Unique Considerations in the Management of Children with Ebola Virus Disease

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Kids: Not Just Little Adults

Must Be 21 To Enter
**Definitions: Who is a Child?**

<table>
<thead>
<tr>
<th>Term</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate</td>
<td>0-28 days</td>
</tr>
<tr>
<td>Infant</td>
<td>1-12 months</td>
</tr>
<tr>
<td>Toddler</td>
<td>1-2 years</td>
</tr>
<tr>
<td>Child</td>
<td>2-11 years</td>
</tr>
<tr>
<td>Early Adolescent</td>
<td>12-14 years</td>
</tr>
<tr>
<td>Mid Adolescent</td>
<td>15-17 years</td>
</tr>
<tr>
<td>Late Adolescent</td>
<td>18-20 years</td>
</tr>
<tr>
<td>Adult</td>
<td>21 &amp; up</td>
</tr>
<tr>
<td>SAM Guidance</td>
<td>Up to 23</td>
</tr>
<tr>
<td>Obamacare</td>
<td>Up to 26</td>
</tr>
</tbody>
</table>
How do Children differ from Adults?

Physiology
Anatomy
Pathology
Therapy
Maturity
Policy
Physiologic Differences

- Increased surface-area-to-volume ratio
  - More susceptible to consequences of fluid loss
- Increased minute ventilation
- Higher cardiac output
- Greater metabolic rate
  - Greater caloric requirements
- Thinner epidermis
- Under-keratinized epidermis
- Immature blood-brain barrier
Pediatric Body Surface Considerations

- Surface Area $\sim x^2$
- Volume $\sim x^3$
- Thus, $\uparrow V > \uparrow SA$
- Relative Head Size
Developmental Considerations

- Caregivers in PPE likely to be frightening
- Children unable to cooperate with care
- Children may tug and pull at PPE
- May not be able to distinguish reality from fantasy
- Children may be more prone to PTSD
• Some therapeutics that may be indicated for adults are contraindicated
  – providers are unfamiliar with dose and use
  – unavailable in a preparation that could be consumed by children
• Use of therapeutics under IND may be challenging due to regulations related to minors
• Pediatric equipment may not be available
• EMS crews may be uncomfortable with the transport of children
• Pediatric-specific HLCC beds are lacking
• Doctrine is sparser than for adults
• Data is limited for management of infants and children
Pediatric Ebola in Endemic Settings

• Children have been under-represented in infected populations in outbreak settings

• Children may be less likely to acquire EVD through intra-familial spread
  – less likely to provide direct care to infected family member
  – less likely to be involved in burial rites

• EVD in children may go unreported

• Breastfeeding is a transmission risk
On the Other Hand......

- children have more complex social networks
- children have a higher number of interpersonal contacts
- children are housed in schools and day care centers
- children are more likely to transmit infections
Ebola Epidemiology

- **Zaire (Kikwit), 1995**
  - 27/315 cases (9%)

- **Uganda (Gulu), 2000**
  - 20/218 cases (9%)
  - M/F = ¾
  - CFR 40%

- **Guinea, 2014**
  - 147/823 cases (18%)
  - CFR 74% in <15yo

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2. African Health Sciences 2001;1:60
3. JAMA Pediatr 2014;168:1087
Differences in Pediatric Presentation

• 100% febrile, but…
• only 16% have hemorrhage

• Respiratory & gastrointestinal symptoms common
• Neurological symptoms rare
• Thus…Ebola looks like influenza-like-illness

African Health Sciences 2001;1:60
# Screening for Ebola during flu season

## Signs and Symptoms of Flu

The signs and symptoms of flu usually develop within 2 days after exposure. Symptoms come on quickly and all at once.

- Fever or feeling feverish
- Headache
- Muscle or body aches
- Feeling very tired (fatigue)
- Cough
- Sore throat
- Runny or stuffy nose

## Signs and Symptoms of Ebola

The signs and symptoms of Ebola can appear 2 to 21 days after exposure. The average time is 8 to 10 days. Symptoms of Ebola develop over several days and become progressively more severe.

