Ebola Virus Disease in Sierra Leone
Reports from the Field

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Public Health Emergency Preparedness
Fall Regional Staff Meeting
October 6, 2015
Outline and Objectives

• Overview of Ebola
• Infection prevention and control; Ebola transmission investigations
• Life in the field
• Case presentation and case definition
• Epidemiology of Ebola virus disease in West Africa
• Clinical care and training at the Ebola Treatment Centre in Lunsar
• Survivors’ stories: triumph and tragedy
• Advances in Ebola vaccines
• Conclusions and perspective
History

First discovered in 1976 near the Ebola River in the Democratic Republic of the Congo

Outbreaks occur sporadically in Africa

Family of zoonotic RNA viruses (Filoviridae)
Symptoms

**WEST AFRICA Ebola Outbreak**

**Early Symptoms:**
Ebola can only be spread to others after symptoms begin. Symptoms can appear from 2 to 21 days after exposure.

- Fever
- Headache
- Fatigue
- Diarrhea
- Vomiting
- Weakness
- Stomach pain
- Lack of appetite
- Unexplained bleeding
- Joint & muscle aches
Transmission

Index case Transmission comes from animals
But once a human is infected, **human-to-human** transmission occurs
Modes of Transmission

• Ebola is spread through direct contact with:
  • A sick person’s body fluids (all! body fluids)
  • Bodies of people who died of Ebola (most contagious!)

• Can also be spread through direct contact with:
  • Contaminated objects (e.g., bedding, needles, medical equipment)

• Ebola is not airborne, waterborne, spread by mosquitoes
Ebola Incubation Period

• The period from contact with a person sick with Ebola to when signs or symptoms appear ranges from 2 to 21 days (average is 8-10 days)

• A person with Ebola virus is **not** contagious until symptoms appear
  • So, people who do not show signs of disease cannot spread the disease
Case Counts

• Total Cases (Suspected, Probable, and Confirmed): 28,444

• Laboratory-Confirmed Cases: 15,239

• Total Deaths: 11,311

• Countries affects (total cases):
  • Sierra Leone (13928)
  • Liberia (10666)
  • Guinea (3808)
  • Nigeria (20)
  • Mali (8)
  • United States (4)
  • Senegal, Spain, UK, Italy (1)
Infection Prevention and Control in Sierra Leone?
Infection Prevention and Control

881 confirmed Health Care Worker Infections; 513 confirmed deaths

Protect yourself!
You are valuable

Protect your community!
They are counting on you

Protect your patients!
Show you care
Roles of Infection Control Specialists

- Hospital and Clinic Assessments
- Field Team Assessments
- Trainings (lots!)
- Implement Triage and Isolation at all HC Facilities
- Hand hygiene
- PPE donning and Doffing
- Waste Management
Trainings

Training Volunteer Hospital Nurses

Training the Burial Teams with MSF

Training the Laboratory Team
Assessments
Assessment of a decontamination team
Assessment of a Community Care Center (CCC)
Assessment of a District Hospital
Key IPC Needs at District Hospital X

Areas for Improvement

- Screening and Triage
- Suspect Patient Isolation
- Monitoring of patients on wards
- Waste Management
- Keeping Healthcare Workers Safe
- Deceased Body Management
- Overall Hospital Cleanliness
- Supply Chain
- Laboratory Services

Plan for Improvements

- Implemented chokepoint and screening/isolation tent
- Plan to monitor vital signs
- Dug a burn pit
- Trainings for triage nurses and lab staff
- Working with burial teams
- Implemented hand-washing stations
- Improved PPE procurement
- Implemented IPC Hospital Leadership team
Epidemiology Disease Detectives - Tracking the Virus

True story: On March 27th CDC and WHO teams were notified that a woman died in District Hospital X on March 23rd tested positive for Ebola

What are the first things we want to know? What do we do?
What do we want to know?

• Important point – we are 4 days into an incubation period before we even found out about the case (so we are already behind)
What do we want to know?

