Pediatric Emergency Preparedness
Disasters, Terrorism and Public
Health Emergencies

Are We Prepared?

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Basic Questions

- Are we ready?
- For what?
- How do we prepare?
Do we really need to worry about mass exposure of children to?

- Disasters?
- Public Health Emergencies?
- Terrorism - CBRNE?

YES
Importance of Pediatric Considerations

- Children are part of the population
  - 26% of the U.S. population are children and youth
  - More than 20 million are under the age of 6 years
Importance of Pediatric Considerations

• Ignoring children may compromise entire preparedness plan
  • August 2003 Survey
    • 90% nationally and 92% in New York City, reported that they would not comply with an official evacuation order
    • 66% of the national sample; 62% of New Yorkers listed concern for their children as the main reason
Is there evidence of intention to target children?

• “We have not reached parity with [the Americans]. We have the right to kill 4 million Americans – 2 million of them children…” Suleiman Abu Gheith (2002)

• Singapore government foils al Qaeda connected plan to attack American School (in Singapore) with 3,000 American expatriate children. (CNN, January 2003)

• Russia: terrorists attack a school and take hostages
How children are exposed to CBRNE weapons/agents

- Inadvertently (Classic Thinking)
- Intentionally targeted (New Thinking)
How Are Children Exposed to Chemical, Biological, Radioactive, and Nuclear Agents (CBRNE) Materials?

- **Unintentionally**
  - Industrial accidents (e.g., chemical leaks, nuclear reactor accidents)
  - Natural disasters
  - Airplane crashes

- **Inadvertently**
  - As collateral victims of terrorism (e.g., Oklahoma City, Madrid)
How Are Children Exposed to Chemical, Biological, Radioactive, and Nuclear Agents (CBRNE) Materials?

- **Indirectly**
  - Posttraumatic stress (PTSD) and other psychological effects
  - Through media (e.g., Oklahoma City, WTC)

**Intentionally Targeted**
- As victims of terrorist attacks (e.g., Oklahoma, Ma’lot, Beslan)
Where were we in the past?
Where are we today?
Unique Vulnerabilities of Children to Terrorism and Disasters

- Based on anatomical, physiological and clinical factors
- Due to developmental and psychological concerns
- System issues
Philosophy of Disaster Medicine
When Children are Victims

- Children are more susceptible to certain injuries or environmental insults than adults
- Children with acute injuries or illness are more likely to respond to rapid and efficient medical care than adults
- Since children are not small adults they require equipment and pharmaceuticals designed for their needs
How Children Are Different

- Differences in effects of terrorism and disasters are based on differences due to
  - Development
  - Anatomy
  - Physiology
There may be proportionally…

MORE KIDS THAN ADULTS
THAT ARE SICK
And children may be... SICKER THAN THE ADULTS
Differences

- Proportionally larger Body Surface Area (BSA)
  - The smaller a patient the greater the ratio of surface area (skin) to size.
  - BSA also parallels certain body functions such as basal metabolic rate and minute volume.
    - Children may receive a higher per kilogram dose of agents absorbed through the skin
- Thinner skin
  - Thinner epidermis
  - Under-keratinized epidermis
    - Children may be more susceptible to agents either effecting the integrity or absorbed through the skin.
Differences

- Children have more rapid respiratory rates
  - Proportionally higher Minute Volumes and more rapid exposure to inhalational agents
- The breathing zone in children is closer to the ground
  - Many agents that are aerosolized are heavier than air: higher concentration lower to the ground
    - Children may be more susceptible to agents absorbed through the pulmonary route than adults with the same exposure
    - Children may show early effects to agents absorbed through the pulmonary route than adults with the same exposure
Differences

- Prevalence of neurological symptoms
  - Immature blood–brain barrier
  - Enhanced CNS receptor sensitivity
    - Nerve agents may produce more symptoms in children requiring treatment than adults with the same exposure.
    - Agents may have CNS effects in children that do not have CNS effects in adults or at lower exposures than adults.
Differences

- Children are more prone to dehydration than adults
- Many of the chemical agents and some of the biological lead to vomiting and diarrhea
- Children may be more symptomatic and show symptoms earlier than adults
Differences

- Children are more prone to ionizing radiation
  - Main effect of ionizing radiation: effects on rapidly growing tissues
    - Children may be more symptomatic and show symptoms earlier than adults
      - CNS – may only see effects in children at certain doses
      - Bone Marrow – more symptomatic than adults
Children may present with...

