
NETEC
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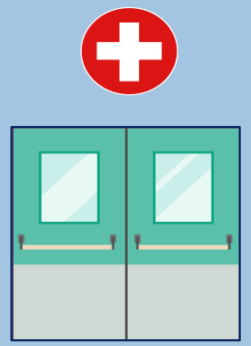
Pediatric Preparedness

What Challenges We Face

Learning Objectives

1. Recognize the critical anatomic, physiologic, immunologic, pharmacologic and developmental differences between children and adults.
2. Identify the importance of these critical differences in disaster preparedness and response planning.
3. Pinpoint gaps in own institutional plans as they relate to caring for pediatric patients in high level isolation.

Current State: A Tiered Approach to Ebola In the US



All Healthcare Facilities

Frontline Healthcare Facility

- Quickly identifies and isolates patients with possible Ebola
- Notifies facility infection control and state and local public health officials
- Has enough Ebola personal protective equipment (PPE) for at least 12–24 hours of care

Prepares for patient transfer, if needed

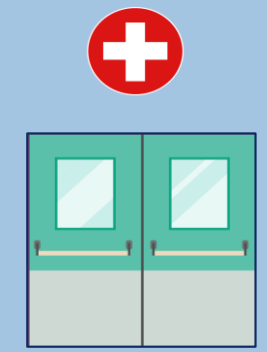
Ebola Assessment Hospital

- Safely receives and isolates a patient with possible Ebola
- Provides immediate laboratory evaluation and coordinates Ebola testing
- Cares for a patient for up to 96 hours (including evaluation and management of alternative diagnoses) until Ebola diagnosis is confirmed or ruled out
- Has enough Ebola PPE for up to 96 hours of care

Transfers a patient with confirmed Ebola to an Ebola treatment center in consultation with public health officials

Ebola Treatment Center

- Safely receives and isolates a patient with confirmed Ebola
- Cares for patients with Ebola for duration of illness
- Has enough Ebola PPE for at least 7 days of care (will restock as needed)
- Has sustainable staffing plan to manage several weeks of care
- CDC experts are ready to deploy to provide assistance as needed



Designated Centers

https://www.cdc.gov/vhf/ebola/healthcare-us/preparing/hospitals.html

Children & Disasters

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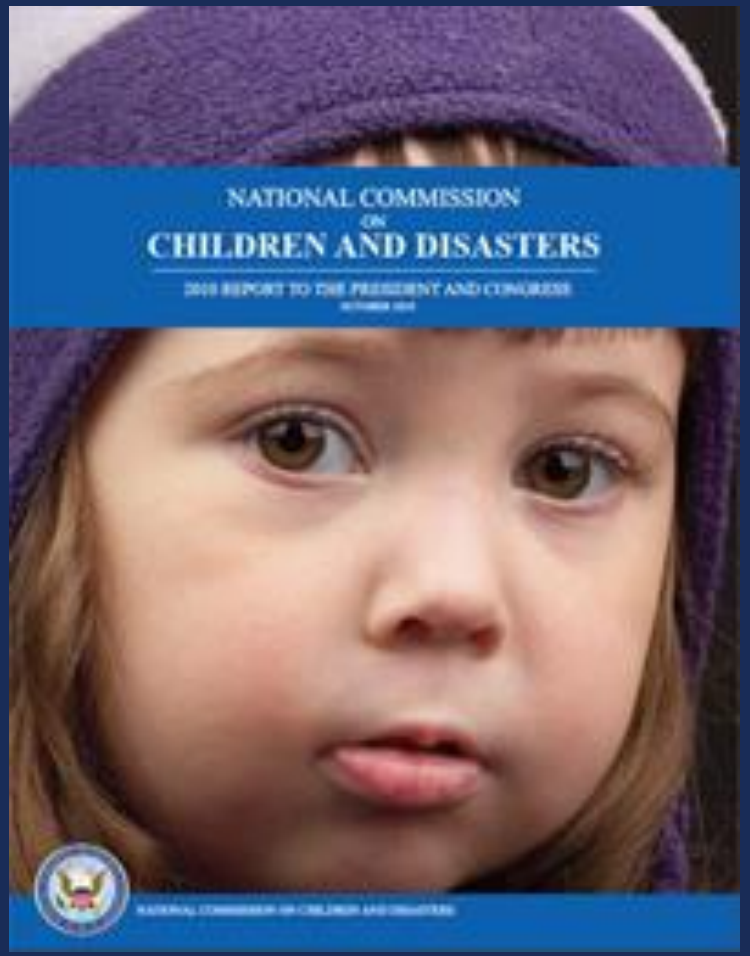
National Commission on Children & Disasters 2010 Report

- 25% of population
- 69 million school/DCC
- Adequately stocked:
    - 25% of EMS
    - 6% of hospital EDs
- SNS* deficiencies
- MH deficiencies
- Training deficiencies
- Holistic deficiencies

*Strategic National Stockpile



Are We Prepared?

