Am J Epidemiol 2005;162:1-8

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Prehospital Preparedness for Children: Case Study

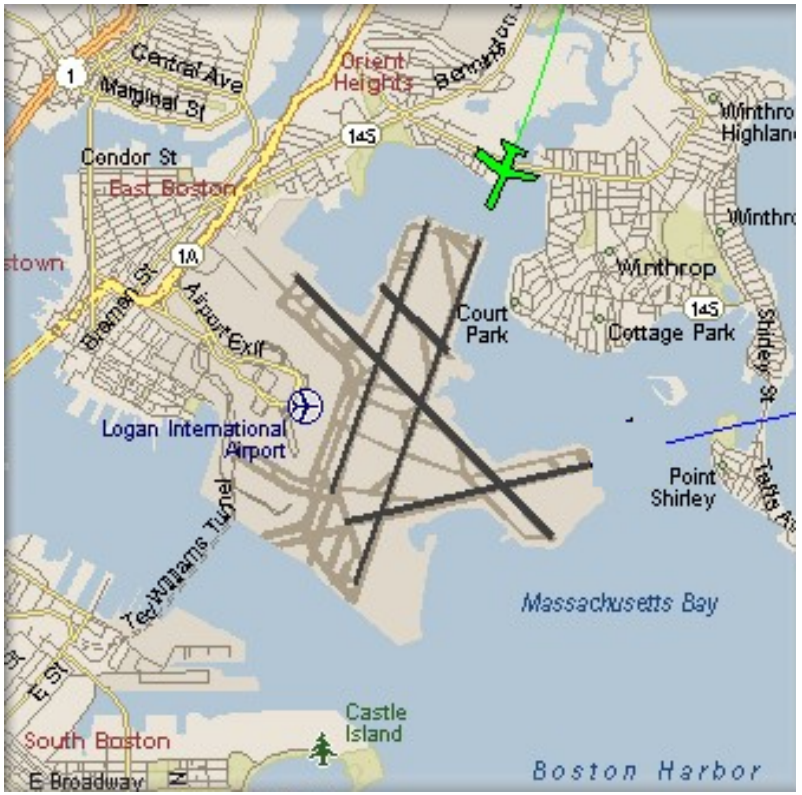
- Operation Ready 2007
  - Mass Casualty Event Drill
  - Sponsored by MassPort Fire Rescue and two commercial Airlines
  - Participating Agencies:
    - City of Boston: Mayor's Office of Emergency Preparedness
    - Massachusetts DPH & Boston Public Health Commission
    - Massachusetts State Police
    - Boston Fire & Boston Police
    - Numerous Hospitals and Community Health Centers

Operation Ready 2007: Scenario

Logan International Airport:

Two aircraft collide at low-to-moderate speed. Passenger loads of both aircraft are full.

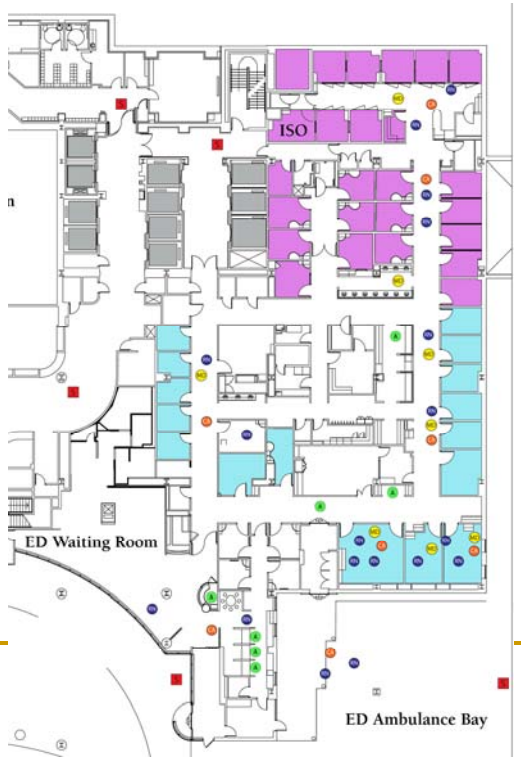
The collision causes multiple casualties.



Federal Air Marshals, executives from Fidelity Investments and State Street Bank, foreign nationals, passengers with disabilities, and a group of local Boy Scouts are among the 520 ‘souls’ on board.