Different disease manifestations
Differences

- Different disease presentations
  - Smallpox: lack of immunity
  - Trichothecene: more susceptible ?
  - Melioidosis: unique parotitis
  - Anthrax: ?? Less susceptible
  - Children may be affected differently by biologic agents and the presentations may be different
Children can be…

MORE CHALLENGING
TO CARE FOR
Differences

- Difficult vascular access.
  - The problems with managing the many size-related issues in an acute emergency.
  - The smaller the patient the more difficult is vascular access.
  - The varying sizes cause error, delay, and discomfort in drug dosing.

  *e.g.*: Medications via IM and IO route may of practical value in a mass casualty situation.
Children may require...

MORE RESOURCES
Differences

- Developmental/Psychological Immaturity
  - Lack of comprehension of situation
    - May go towards danger because it is interesting
  - Cannot follow group directives
    - Group decontamination may not be feasible
  - Need continuous psychological support
    - Need more resources/personnel to care for children.
Differences

- Children with Special Health Care Needs and Technologically dependant children
  - Survival may be based on ventilators, IV nutrition, etc…
  - Will require stockpiling of equipment and medications specific to children
Children may require…

DIFFERENT RESOURCES
Triage?
START Triage

RESPIRATIONS

YES

Immediate

NO

Position Airway

Immediate

NO

Non-salvageable

YES

Immediate

Over 30/min

PERFUSION

Under 30/min

Immediate

Cap refill > 2 sec

Immediate

Cap refill < 2 sec.

MENTAL STATUS

Immediate

Failure to follow simple commands

Immediate

Can follow simple commands

Delayed
The JumpSTART
Field Pediatric Multicasualty Triage System ©
(Patients aged 1-8 years)

respirations? → NO → Open airway
respirations? → YES → IMMEDIATE

Peripheral pulse? → NO → IMMEDIATE

Perform 15 sec.
Mouth to Mask
Ventilations
Spontaneous respirations?
YES → IMMEDIATE
NO → DECEASED

Check resp. rate
< 15/min or
> 40/min or irregular
Peripheral pulse?
YES → IMMEDIATE
NO → DECEASED

Check mental status
(AVPU)
P (inappropriate)
A
V
U
P (appropriate)
IMMEDIATE
IMMEDIATE
DELAYED
What are some of the key gaps?
Identification and Reunification
Identification and Reunification of Children After a Mass Casualty Incident

- Requires means of rapidly collecting information on arriving casualties (e.g., digital photos)
- Photo indexing
- Site where arriving parents can review photos
- System for presenting select photos
Pediatric Sheltering Issues

- Is it child safe?
- Who will supervise the children?
- Does the shelter have the correct equipment?
- Can families stay together?
### Pediatric Shelter Considerations

<table>
<thead>
<tr>
<th>NUTRITION, SLEEPING ARRANGEMENTS, AND RECREATIONAL AND THERAPEUTIC ACTIVITIES APPROPRIATE FOR AGE AND STAGE OF DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate hygiene/waste disposal resources</td>
</tr>
<tr>
<td>Basic health screening to ensure appropriate levels of available care</td>
</tr>
<tr>
<td>Safety and supervision of children around frail adults (including preventing access of children to medications)</td>
</tr>
<tr>
<td>Security of unattended or unsupervised minors</td>
</tr>
<tr>
<td>Availability of medical information resources (computers, posters, phone referral lines, etc) to aid in appropriate use of medical resources</td>
</tr>
<tr>
<td>Standardized health care data collection</td>
</tr>
<tr>
<td>Environmental considerations (smoking, alcohol, other drugs, weapons)</td>
</tr>
<tr>
<td>Secure transportation within the shelter and the medical care and resources system (transportation of shelter occupants must include appropriate official supervision of and accountability for unattended minors)</td>
</tr>
<tr>
<td>Arrangements for children with special health care needs, including providing for patients on long-term medications without affecting local emergency care resources</td>
</tr>
</tbody>
</table>
Surge Planning
What is Pediatric Surge?