High-Level Isolation Unit (Biocontainment Unit) Clinical Capabilities

(from 2018 NETEC International Workshop)

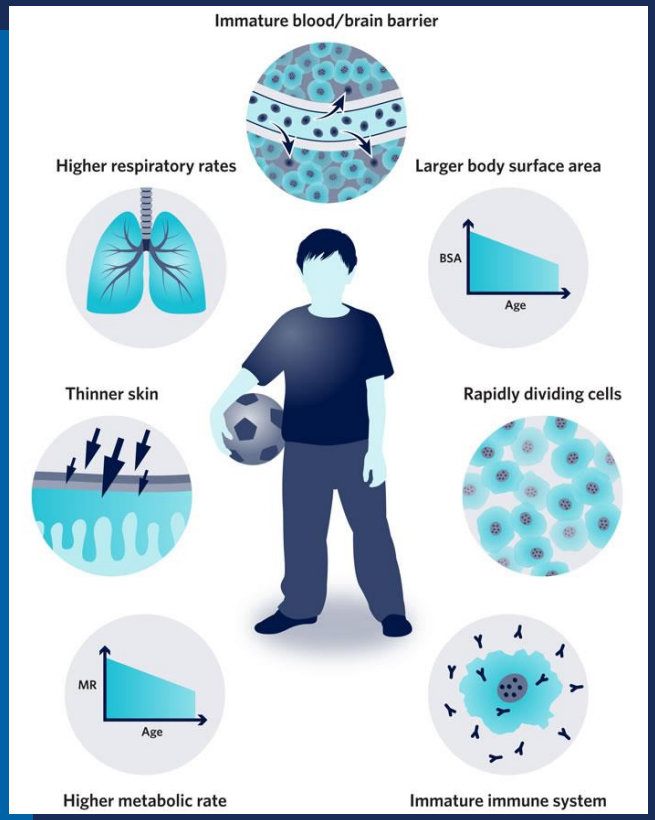
Special Population Care	Facilities Providing HLIU Care (N=19)
Adults	100% (19/19)
Pregnant Women	79% (15/19)
Children	58% (11/19)
Neonates	42% (9/19)

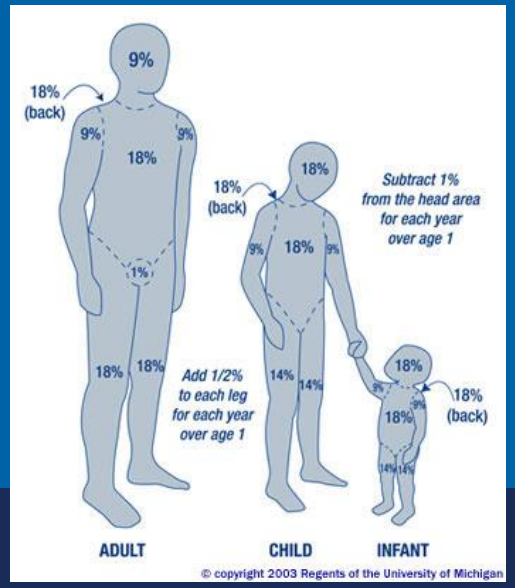
National Ebola Training and Education Center. International Workshop on High Level Isolation. Washington D.C. April 24-25, 2018.

Why Does the Disparity Exist?