• Important point – we are 4 days into an incubation period before we even found out about the case (so we are already behind)

• How was the case buried?
What do we want to know?

• 1st point – we are 4 days into an incubation period before we even found out about the case (so we are already behind)
• How was the patient buried?
• Who were the patient’s contacts?
What do we want to know?

- 1st point – we are 4 days into an incubation period before we even found out about the case (so we are already behind)
- How was the patient buried?
- **Who were the patient’s contacts while symptomatic?**
  - Where was she in the hospital; and trace her movement while admitted
  - Who drove her to the hospital?
  - Family that took care of her (both at home and while in the hospital)
  - Nurses
  - Doctors
  - Laboratory staff (did she have blood drawn?)
  - Hospital custodial crew
  - Patient’s located next to her
  - Who else…..?
What to do

1) Make a line list

<table>
<thead>
<tr>
<th>Contact Name</th>
<th>Type contact</th>
<th>Date</th>
<th>Phone Number</th>
<th>Village</th>
<th>Notes on Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Sister</td>
<td>3/22/15</td>
<td>1234567</td>
<td>AAAAAA</td>
<td>Helped while vomiting</td>
</tr>
<tr>
<td>BB</td>
<td>Taxi Driver</td>
<td>3/23/15</td>
<td>2345678</td>
<td>AAAAAA</td>
<td>Drove to Hospital</td>
</tr>
<tr>
<td>CC</td>
<td>Triage Nurse 1</td>
<td>3/23/15</td>
<td>3456789</td>
<td>BBBBBBB</td>
<td>Admitted to Hospital</td>
</tr>
<tr>
<td>DD</td>
<td>Laboratorian</td>
<td>3/23/15</td>
<td>9876543</td>
<td>BBBBBBB</td>
<td>Draw blood x 2</td>
</tr>
</tbody>
</table>
What to do

2) Contact Tracing
What is contact tracing?

Contact tracing can stop the Ebola outbreak in its tracks

Contact tracing is finding everyone who comes in direct contact with a sick Ebola patient. Contacts are watched for signs of illness for 21 days from the last day they came in contact with the Ebola patient. If the contact develops a fever or other Ebola symptoms, they are immediately isolated, tested, provided care, and the cycle starts again—all of the new patient’s contacts are found and watched for 21 days. **Even one missed contact can keep the outbreak going.**

**Contact tracing finds new cases quickly so they can be isolated to stop further spread.**
Village A Cluster
Things to consider during contact tracing

• Who will do follow-up every day for 21 days?
• How will this be done/documented (logistics)?
• How will symptomatic contacts be transferred?
• How will you get people to agree to be quarantined?
• What if they run?
• If they cannot leave their home, how will you provide for their basic need?
LOTS of collaboration: CDC, WHO, WFP, MOH, MSF, UNICEF, GOAL, IMC, UNMEER, etc (loosely based off the cluster system)

Hand Washing!
Life in the Field

Most Important Person
Life in the Field
Case Presentation - 1

• History:
  – 32 yo male with no PMH from Freetown, SL presents with 3 days of progressive nausea, vomiting, muscle aches, headache
  
  – In the last day he developed intractable hiccups and throat pain
  
  – Denies known sick contacts (humans or animals), recent burial attendance
Case Presentation - 2

- Physical exam:
  - VS: T 39.1, tachycardic, tachypneic
  - Gen: Ill-appearing middle aged man, hiccupping
  - HEENT: scleral injection, clear OP, no LAD
  - CV: tachycardic
  - Pulm: tachypneic
  - Abd: abdominal distension, epigastric tenderness
  - Skin: no rash
  - Psych: clear psychological distress
A **SUSPECTED CASE** is any person:

- Having had contact with a clinical case **AND**
- Presenting with acute fever (>38°C)

**OR**

- Having had contact with a clinical case **AND**
- Presenting with 3 or more of the symptoms: headache, vomiting, nausea, loss of appetite, diarrhea, intense fatigue, abdominal pain, general muscular or articular pain, difficulty in swallowing, difficulty in breathing, hiccups, miscarriage