- Secondary Victims
  - Proportion of normal census
- Uniquely Pediatric Event
  - Out of proportion to normal census
  - School, day care, school bus, camp
- Family Unit
  - Ability to care for family without separating children and adults
Pediatric Surge Planning

- Address pediatrics out of proportion to normal numbers
  - Emergency Operations Plans
  - Providers
  - Equipment, pharmaceuticals
  - Drills and exercises
- Plans for care of children
  - Adult Providers
  - Adult Units
  - Adult Equipment
- Plans for care of adults in pediatric units
Pediatric Specific Resources

- Providers
- Medications
- Equipment
- Triage
- Treatment Protocols
Decontamination
Example:
The Chemical Contaminated Casualty
Contaminated Casualty Victims
Current Status

- Most Hospitals Have Minimal Decontamination Capability
- HazMat Teams Are Supposed to Decontaminate Patients at the Incident Site
- Decontaminated Patients Then Transported to Health Care Facilities for Treatment
- No Contaminated Patients Are Expected to Arrive at the Hospital
Tokyo March 20, 1995

- 5,500 People Exposed
- 3,227 Went to Hospital
- 550 Transported Via EMS
- Essentially no Decontamination of Patients
Sarin Secondary Contamination

- 11 ED physicians were affected by Sarin carried into the ED by victims.
- Once the victims were forced to remove their clothing before entering the ED, no further ED staff affected.
What about pediatric decontamination?

Where does an infant go?
Decontamination
Pediatric Considerations

- Water pressure
  - Will it injure a child?
- Water temperature
  - If water is not warm: may cause hypothermia
- Non-ambulatory child
  - Infants, toddlers
  - Children with special healthcare needs
- Mental health concerns
  - Will children follow instructions
  - Long term effects
WMD Antidotes
Mark-1 Auto-Injector

- Standard antidote for nerve agent exposure
  - Deployed in most hospitals and EMS systems
- What about children?
  - Manufacturer makes pediatric model for Israel and other countries
- Not FDA approved
  - Dosage is safe for most children based on data from organophosphate poisoning
Table 5. Autoinjector Usage

<table>
<thead>
<tr>
<th>APPROXIMATE AGE</th>
<th>APPROXIMATE WEIGHT</th>
<th>NUMBER OF AUTOINJECTORS (EACH TYPE)</th>
<th>ATROPINE DOSAGE RANGE (MG/KG)</th>
<th>PRALIDOXIME DOSAGE RANGE (MG/KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-7 yrs</td>
<td>13-25 kg</td>
<td>1</td>
<td>0.08-0.13</td>
<td>24-46</td>
</tr>
<tr>
<td>8-14 yrs</td>
<td>26-50 kg</td>
<td>2</td>
<td>0.08-0.13</td>
<td>24-46</td>
</tr>
<tr>
<td>&gt;14 yrs</td>
<td>&gt;51 kg</td>
<td>3</td>
<td>0.11 or less</td>
<td>35 or less</td>
</tr>
</tbody>
</table>

Note: Each Mark 1 kit contains two autoinjectors (0.8 inch needle insertion depth), one each of atropine 2 mg (0.7 ml) and pralidoxime 600 mg (2 ml); while not approved for pediatric use, they should be used as initial treatment in circumstances for children with severe, life-threatening nerve agent toxicity for whom IV treatment is not possible or available or for whom more precise IM (mg/kg) dosing would be logistically impossible. Suggested dosing guidelines are offered; note potential excess of initial atropine and pralidoxime dosage for age/weight, although within general guidelines for recommended total over first 60-90 min of therapy for severe exposures.
Pediatric Dosage AtroPen®
Key Points

- AtroPen® is only ½ of a Mark-I Kit
  - Does not include pralidoxime.
  - Pralidoxime should be added for appropriate treatment of nerve agent exposure.
  - Complete treatment will require the usage of anticonvulsants
  - Creates operational issues
AtroPen Recommendations

The Mark 1 Kit should remain as the preferred emergency treatment for children of any age.

This recommendation includes using the Mark 1 Kit in children younger than 3 years old after bona fide nerve agent exposure.
School Planning
Preparedness & The Schools

- Preparedness planning
- Coping and resiliency issues for teachers and students
- Special issues: KI, what to stockpile, syndromic surveillance
- Communications with parents
Questions?
Key Reference Web Sites

- **Know your resources:**
  - Center for Disaster Medicine
    - [www.nymc.edu/cdm](http://www.nymc.edu/cdm)
  - AAP
    - [www.aap.org/terrorism](http://www.aap.org/terrorism)
  - CDC
    - [www.bt.cdc.gov](http://www.bt.cdc.gov)
  - ARC
    - [www.redcross.org](http://www.redcross.org)