- **People with Ebola cannot spread the virus until symptoms appear.**

- Fever
- Severe headache
- Muscle pain
- Feeling very tired (fatigue)
- Vomiting and diarrhea develop after 3–6 days
- Weakness (can be severe)
- Stomach pain
- Unexplained bleeding or bruising
Additional insight into clinical presentations of Ebola in children

- Respiratory symptoms are more common, and....
- CNS manifestations are less common than in adults

- Maculopapular rash on the face and torso at day 4-5
- Conjunctival injection & subconjunctival hemorrhages
- Laboratory abnormalities
  - hepatic dysfunction (AST > ALT)
  - hypo- kalemia, natremia, calcemia, magnesemia
- Microvascular instability occurs at ~ day 7 of illness
- Pediatric mortality
  - fatal around day 10-12
  - usually from septic shock and end organ failure
Ebola in the Fetus and Neonate

- Approximately 30% of pregnant women with EVD present with hemorrhage and spontaneous abortion.
- Maternal mortality approaches 90% if infection occurs in the 3\textsuperscript{rd} trimester.
- ALL neonates delivered to mothers with active EVD to date have died.
- Full cause of death investigations are lacking on these infants.
Ebola & Pets

• Ebola can be transmitted via blood, fluids, or meat of an infected animal
  – Limited evidence that dogs become infected with Ebola virus
  – No reports of dogs or cats becoming symptomatic with or transmitting Ebola

• Spanish experience—dog euthanized
• Dallas experience—dog quarantined and released after 21 days

http://www.newsweek.com/ebola-infected-nurses-dog-bentley-tests-negative-virus-279217
Yet Another Tragedy: Ebola Orphans

- 3500 Pediatric Cases
- 1200 Pediatric Deaths
- 10,000 Orphans

UNICEF
Guinea, Liberia, Sierra Leone
as of December 2014
Pediatric-Specific Preparedness
Key Participants in Pediatric Healthcare

- Child
- Family – parents/siblings
- Pediatric/PICU nurses and technicians
- Pediatric physicians
- Pediatric phlebotomists
- Pediatric Respiratory therapists
- Pediatric pharmacists
- Child Life Specialists & teachers
- Occupational therapists
Pediatric Nurses

- Pediatric Nurses must:
  - Adapt assessment skills to suit the different age ranges of children
  - Be aware signs/symptoms of organ dysfunction/failure
    - Respond immediately
- The Pediatric Nurse is essential in mitigating stress for the child and his/her family
  - Nurses spend more time with the child and family than any other health care team member
  - Nurses provide valuable input to other team members in how to approach the child and family
  - Nurses are in a key position to help the child and family with coping strategies
Emory & Nebraska Pediatric Planning: Two Systems; One Goal

Emory/CHOA

UNMC
For the Engineers
Equipment must be procured, prepared, tested, and exercised in advance.
## Supply List 0-1 Years

- Infant/Pediatric stethoscope
- Isolette/Warmer/Crib and crib linen
- Age appropriate toys
- Diapers sizes newborn-3 (depending upon weight)
- Infant scale; Diaper scale
- Sterile bottles and regular -flow nipples/Sippy cups/pacifiers
- *consider use of donor human milk if mom breastfeeding
- Oral syringes 1ml,3ml,5ml,10ml
- EGG leads and Cable
- 6F, 8F, 10F NG tubes
- Feeding tubing
- 10ml syringes with blunt tip connectors for indirect blood draws
- Infant ambu bag
- 20-60ml IV syringes
- Small mask
- Pediatric Code Cart
- NICU/PEDS Alaris Pumps (mamas and babies)
- Alaris 3 port IV tubing
- 24G 5/8” and 24G 7/8” Insyte IV catheters
- CHG CL dressing change kits w/o dressing; order size 1660 CHG dressing separately
- NC/O2 tubing
- Sterile water for humidified O2
- Emergency Drug Sheet
Regular Drills

Some drills test the ability to don & doff full PPE and to function in it for prolonged periods.