Illness Looks Different

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





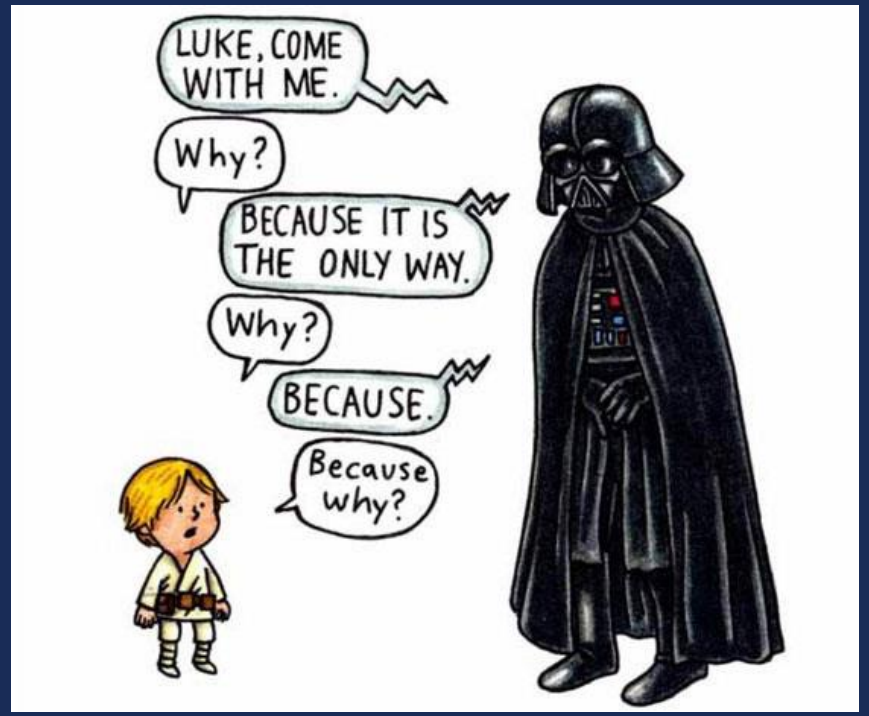
Physiologic Differences

Care Considerations

- Vital sign ranges
- Weight based medications
- Weight based lab draws
- Equipment sizes
- Different comorbidities
- Family involvement
- Treatment options

Developmental Considerations

- Caregivers in PPE likely to be frightening
- Children unable to cooperate with care
- Children may tug and pull at PPE
- Can’t distinguish reality from fantasy
- Children may be more prone to PTSD
- Communication/ comprehension/ learning styles
- Children engage in high-energy activity (4-5 hrs/day outdoors)



Therapy & Policy Considerations

- Some medications are contraindicated
  - Or providers are uncomfortable with them
  - Or they are unavailable in liquid preparations
- Pediatric equipment may not be available
- HCW out of “comfort zones”
- EMS crews may be uncomfortable with pediatrics
- Pediatric-specific HLCC* beds are lacking worldwide
- Doctrine is sparser than for adults
- Research is more difficult in children
- Extenuating circumstances

*High Level Containment Care

Furthermore…

Children live closer to the ground…

Children & their social networks…

- Children have more complex social networks (adults = 4-8 ppl; children = dozens & dozens)
- Children have a higher number of interpersonal contacts
- Children are housed in schools & day care centers
- Children are more likely to spread disease (hand hygiene…. or not….)

What Have We Seen in the U.S.?

During 2014-15 Ebola Outbreak

Background:

- 2014-15 EVD epidemic largest in history
- PUI = symptom (fever [81%], nausea, vomiting, headache, diarrhea, abdominal pain, myalgia, fatigue, or unexplained bleeding) + epi risk factor (exposure to a person with EVD or travel from an affected country 21 days before symptom onset)
- Laboratory assessment for Ebola ≥72 hours after symptom onset