Children's Hospital Preparations

- Anticipate receiving all the pediatric patients (boy scouts) and their families
- Plan for surge in all departments: ED, OR, ICU and ancillary services
- ED plans include:
  - patient tracking
  - physical division of the ED
  - alternate care site activation
  - Psychosocial Team



Operation Ready 2007: Results

- Largest airport exercise in US History
  - 430 victims transported from Logan International Airport to area hospitals and a community health center
- Pediatric Patients Transport Results:
  - 5 “critical” Children and one Adult sent to Children Hospital
  - Some pediatric patients sent to hospitals with pediatric capabilities (PICU, Trauma)
  - Some pediatric patients sent to hospital with limited pediatric capabilities (No PICU, Trauma)
  - Some pediatric patients were unaccounted for during the duration of the drill

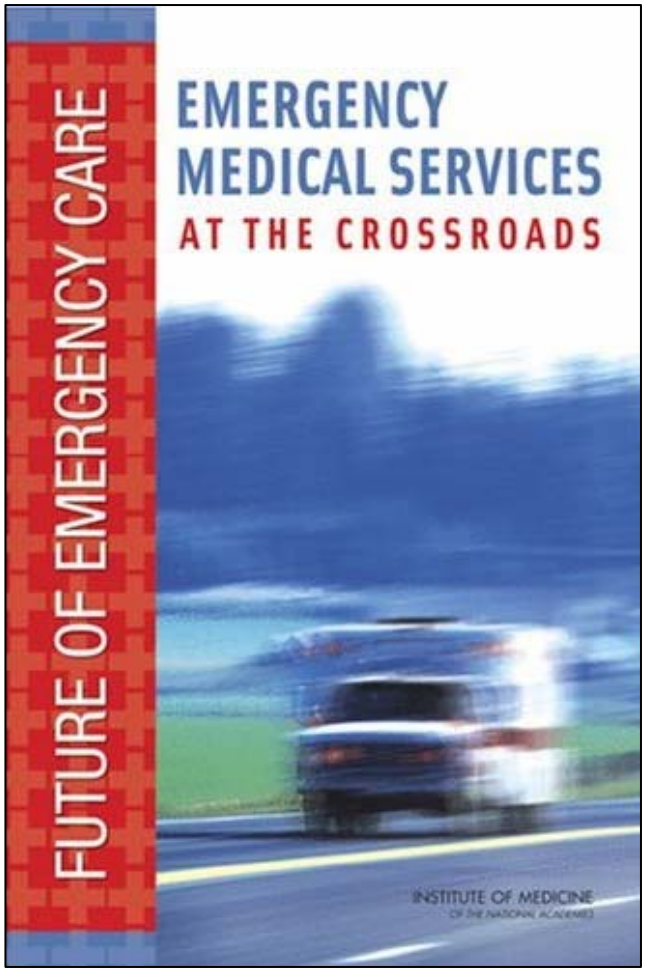
Operation Ready 2007: Pediatric Considerations

- Revealed gaps and shows areas for improvement in Prehospital Planning for Pediatric Patients. Even in a drill:
  - Children were separated from their families based on perceived acuity
  - Mechanism for Identification and Process for Reunification needed to take place at each health care facility where children presented.
  - Difficult to account for all children in a mass casualty event

Is this event typical or atypical of a prehospital response?

Institute of Medicine Report 2007

- Emergency Medical Services (EMS)
  - Highly fragmented and variable
  - Lack of standardization for training and regional coordination of EMS
  - Lack of coordination between ED's and EMS
  - "Uncomfortable" with the pediatric patient



Pediatric Mass Casualty Events (MCE)

Prehospital Preparedness survey results (N=1808):

- 72.9% EMS Agencies have written MCE plan
- 13.3% EMS Agencies have written Pediatric specific MCE
- 19.2% EMS Agencies have Pediatric-specific triage protocol for MCE
- Of the Regional Disaster Drills sampled: 49% included pediatric victims.

Shirm, S et al. *Pediatrics* 2007;e756-e761

Operation Ready 2007: Pediatric Considerations

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Is this event typical or atypical of a prehospital response?

Answer: Probably a typical response.