**OR**

- Presenting with acute fever **AND**
- Presenting with 3 or more of the symptoms above

**OR**

- Any person with unexplained bleeding
Case Presentation - 3

• Clinical course:
  – Day 1: standard empiric treatment of
    • ceftriaxone 1 g IM daily
    • artemisinin-based combination therapy (ACT) 2 tablets po daily
    • paracetamol 1 g po TID
    • oral rehydration therapy
  – Day 2: found dead

• Laboratory (reported on day 2):
  – Ebola PCR positive, Cycle threshold (Ct) value 23
  – Malaria rapid test negative
**EVD Progression**

**Symptom Stages**

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent fever, no pattern, not very high</td>
<td>Vomiting, diarrhea, abdominal &amp; chest pain</td>
<td>Conjunctivitis</td>
</tr>
<tr>
<td>Headache</td>
<td>Liver tenderness</td>
<td>Cognitive slowing – “Ebola stare”, disorientation, confusion, falling over, lying on floor</td>
</tr>
<tr>
<td>Back pain, joint pain, myalgia</td>
<td>Hiccups ? paralytic ileus</td>
<td>Bleeding rare – from gums, cannula sites, IM injections, epistaxis, vaginal bleeding</td>
</tr>
</tbody>
</table>
Sierra Leone Geography

14 districts
149 chiefdoms
over 1000 villages
Sierra Leone: A Small Country
Cumulative Cases by Date of Reporting

Data Source: WHO

Updated: 1.21.15 by @maimajumder
To Scale: Doctors Here, Doctors There

Liberia 51  
Guinea 46  
Sierra Leone 136

West Africa TOTAL DOCTORS! (pre-epidemic)

University of Colorado / Children’s Hospital 1400 ATTENDINGS!
Local HCW Ranks Decimated by Ebola

Modupeh Cole, 56, attending physician
Martin Salia, 44, attending surgeon
Sheikh Khan, 39, attending physician

And many others: 881 health care workers from 3 West African countries, 513 deaths
WHO Situation Report
Sept 30, 2015

- 4 confirmed cases of Ebola virus disease in week of Sept 27, all in Guinea
- All were contacts of a 10 yo girl who died, 2 were traditional healers who treated her; 450 contacts in follow-up
- No new cases in Sierra Leone for 2 weeks; 700 contacts in follow-up since last case on Sept 13
- Liberia declared free for a 2nd time on September 3
Lunsar Ebola Treatment Centre
Patient White Boards - Updated every Shift

<table>
<thead>
<tr>
<th>C11</th>
<th>Kumara Kejika</th>
<th>22M</th>
<th>26/01/15</th>
<th>3</th>
<th>Pos</th>
<th>26/01/15</th>
<th>Neg</th>
<th>Yes</th>
<th>2</th>
<th>Stab</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12</td>
<td>Sesay Nanaal</td>
<td>8F</td>
<td>26/01/15</td>
<td>3</td>
<td>Pos</td>
<td>26/01/15</td>
<td>Neg</td>
<td>Yes</td>
<td>3</td>
<td>Taking</td>
</tr>
<tr>
<td>C13</td>
<td>Kargbo, Isatu</td>
<td>30F</td>
<td>19/01/15</td>
<td>9</td>
<td>Pos</td>
<td>25/01/15</td>
<td>Neg</td>
<td>Yes</td>
<td>2</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>C17</td>
<td>Kamara Kadiatu</td>
<td>13F</td>
<td>25/11/15</td>
<td>4</td>
<td>Pos</td>
<td>25/11/15</td>
<td>+ve</td>
<td>+ve</td>
<td>3</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>C18</td>
<td>Kamara, Sente</td>
<td>14F</td>
<td>25/11/15</td>
<td>4</td>
<td>+ve</td>
<td>25/11/15</td>
<td>+ve</td>
<td>+ve</td>
<td>3</td>
<td>Hard-of-</td>
</tr>
</tbody>
</table>