Children & Ebola: U.S. Pediatric PUIs

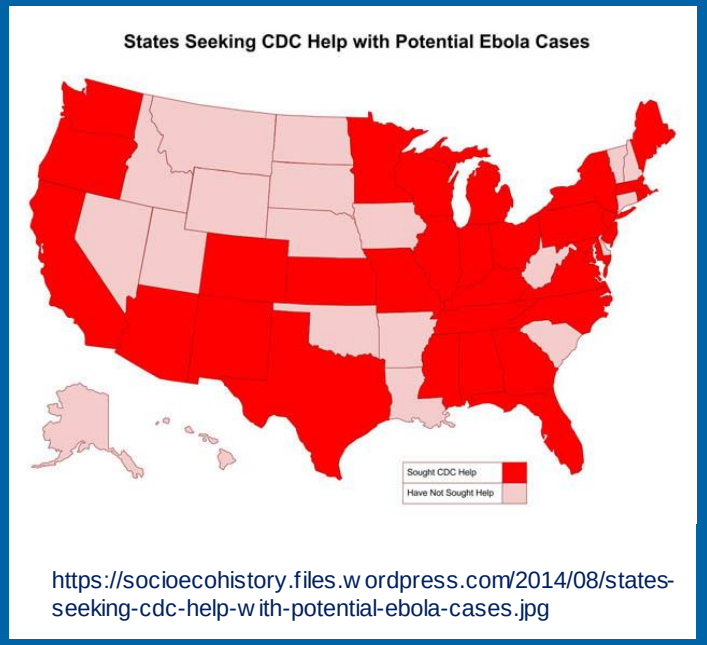
CDC Assistance during Ebola Outbreak

7.9.2014: CDC activated its Emergency Operations Center and established a consultation center

7.9.2014 - 1.4.2015: Received 89 inquiries

- 56 (63%) no epi risk factors for Ebola
- 33 (37%) with epi risk factors (travel to Ebola endemic country)
- 32 met PUI criteria due to symptoms
- 15 tested and Ebola virus RT-PCR negative
- Alternative diagnoses (n=19) – malaria (5), influenza (5), other viral illnesses (3), nonviral illnesses (6)
- 15 PUIs into isolation; 10 transferred another hospital
- ICU care for 3 – malaria, dehydration, viral illness

! • Appropriate clinical care delayed for at least 5 children due to reluctance/concern about contamination or exposure !



https://socioecohistory.files.wordpress.com/2014/08/states-seeking-cdc-help-with-potential-ebola-cases.jpg

MMWR Sept 18, 2015, 64(36): 1006-1010

Children & Ebola: U.S. Pediatric PUIs

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Real Examples of U.S. Pediatric PUIs

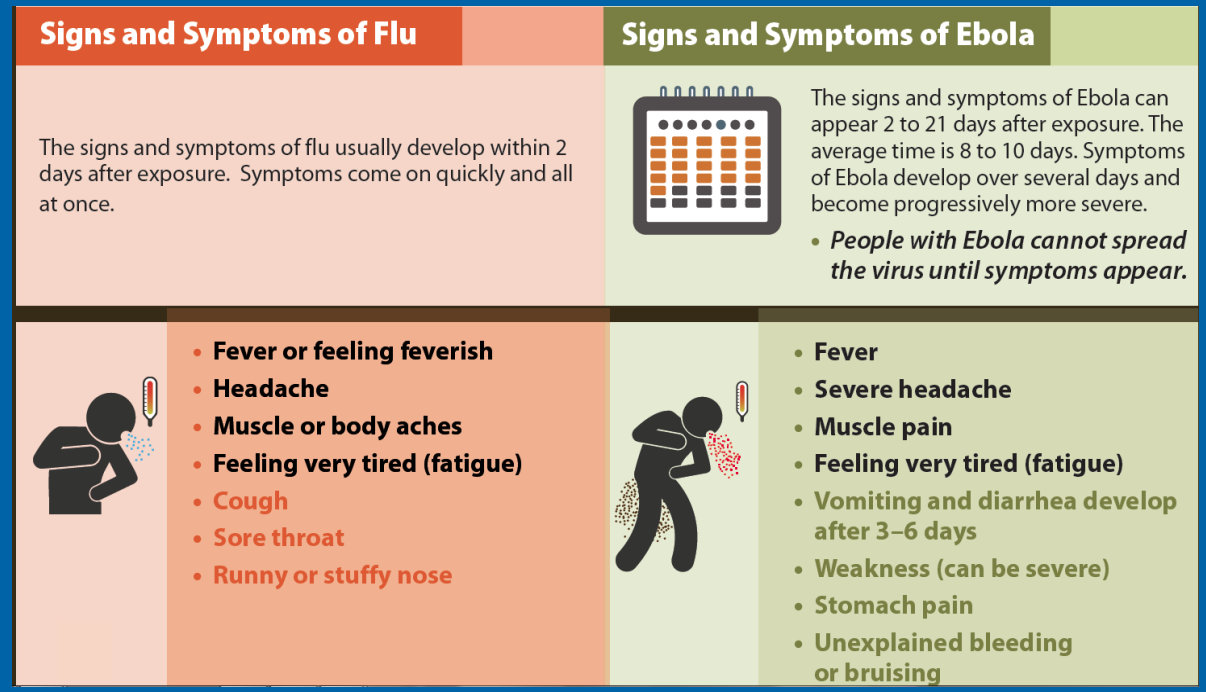
Lessons Learned:

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. Communication is critical

Date	Age & Sex	Origin	Exposure	Symptoms	Diagnosis
8/14, IP	4 mo M	Sierra Leone	None known; in US x 12 d	Fever, anorexia, cough	EV D68
9/14, UC	5 children; 2-10 yo	Nigeria	Nurse in Nigeria x 3 wks	Two with emesis, fever, diarrhea	AGE
10/14, ED	10 yo F	"West Africa"	Classmate from Africa	Nausea, emesis	AGE (NoV)
11/14, ED	9 yo M	Mali	Travel to Africa	Fever, lethargy, abd pain	Malaria (24%)
11/14, ED	4 yo F	Liberia	GM from Liberia	Fever, anorexia	SC Crisis

Children & Ebola: Presentation

- Very high % febrile (90-100%), but… very low % have hemorrhage (~16%)
- Respiratory symptoms & GI symptoms are common (CNS symptoms less common)
  - Thus… Ebola looks like Influenza Like Illness (ILI)
- Conjunctival injection & subconjunctival hemorrhages
- Laboratory abnormalities:
  - hepatic dysfunction (AST > ALT)
  - hypo- kalemia, natremia, calcemia, magnesemia
- Microvascular instability occurs around day 7 of illness
- Pediatric mortality:
  - fatal around day 10-12
  - usually from septic shock & end organ failure



African Health Sciences 2001;1:60

Children & Ebola

- Children have been underrepresented in infected populations in outbreak settings
- Children may be less likely to acquire EVD through intra-familial spread
    1. less likely to provide direct care to family member
    2. less likely to be involved in burial rites
- EVD in children may go unreported
    - •Zaire (Kikwit), 1995[1]= 27/315 cases (9%)
    - •Uganda (Gulu), 2000[2]= 20/218 cases (9%); CFR 40%
    - •Guinea, 2014[3]= 147/823 cases (18%); CFR 73.4% in <15yo
    - •Guinea, Liberia, Sierra Leone, 2014= 3,500 pediatric case with 1,200 pediatric deaths
        - -16,600 lost at least one parent and 10,000 orphans
- Current DRC outbreak
- Breastfeeding is a transmission risk

[1]Pediatr Infect Dis J 1996;15:189
[2]African Health Sciences 2001;1:60
[3]JAMA Pediatr 2014;168:1087

Children & Lassa

- Seroprevalence 20% in West Africa
- 10-16% of all hospitalizations
- Mortality rate = 27%
  - In symptomatic children
- Mortality ~100% in Congenital Lassa
- “Swollen Baby Syndrome”
  - Mortality ~75%