Prehospital Recommendations for Children in MCE

- Response agencies and local pediatric experts should collaborate to develop Pediatric specific triage protocol and plans for mass casualty events
- Extensive pediatric focused training and drills
- Improve prehospital communication tools to better understand hospital's pediatrics capabilities:
  - Pediatric physicians, nurses, equipment, subspecialty services, etc

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Hospital Surge: Case Study 2: School Event 2007

- Elementary School
  - (pre k-8th grade)
- Developed antifreeze leak causing evacuation of 600 students
- Medical complaints of nausea, dizziness, and asthma exacerbations
- ***Transportation Results: 20 children were sent to hospitals who normally <u>only treat adults</u>***

Hospital Surge Capacity

- Sarin attack Japan 1995: more than 4000 victims arrived to area hospital by their own means: car, foot, bus
- Federal (2004): “establish system that allows for triage, treatment, disposition of 500 adult and pediatric patients per 1 million population”
- Illinois – EMSC(2005): “Plan for an influx of 15-20 children over and above already admitted pediatric volume for minimally 3 days”

Pediatric Considerations for Hospital Surge

- Decontamination/Protection of Health Care Workers
- Treatment of Families as a Unit
- Identification and Reunification Systems
- Staff with pediatric knowledge
- Hospital Facilities
- Equipment/Medication
- Security
- Transfer Protocols

Hospital Surge: Decontamination of Children

- Water Temperature and Pressure
  - Ideally 37.8 to prevent hypothermia
  - Large volume, low pressure water systems
- Nonambulatory children
  - Infants and toddlers
  - Children with special care needs
- Families as a Unit
- Attention to child's stage of development
  - Sensitive to child's fear
  - To promote maximum cooperation

- Children size clothing post decontamination to prevent hypothermia

AHRQ Training Video Decontamination of Children
Available at http://www.ahrq.gov/research/decontam.htm

Treating Families as a Unit

- Provide medical treatment to all family members together to minimize separation of families
  - Currently hospitals that treat adults and children are best suited though this may not be their usual practice

- Challenges:
  - Adult only hospitals who need to prepare for pediatric patients
  - Children's Hospitals who need to accommodate adults

Identification of Children

- Children will be displaced from families
- Depending on development stage and/or fear, children may not be able to identify self
- Natural Disasters
  - Hurricane Katrina/Rita: 5192 children displaced from families.
    - 6 months later the last child was reunited with her family
- Terrorist Attacks
  - Happen during the day when children are in school, camps, and after school programs

Broughton DD et al. Pediatrics, May 2006; 117: S442 - S445.

Reunification of Families

- Hospitals need to have set protocols for tracking and identification of children (identification survey, photographs) and facilitating family reunification
- Ideally, all information of displaced children should be sent to a regional center that family members can access
- After reunification, expect 4-5 visitors/family per pediatric patient

CDC Health Advisory, " Instructions for Identifying and Protecting Displaced Children." Sept 28 2005

Pediatric Healthcare Providers

- Identify number of healthcare providers (MD, RN) with pediatric expertise that are on premises on a “typical working day”

- Pre-identify providers with pediatric clinical expertise that can be available:
  - Pediatrics, Emergency Medicine, Family Medicine, Surgery and Surgery subspecialty, Anesthesia, Newborn and Special Care nurseries

Pediatric Healthcare Providers

- Educate all to hospital disaster plan regarding children and provide disaster training

Psychosocial Support Staff

- Children will have different capabilities of understanding and processing events based on developmental stage.
- Identify personnel that have training in
  - Child Life: to explain events on the child's level and reduce fear
  - Social Work: to help facilitate family reunification and support
  - Psychiatry: immediate intervention to prevent future mental health disturbances
- Develop hospital disaster plans with their input

Hospital Facilities

- Census of Pediatric beds
- Alternate Care Sites
- Pediatric Safe Areas
- Family Reunification Center
- Media Center

Hospital Facilities: Census of Pediatric Beds

- Identify all current pediatric beds availability (ED, Floor, ICU, OR)
  - Identify beds that can be used for critically ill pediatric patients
  - Identify possible beds that can be used for pediatric patients (with accompanying pediatric health care providers)
- Recommend each hospital has 5 cribs, port-a-cribs, or playpens in storage

Hospital Facilities: Alternate Care Sites

- Identify other areas that can be used for triage and treatment of less critical patients (lobbies, ambulatory clinics, cafeteria, conference rooms, auditoriums)
- Inspect areas to determine child safety-proof
  - Windows, heavy equipment, locked medications, outlets, choking hazards, cleaning supplies
- Create checklist of Pediatric Equipment and Medications minimally needed to provide care at each site.

