BRINGING NEW VIRILITY TO STERILITY

RE-TOOLING DECONTAMINATION FOR EMERGING EPIDEMICS

Jon Jui MD, MPH
Upcoming Attractions

- Ebola
- Middle East Respiratory Syndrome Coronavirus (MERS-COV)
- Bird Flu (Avian Flu)
- Pandemic Flu
Teaching Points

• What lessons can we learn from the recent Ebola outbreak?

• Are you and your agency ready for the next epidemic?
Ebola: U.S. Wake up call
Major Ebola Outbreaks
Confirmed cases and years (as of Aug. 11, 2014).

Current outbreaks in Guinea, Liberia, Sierra Leone, Nigeria

Source: World Health Organization
Bloomberg Visual Data
Outbreak Distribution — West Africa, February 11, 2015

Map includes total confirmed EVD cases reported to WHO

Source: WHO: Ebola Response Roadmap
11 February 2015

Map includes total confirmed EVD cases reported to WHO
2014 Ebola Outbreak: Reported Cases (Suspected, Probable, and Confirmed) in Guinea, Liberia, and Sierra Leone

This graph shows the total reported cases (suspected, probable, and confirmed) in Guinea, Liberia, and Sierra Leone provided in WHO situation reports beginning on March 25, 2014 through the most recent situation report on February 11, 2015.
Ebola Virus Reservoir

**Ebola viruses:**
- Ebola virus (formerly Zaire virus)
- Sudan virus
- Tai Forest virus
- Bundibugyo virus
- Reston virus (non-human)

Following initial human infection through contact with an infected bat or other wild animal, human-to-human transmission often occurs.

Human-to-human transmission is a predominant feature of epidemics.
EBV MODE OF TRANSMISSION
EBV Mode of Transmission

- Personal direct contact with infected patient
- Body fluids
- Ebola does not penetrate skin

** Airborne transmission in weaponized Ebola demonstrated in Lab.
EBV IN THE ENVIRONMENT
EBV in the Environment

• Q: How long does the virus live in the environment?

• A: Not very long
  • < 24 hours
  • On hard surfaces very short < 12 hours.
Ebola outbreak

An outbreak of the deadly Ebola virus has killed at least 59 people in Guinea. Ebola is spread by close contact and kills between 25 and 90 percent of victims; there is no cure or vaccine.

Ebola virus’ typical path through a human being

© 2014 MCT
Source: U.S. Centers for Disease and Control, BBC

Graphic: Melina Yingling
Detection of Ebola Virus in Different Human Body Fluids over Time

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Acute phase</th>
<th>Convalescent phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viremia/Blood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saliva/Swab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tears/Conj.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin/Sweat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaginal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectal/Feces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ebola Patients Treated Outside of Africa

A doctor, who was recently in Africa treating Ebola patients, tested positive on Oct. 23.

The two nurses who contracted Ebola at a Dallas hospital were transferred to specialized units in Atlanta and Bethesda, Md., and have recovered.

A Spanish nurse contracted Ebola while treating a missionary who died in a Madrid Hospital.

Countries with Ebola outbreaks
US Ebola Survivors
<table>
<thead>
<tr>
<th>Name</th>
<th>Care after onset of symptoms</th>
<th>Symptoms at time of presentation to hospital</th>
<th>Outcome</th>
<th>Days in hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas Duncan</td>
<td>Sept 24 (hospitalized Sept 28)</td>
<td>Diarrhea, abdominal pain and fever</td>
<td>Died</td>
<td>Died Oct 8</td>
</tr>
<tr>
<td>Nina Pham RN</td>
<td>Oct 10</td>
<td>Low grade fever</td>
<td>Survived</td>
<td>Oct 10-24</td>
</tr>
<tr>
<td>Amber Vinson RN</td>
<td>Oct 15</td>
<td>fever</td>
<td>Survived</td>
<td>Oct 15-28</td>
</tr>
<tr>
<td>Dr. Craig Spencer</td>
<td>Oct 23 (sluggish Oct 21)</td>
<td>Fever, lethargy</td>
<td>Survived</td>
<td>Oct 24-Nov 11</td>
</tr>
<tr>
<td>Dr. Kent Brantly</td>
<td>July 23 Tx Aug 2</td>
<td>fever</td>
<td>Survived</td>
<td>Aug 2 – Aug 21</td>
</tr>
<tr>
<td>Nancy Writebol</td>
<td>July 23 Tx Aug 5</td>
<td>fever</td>
<td>Survived</td>
<td>Aug 5-Aug 21</td>
</tr>
<tr>
<td>Dr. Rick Sacra</td>
<td>Sept 4</td>
<td>Fever + headache</td>
<td>Survived</td>
<td>Sept 4 - 25</td>
</tr>
<tr>
<td>Ashoka Mukpo</td>
<td>Oct 2 (fever)</td>
<td>fever</td>
<td>Survived</td>
<td>Oct 6-21</td>
</tr>
<tr>
<td>Dr. Martin Salia</td>
<td>Nov 7, + Nov 10</td>
<td>Fever</td>
<td>Died</td>
<td>Nov 15 - Nov 17</td>
</tr>
<tr>
<td>Dr. Ian Corzier</td>
<td>Sept 6 - Tx Sept 8 9</td>
<td>Fever, headache</td>
<td>Survived</td>
<td>Sept 9 – Oct 19</td>
</tr>
</tbody>
</table>
Investigational Therapies for EVD Patients