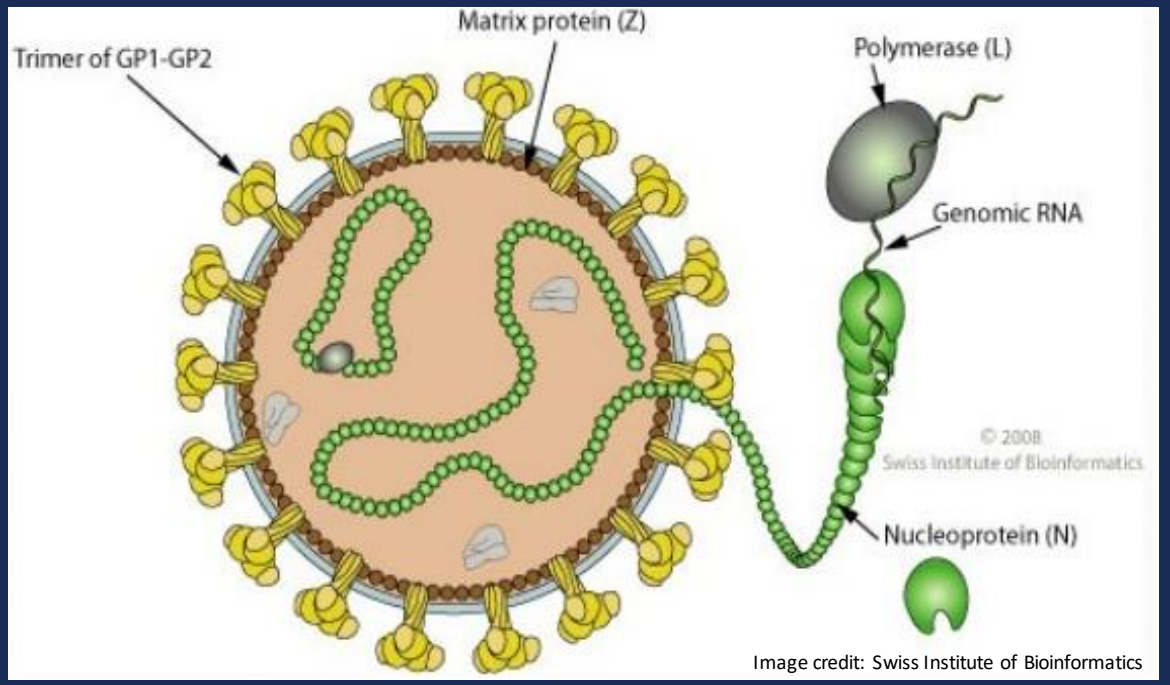


Image credit: Swiss Institute of Bioinformatics

Background Lassa image credit: CDC

Children & MERS-CoV

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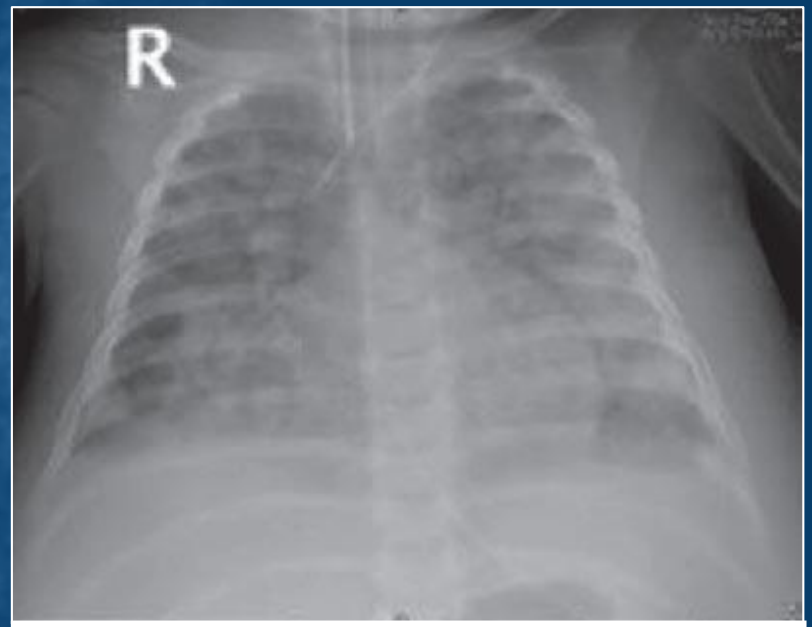
- Can result in asymptomatic (most common) to severe & fatal illness, with more severe illness reported with underlying comorbidities.
- Much of person-to-person spread has occurred within health care facilities, but the majority of reported pediatric cases have been household contacts of adult cases.
- Typically milder & with a lower mortality rate than in adults.



bilateral diffuse infiltrates

Background MERS image credit: NIAID

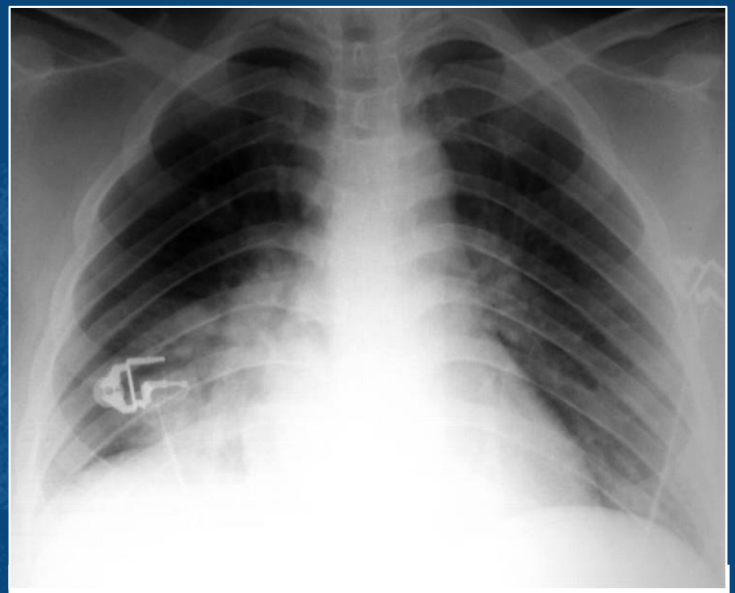
Children & SARS

Diagnosis often difficult unless there was a clear history of contact with an infected patient.