Alternate Care Sites: Medications

- Acetaminophen
- Albuterol
- Ipratropium
- Amoxicillin
- Augmentin
- Aurasol
- Azithromycin
- Bacitracin
- LET
- Dexamethasone
- Diphenhydramine
- Ibuprofen
- Lidocaine
- Ondansetron
- Prednisone
- Normal Saline

Hospital Facilities: Pediatric Safe Areas

- Identify areas for placement of medically treated and released pediatric patients without caregivers
- Area must be inspected for child safety
- Children activities (games, videos, toys, stickers)
- Trained staff for supervision
  - Recognize and reassure children who are frightened
  - Prompt referrals to psychiatry for immediate interventions

Pediatric Safe Area Checklist

YES	NO	ITEM
		Needle boxes are at least 48 inches off the floor?
		Do the windows open?
		Are the windows locked?
		Do you have window guards?
		Can you contain children in this area (consider stairwells, elevators, doors)?
		Do you have distractions for the children (age and gender appropriate videos, games, toys)?
		Poison-proof the area (cleaning supplies, Hemoccult developer, choking hazards, cords should be removed or locked)
		Are your med carts and supply carts locked?
		Do you need to create separate areas for various age groups?
		Have you conducted drills of the plans for this area with all relevant departments?
		Do you have a plan for security for the unit?
		Do you have a plan to identify the children?
		Do you have a plan for assessing mental health needs of these children?
		Are there any fans or heaters in use? Are they safe?
		Do you have an onsite or nearby daycare? Could they help you?
		Do you have enough staff to supervise the number of children (Younger children will require more staff)?
		Do you have a sign-in, sign-out sheet for all children and adults who enter the area?
		Will children need to be escorted away from safe area to bathrooms?
		Are age appropriate snacks available for children?

Available at http://www.nyc.gov/html/doh/downloads/word/bhpp/bhpp-focus-ped-toolkit.doc

Hospital Facilities: Family Reunification Center

- Staffed by train professionals (Social work)
- Provides accurate information to reunify families and emotional support
- Identify area away from ER and alternate care sites to allow for unhindered medical treatment
- Ideally area would have a main reception area with adjacent enclosed areas for families that need privacy

Hospital Facilities: Media Center

- Anticipate Media Coverage- Potentially injured children is “Big News”
- Identify area away from medical treatment and Family Reunification Center
- Provide updates not only to media but also internally to families and hospital personnel

Pediatric Equipment

- All treatment areas should have age appropriate equipment
  - Thermometers
  - Blood pressure cuffs
  - Pulse oximetry
  - Pediatric leads for CVR monitoring
  - Pediatric gauge IVs
  - Pediatric pads for pacing, defibrillation

Minimal Recommended Number of Items per 1 Expected Critical Pediatric Patient

Equipment Type	Amount
Ambu Bags Infant Child	2 2
Arm Boards	2
Blood Pressure Cuffs Infant/Small Child	1
Chest Tubes Sizes 12F, 16F, 20F, 24F, 28F	2 each size
Dosing Chart, Pediatric	1
$ETCO_2$ Detectors (pediatric, disposable)	2
ET Tubes 2.5 - 6.5	3 each size
Foley Catheters Sizes 8F, 10F, 12F	2 each size

Available at http://www.nyc.gov/html/doh/downloads/word/bhpp/bhpp-focus-ped-toolkit.doc

Minimal Recommended Number of Items per 1 Expected Critical Pediatric Patient

Equipment Type	Amount
Gastrostomy tubes Sizes 12F, 14F, 16F	 2 each size
Infant Scale	1 for any # patients
Intraosseous Needles	3
Intravenous Infusion Pumps	1
Laryngoscope Blades Macintosh 0,1,2 Miller 0,1,2	 2 each size 2 each size
Laryngoscope Handles (pediatric)	2
Masks Face masks, clear self-inflating bag (500cc) Infant Child Non Rebreather Infant Child	 2 2 2 2

Available at http://www.nyc.gov/html/doh/downloads/word/bhpp/bhpp-focus-ped-toolkit.doc

Minimal Recommended Number of Items per 1 Expected Critical Pediatric Patient

Equipment Type	Amount
Nasal cannula Infant Child	 2 2
Nasogastric Tubes Sizes 6F, 8F, 10F, 12F, 14F, 16F	 2 each size
Nasopharyngeal Airways (all pediatric sizes)	1 each size
Newborn Kit / Obstetric/Delivery Kit	1
Oral Airways (all pediatric sizes 00, 01)	2each size
Over the Needle Intravenous Catheters Sizes 20, 22, 24	 5 each size
Restraining Board (pediatric)	1
Resuscitation Tape, length based (Broselow)	2