Body aches

Taking PO fluid well, febrile \( \uparrow 40.1 \) diarrhea

Diarrhea + abdom pain. D/c pending lab result

1000mL IVF

Diarrhea, vomited meds, 1000mL IVF given

Artesunate IV given

Hard-of-hearing, diarrhea, tachypnea

Refused meds

Pt disoriented \( \rightarrow \) Plis Crash Medicin
Multi-agency Training Collaborative
International Medical Corps (IMC)

- Establish a collaborative to train skilled staff to manage EVD cases
- To staff Ebola treatment units (ETUs) by providing didactic and simulated training in clinical, WASH, and psychosocial support
- Ongoing technical assistance and support to partners establishing ETUs across Liberia, Sierra Leone, Guinea and Mali
- Provide centralized comprehensive training of trainers from county or district hospitals and mobile training units

- Funded by USAID Office of Foreign Disaster Assistance (OFDA) in Liberia, and UK Children’s Investment Fund Foundation (CIFF) in Sierra Leone
IMC Training Centre in Bong, Liberia at vacant Cuttington University
Training Activities

![Training sessions with participants in a tent.]

Above: A slide titled 'Life Cycle' is projected, with a presenter and audience in the background. The audience includes medical professionals and students. A sign on the right reads 'LUNSAR LOVES TO LEARN!!!!!

Below: A poster with the text:

LUNSAR LOVES TO LEARN!!!!!

Please join us for education sessions to increase our knowledge.

- Tuesday, January 27
  - HIV and Tuberculosis, Dr. David
- Thursday, January 29
  - Malaria, Dr. Matt
Ebola Survivor - Aminata

29 yo hospitalized for 44 days
After discharge, learned that her 5 children (ages 14, 12, 8, 8 & 17 mo) and husband had died

Family support - older brother in Freetown, can’t help
Staying with older man in Lunsar
His wife is jealous, wants to kick her out
Ebola Survivor - Ibrahim
Ebola Survivor - Ibrahim

13 yo discharged with joyous celebration
After return to his village, found out his 9 siblings and father were dead. Mother alive
CONAKRY, GUINEA—With the death toll in West Africa continuing to rise amid a new outbreak of the Ebola virus, leading medical experts announced Wednesday that a vaccine for the deadly disease is still at least 50 white people from being developed. “While all measures are being taken to contain the spread of the contagion, an effective, safe, and reliable Ebola inoculation unfortunately remains roughly 50 to 60 white people away, if not more,” said Tulane University pathologist Gregory Wensmann, adding that while progress has been made over the course of the last two or three white people, a potential Ebola vaccination is still many more white people off.
Candidate Ebola vaccines

All depend upon a viral platform and ebola genes - 3

A. Recombinant VSV vaccine

Canada, US, Gabon, Switzerland, Germany

VSV wild-type

Deletion of fusogenic VSV-G protein with substitution of Ebolavirus Zaire-strain Kikwit envelope protein

BPSC1001

B. NIAID/GSK cAd3 Ebola vaccine

VRC, UMB, Emory, Oxford UK, Mali

cAd3 genome

E1 replaced with EBOV GP gene inserts

E4 deleted

cAd3–EBOV

NEJM Oct 2014

C. Ad26-EBOV/MVA EBOV – J&J, Janssen, and Bavarian Nordic - Adenovirus 26-EBOV prime boosted by MVA

All have completed phase 1 trials; current ongoing phase 2/3 trials
Partnership for Research on Ebola Vaccines in Liberia (PREVAIL) - NIH/MOH Phase 2/3 Trial