Signs & Symptoms:: It generally begins with a fever & progresses to include dry cough, coryza, body aches & chills.

- Most had relatively mild disease & seldom progressed to acute respiratory distress syndrome.
- Research suggests children are infectious only when they are having symptoms & are most infectious during their 2nd week of illness.

https://fn.bmj.com/content/90/6/F461



The characteristic feature: patchy airspace consolidation predominantly located at the periphery & lower lobes

Background SARS image credit: NIAID

Steps to Help You Prepare

The Basics: Special Population Preparedness

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1. Physical space dedicated to special isolation
2. A trained team of individuals to care for the patient
3. Personal Protective Equipment (PPE)
4. Procedures & Protocols (i.e. SOPs)
5. Good communication & (lots of) friends
6. PRACTICE

The Space

What is so special about the space?

- Negative air pressure ventilation system
- Ways to limit exposure (i.e. pass through boxes)
- Restricted access & visibility
- Seamless, cleanable surfaces
- High visibility of patients & staff inside unit
- Waste management (i.e. autoclaves)
- BSL3 laboratory capabilities (or know where to send specimens & how long it takes to result)
- Amount of space
- Secure communications system

Biosecur Bioterror. 2006;4(4):351-65

The Basics: Team

Key participants:

- Patient
- Family
- Specialized Care
  - Nurses: Pediatric/PICU; L/D; Mother/Baby; NICU
  - MDs: PICU; Pediatricians; L/D; NICU; Consults
- Pharmacists
- Respiratory therapists
- Child life specialists & teachers
- Occupational therapists
- Behavioral Health
- Chaplaincy
- Social Workers and Public Health
- Other

Team should be:
flexible, dependable & prepared

The Team

Why is the role of the pediatric nurse important?

1. Nurses spend more time with the child (& family) than any other health care team member
   - Caregiver role (nurse/parent/teacher/playmate/etc.)
2. Must be able to adapt assessment skills to suit the different age ranges of children
3. Be aware signs/symptoms of organ dysfunction/failure
4. Respond immediately
5. Essential in mitigating stress for the child & his/her family
6. Provide valuable input to other team members in how to approach the child & family
7. Help the child & family with coping strategies

The Basics: PPE

Questions to consider:

1. What is your team going to wear?
2. Staff familiarity with supplies
   - How much do you have? Where is it kept?
3. Will it be pathogen specific?
4. What physical modifications might be necessary to care for these patients?
   - Can your PPE withstand large amounts & types of fluid?
   - Reinforced?
   - Holding a patient or dealing with a flailing toddler?

The Basics: Procedures & Protocols

Topics to consider when making your special population specific SOPs:

1. Family support for patient?

a) Under what circumstances can a parent enter the room?

b) What would they wear? PPE?

c) Would this policy vary with age? Or developmental status? Or by disease (Ebola vs. MERS vs. Smallpox)?

d) Who would you involve? (Family Liaison, Social services, Child Life, Family advocacy, Pastoral services, Language services, Security)

e) Is there a separate, private family room outside/near unit?

f) Technology available for family/patient communication?

The Basics: Procedures & Protocols

Topics to consider when making your special population specific SOPs:

2. Equipment

a. What's in the room?
b. Appropriate sizes (adult vs. pediatrics vs. neonate)
c. Lab volumes

3. Would you permit cohorting?

a. Infected child with infected parent?
b. Infected sibling together?
c. Do the mother & neonate stay together?
d. Secondary patient- neonate should be treated as a PUI
e. Resources & space requirements needed?

The Basics: Procedures & Protocols

Topics to consider when making your special population specific SOPs:

4. Countermeasures?

a. Would willingness to receive a vaccine change any of your polices?

b. Under any circumstance would this be required?