This particular drill examined staff ability to perform assessments in triple gloves.

The Stethoscope should not be here; it cannot be used in full PPE.
<table>
<thead>
<tr>
<th>Date</th>
<th>Age &amp; Sex</th>
<th>Origin</th>
<th>Exposure</th>
<th>Symptoms</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/14, IP</td>
<td>4 mo M</td>
<td>Sierra Leone</td>
<td>None known; in US x 12 d</td>
<td>Fever, anorexia, cough</td>
<td>EV D68</td>
</tr>
<tr>
<td>9/14, UC</td>
<td>5 children; 2-10 yo</td>
<td>Nigeria</td>
<td>Nurse in Nigeria x 3 wks</td>
<td>Two with emesis, fever, diarrhea</td>
<td>AGE</td>
</tr>
<tr>
<td>10/14, ED</td>
<td>10 yo F</td>
<td>“West Africa”</td>
<td>Classmate from Africa</td>
<td>Nausea, emesis</td>
<td>AGE (NoV)</td>
</tr>
<tr>
<td>11/14, ED</td>
<td>9 yo M</td>
<td>Mali</td>
<td>Travel to Africa</td>
<td>Fever, lethargy, abd pain</td>
<td>Malaria (24%)</td>
</tr>
<tr>
<td>11/14, ED</td>
<td>4 yo F</td>
<td>Liberia</td>
<td>GM from Liberia</td>
<td>Fever, anorexia</td>
<td>SC Crisis</td>
</tr>
</tbody>
</table>
Lessons from PUIs

1. Take a detailed history
   - exposure history is KEY
2. Use contacts to help assess
   - are siblings ill?
3. Consider the differential
   - malaria, influenza, EV-D68, norovirus, typhoid
4. Consider the impact
   - of providers in PPE
   - of the media
5. Ebola can be stigmatizing
   - plan ahead for this
6. Internal and external communications are critical
Care of the Neonate Born to Woman with EVD (1)

• Neonates delivered to mothers with confirmed EVD should be considered to be PUIs
• Local health authorities should be alerted
• Neonates and mothers ideally should be immediately separated and cared for in an isolation unit for 21 days
• HCW should employ PPE as for confirmed EVD
• Resuscitation should occur with adherence to isolation precautions, environmental safety, and worker safe practices
• Discharge decisions of asymptomatic PCR-negative infants should be made in collaboration with the local health department
Care of the Neonate Born to Woman with EVD (2)

- The neonate with EVD exposure is still a neonate
- Need routine care and immunizations
- Require evaluation for febrile illness (hospital and community acquired infections)
- Require evaluation for concomitant infections (acquired internationally)
- Circumcision should be delayed for 21-day observation period or EVD negative PCR testing
Breastfeeding

- Breastfeeding contraindicated for infants born to women with confirmed or suspected EVD
- Ebola virus detected in human milk 15 days after onset of symptoms
- Minimal data exists on transmission of Ebola from mother to infant via human milk and on occupational risks from exposure to human milk from a woman with EVD
- PPE is recommended for anyone handling expressed breast milk
- Expressed breast milk is Category A waste
Care of the Neonate Born to a PUI Woman

• Neonate is in same risk category as mother
• Neonate can remain in same room with mother unless mother or neonate becomes symptomatic → separation
• Neonate should be monitored with q12 rectal temperatures and symptom screens
• Mother may breastfeed as long as she and infant are asymptomatic
• Dyad should be monitored for 21 days after mother’s potential exposure
The Toughest Question: Parental Presence

- Visitors are permitted for neonates born to asymptomatic mothers with potential Ebola virus exposure.
- Visitors are generally not permitted with neonates born to women with confirmed EVD or for PUIs until status confirmed.
- Visitors are generally not permitted with children with confirmed EVD.
- Exceptions must carefully weigh risks and benefits.
- Visual observation or videoconference technology generally preferred at present.
Family-Centered Care and High-Consequence Pathogens

Thinking Outside the Room

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Parenting via Skype