- Safety and efficacy of two Ebola vaccines
- Phase 2 immunogenicity substudy - ELISA and neutralization antigen-specific antibodies at 1 month
- Adults ≥18 yo in Liberia who are at risk for Ebola infection
- ChAd3-EBO Z vs rVSV-ZEBOV vs placebo, double-blind; randomized 2:1:2:1
- Primary efficacy endpoint: EVD ≥21 days after randomization, confirmed by a positive blood or buccal swab sample
- Primary safety endpoint: SAEs within 30 days of vaccination
- Sample size 28,170; 1500 enrolled January-May 2015, follow-up 8-12 months
- Have put some of the vaccine resources toward a study of survivors and controls (PREVAIL-3)

Clinical Trials.gov; C. Lane, personal communication
Sierra Leone Trial to Introduce a Vaccine against Ebola (STRIVE) - CDC/MOH Phase 2/3 Trial

- Safety and efficacy of rVSV-ZEBOV vaccine in 5 districts in Sierra Leone
- Phase 2 reactogenicity (fever, redness) and immunogenicity substudies - antibody levels at baseline and 3 X in a year
- Health care and other front-line workers at risk for Ebola infection, adults ≥18 yo
- rVSV-ZEBOV vaccine, unblinded, individually randomized, immediate (day of enrollment) vs deferred (≈ 6 months)
- Primary efficacy endpoint: Rates of EVD in vaccinated vs unvaccinated participants
- Safety parameters: sore arm, fever, headache, fatigue, nausea, myalgia, arthritis, rash
- Sample size 8000; 6000 enrolled as of June 2015, follow-up 12 months

cdc.gov, who.int
Ebola ca Suffit ("Ebola this is enough") trial
Ring vaccination cluster-randomized trial of immediate vs delayed rVSV-ZEBOV vaccine - Guinea, April-July, 2015

From index cases, contacts and contacts of contacts randomly assigned to 2 clusters: 48 clusters (n=4123) to immediate vaccination, 42 clusters (n=3528) to delayed vaccination (21 days later)

In eligible persons who received vaccine (≥ 10 days after vaccination): 0 cases of EVD in immediate arm
16 cases of EVD in delayed arm
Vaccine efficacy = 100% (95% CI 74.7-100%, p=0.0036)

Persistence of Ebola Virus in Ocular Fluid during Convalescence


Response to the Ebola Epidemic in West Africa - Perspective 1

• Complacency and/or delayed responses by WHO, AFRO, CDC, other organizations; no or little coordination
• Urgent call for emergency assistance by MSF, others in the field
• Distraction of misconception, fear, panic and inappropriate actions in U.S. and Europe
• Eventual response by multiple donors with scale-up of infrastructure and volunteer personnel: *Hurry up and wait*
• Need to overcome denial, limited infrastructure and cultural barriers in each country
• Well-meaning but sluggish attempts at treatment and vaccine research
• Facilities and provider response: *Too much, too late*
Response to the Ebola Epidemic in West Africa - Perspective 2

- Highly dedicated, committed and diverse providers, working for a common purpose - *although high turnover in multiple sites*
- Collegiality, cooperation and unique esprit-de-corps
- Quality care and treatment, despite constraints of strict PPE and very hot, humid conditions
- Employment of thousands of local citizens, when virtually all business had come to a halt
- At the treatment sites, extraordinary amalgamation of clinical, psychosocial, cleaners, logistics, engineering, human resources, finance, transport and epidemiology
- When resources were finally in place, impressive emergency and public health response with coordination and collaboration of many agencies
After Ebola?
(No detected cases for 42 days in West Africa)

- Continued vigilance through Ebola screening and referral units; concerted follow-up of Ebola survivors
- Restore and rebuild previously closed hospitals, community care centers, peripheral health units
- Hire and retrain health care personnel
- Reopen schools, universities, other facilities
- Ongoing partnerships of Ministry of Health, chiefs and donor agencies
- Surveillance for vaccine-preventable illnesses (e.g., measles, cholera) with targeted vaccine campaigns
- Restore maternal and child health; malaria, TB and HIV programs; infection and prevention control
- Business as usual? Ever?? Who will fund???
Thank you!
Questions?