5. Breastfeeding?

a. Under what circumstances would you permit an infected mother to nurse?

b. How would you manage the PUI dyad?

c. Expressed breast milk of a +EVD mother should be treated as Category A waste

6. Staffing?

a. How would you organize staffing? Make up? Numbers?

b. Which nurses would you use in a primary role?

The Basics: Procedures & Protocols

Topics to consider when making your special population specific SOPs:

7. Sedation/Medication?

a. Is there a role for sedation of the flailing child?
b. Threshold different?

8. Restraint?

a. When is physical restraint appropriate?
b. What would this restraint look like?
c. What ethical considerations apply?

9. Ethics?

a. Life saving measures
b. Procedures offered vs. not offered
c. Make sure right decision makers are at the table to discuss

The Basics: Procedures & Protocols

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Topics to consider when making your special population specific SOPs:

10. What is the role of the Child Life Specialist?

a. Should "play" be permitted in the room?

b. What can be brought into the room? Can "Teddy" ever go home again?

c. Risk of adding to the number of personnel in PPE?

11. School/Community Reintegration?

a. What problems do you envision school & social reintegration?

b. Remember Ebola & other infectious diseases can be stigmatizing

c. How might we mitigate these?

The Basics: Communication

The importance of establishing relationships!!!

Do you know your:

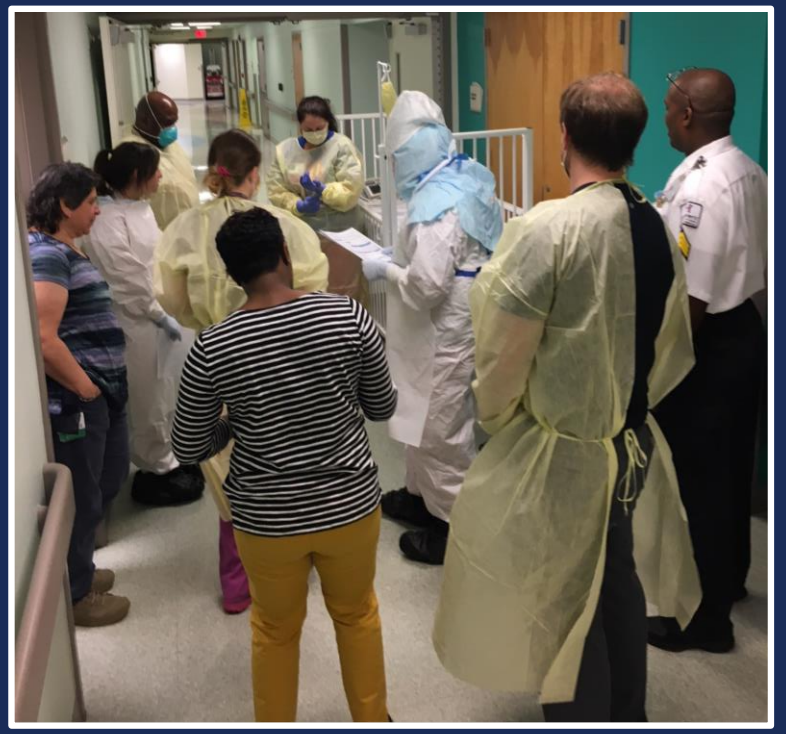
- County, city, state government
- Public health
- Transport partners
- Intra-hospital relationships
- Clinical Relationships
- Leadership
- Community
- CONOPS/ regional partners

The Basics: Practice

Question - So now what should I do once I have everything in place?

Answer - PRACTICE!!!!!

- **What works for me may not work for you & your team… & in your space!**
- If you don't use it, you WILL lose it!
- PPE donning/doffing is critical… do it A LOT!!
- Practicing skills in PPE is invaluable
- Just-in-time training will be needed
- Simulation training is KEY (can be LOW fidelity)
- Discuss all the "what if's" & plan for them



Resources

- White Paper- Perspectives on the Management of Children in a Biocontainment Unit: Report of the NETEC pediatric workgroup
- NETEC Repository: Special Populations Exhibit:

https://repository.netecweb.org/exhibits/show/specialpopulations

- Readiness Consultations:

https://netec.org/request-a-readiness-consultation/

- Virtual Technical Assistance:

https://netec.org/technical-assistance/

- Questions? (info@netec.org)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