Available at http://www.nyc.gov/html/doh/downloads/word/bhpp/bhpp-focus-ped-toolkit.doc

Minimal Recommended Number of Items per 1 Expected Critical Pediatric Patient

Equipment Type	Amount
Semi Rigid Cervical Spine Collars Infant Small Child Child	 2 2 2
Suction Catheters 5F, 8F	 5 each size
Syringes, 60cc, catheter tip (for use with G/T tube)	2
Tracheostomy Tubes Sizes 00 to 6	 2 each size
Warming Device (overhead warmer for newborns)	1

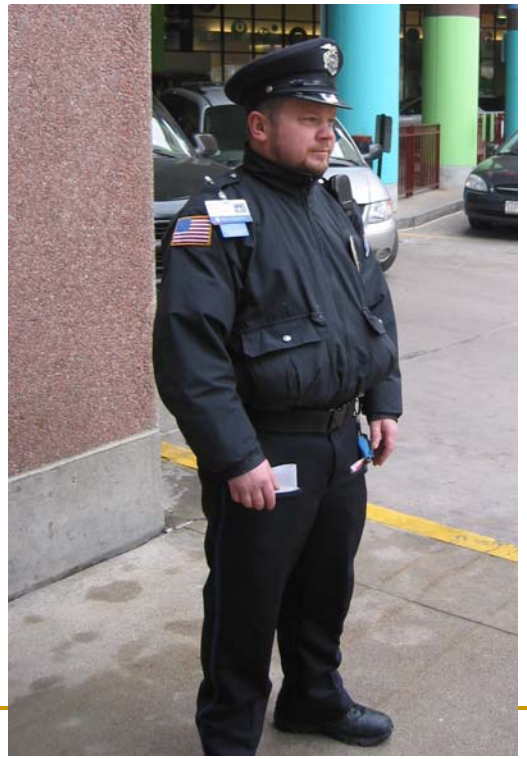
Available at http://www.nyc.gov/html/doh/downloads/word/bhpp/bhpp-focus-ped-toolkit.doc

Pediatric Medication

- Pediatric Stockpile: Anticipate 72 hour need for pediatric patients and hospital staff's children
- Pediatric Code Cart: Able to rapidly produce pediatric doses of resuscitation medications based on patient's age
- Assess inventory in stock for treatment of biological, chemical, radiological disasters and influenza for children
  - If not available, a list of contacts to receive additional medications
- Develop protocol for creating suspension preparations of medications

Security

- Ensure hospital safety
- Anticipate 4-5 family members per child – Need for crowd control
- Security reinforcement at Pediatric Safe Areas and Family Reunification Center



Transfer Protocols

- Hospitals needing to transfer pediatric patients should have prearranged agreements not only with tertiary pediatric centers but also local hospitals with pediatric capabilities given traffic obstructions during a disaster
- If available, Pediatric Transport teams can also assist in management of the critically ill pediatric patient

Summary

- Clearer understanding of the vulnerabilities of children can provide a framework for hospital planning for disasters involving pediatric victims and improve care
- Prehospital agencies with the help of local pediatric experts should develop pediatric specific triage and mass casualty plans and understand area hospital pediatric capabilities

Summary

- All Hospitals should prepare to receive pediatric victims
- Hospital Surge plans for pediatric victims should include:
  - Decontamination protocols for children
  - Protocols for Child Identification and Reunification of Families
  - Identification of staff with pediatric knowledge
  - Census of pediatric beds and plan for surge
  - Areas for Pediatric Safe Area and Family Reunification Center
  - Appropriate pediatric equipment and medication doses

Resources

- Centers for Disease Control and Prevention
  - http://www.bt.cdc.gov/children/
- American Academy of Pediatrics
  - http://www.aap.org/terrorism/index.html
- NYC Health: Hospital Guidelines for Pediatrics in Disasters
  - http://www.nyc.gov/html/doh/html/bhpp/bhpp-focus-ped-toolkit.shtml
- Illinois EMSC Pediatric Disaster Preparedness Guidelines
  - http://www.luhs.org/depts/emsc/peddisasterguide.pdf

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