• Convalescent serum
• Therapeutic medications

  o **ZMapp** – three chimeric human-mouse monoclonal antibodies
  o **Tekmira** – lipid nanoparticle small interfering RNA

  o **Favipiravir** – oral RNA-dependent RNA polymerase inhibitor
  o **Brincidofovir** (oral precursor for cidofovir)
cAd3 vector vaccine

- Ebola Glycoprotein
- Efficacy in Macaque model
Vesicular Stomatitis Virus EBV Vaccine

• Completely protected 3 macaques against EBV challenge with aerosolized EBV

• All 3 control animals died 6-8 days later
WHERE DO YOU THINK THE PROBLEMS WITH HEALTH CARE WORKERS
Ebola PPE: Prior to CDC modifications
UK Ebola Personal Protective Equipment
CHANGING PARADIGM
EMS, HOSPITALS,
PUBLIC HEALTH
New Relationships

911 EMS
HAZMAT

Public Health
Hospital
PUBLIC HEALTH EBOLA RISK CLASSIFICATION
**Patient under Monitoring: Asymptomatic Individuals**

**HIGH-RISK EXPOSURE**
- Direct Contact with blood or body fluids
- Cared for Ebola patient with direct contact (without PPE)

**SOME RISK EXPOSURE**
- In countries with widespread transmission or cases in urban areas with uncertain control measures:
  - Direct contact while using appropriate PPE of symptomatic patients
  - Any direct patient care in other healthcare settings
- Close contact in households, healthcare facilities, or community settings with a person with Ebola while the person was symptomatic

**NO IDENTIFIABLE RISK EXPOSURE**
- Contact with an asymptomatic person who had contact with person with Ebola OR
- Contact with a person with Ebola before the person developed symptoms OR
- Having been more than 21 days previously in a country with widespread transmission or cases in urban areas with uncertain control measures OR
- Having been in a country with Ebola cases, but without widespread transmission or cases in urban settings with uncertain control measures, and not having any other exposures as defined above OR
- Having remained on or in the immediate vicinity of an aircraft or ship during the entire time that the conveyance was present in a country with widespread transmission or cases in urban areas with uncertain control measures and having had no direct contact with anyone from the community
Evaluation and Management of Suspected Ebola Patients

1. PUM with Symptoms
2. Contact Public Health
3. PUI
   - Transport to Ebola hospital
US Hospital Ebola Classification

Preparing U.S. Hospitals for Ebola

C.D.C. has developed a strategy to help healthcare facilities and states prepare for patients with possible or confirmed Ebola. This strategy helps decide which hospitals will provide different levels of care for patients being assessed and treated for Ebola.

Frontline Healthcare Facility
- Bystander dose from an infectious patient
- Not critically ill, infection control and medical diagnosis
- No demonstrated severe infectious disease

Ebola Care Hospital
- Safely transport and assess a patient with possible Ebola
- Provide immediate medical care and coordinate Ebola testing
- Care for a patient for up to 21 days (with and without use of antivirals as designated
- Ebola infection is confirmed
- Ebola dose is less than 5 days of care

Ebola Treatment Center
- Safely transport and evaluate a patient with confirmed Ebola
- Care for a patient for up to 21 days (with and without use of antivirals as designated
- Ebola infection is confirmed
- Ebola dose is greater than 5 days of care

All of the hospitals will be prepared to do the following:

- Trained staff
- Infection control and medical diagnosis
- Safe disposal
- Reused equipment
- Personal protective equipment

In some cases, a hospital should be prepared to serve more than one role. Hospitals may serve
MCEMS Recommended PPE
MCEMS Patient Isolation Bag
Patient Isolation Ambulance
Scene and Hospital Decon
Biological Hazards and UV light
Recommendations

- **Develop your relationships** with your public health and hospital colleagues
- Identify and **acquire (before the event)** your PPE and medical countermeasures
- Identify and integrate your operations with your local HAZMAT providers
- Within your system, **identify and train your personnel** to work in level B / level C PPE environment.
- **Monitor the hospital infectious disease** biological categorization and/or designation
THE END