Responding to the Ebola Epidemic

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"The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of [the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry]."
CDC response

- Activation of CDC’s Emergency Operations Center (EOC) on July 9, 2014
- Largest international response for CDC
  - Approximately 3,000 deployments
  - Approximately 200 in West Africa at any time
- Collaborations with a wide range of partners
- Support of ministries of health
  - Technical assistance and field work — epidemiology, laboratory diagnosis, infection prevention and control
  - Development of guidelines
  - Communications
Protection of human subjects

- Observed in all emergency responses at CDC
  - In accordance with 1991 “Common Rule” (45 CFR part 46)
- With EOC activation, creation of EOC Associate Director of Science (ADS) and Human Subjects Research Officer (HSRO)
  - All activities involving data collection required HSRO “project determination and approval”
- During 15 months of EOC activation, there have been 65 EOC HSRO project determinations
  - 59 projects determined to be exempt from human subjects research because primary intent is disease control activity
  - 6 projects determined to require institutional review board (IRB) approval
    - 2 vaccine trials
    - 2 longitudinal studies of survivors
    - 2 knowledge, attitude and practice (KAP) studies
Timeline of the Ebola epidemic

- Describe in four phases
  - Explosive growth
  - Initial control
  - Get to zero
  - Maintain vigilance
New Ebola cases by week*
Guinea, Serra Leone, Liberia, 2014-2015

*All suspect, probable and confirmed EVD cases for weeks 13-44; confirmed and probable cases weeks 45-50; confirmed cases only from week 51
Epidemiologic weeks correspond through June 2015
Phase one: Explosive growth

- Get to zero
- Maintain vigilance
- Initial control

Bar chart showing suspected, probable, and confirmed cases for Guinea, Sierra Leone, and Liberia.
Phase one: Explosive growth
(July 2014 - October, 2014)

- Control:
  - Seek resources
  - Establish incident management
  - Expand laboratory capacity
  - Expand treatment capacity, establishing burial teams
  - Initiate infection control training
  - Disseminate risk reduction messages
  - Ensure medical care for responders

- CDC efforts: Track case counts, model case numbers
- 16 HSRO reviews (all exempt): case report forms, exposure questionnaires
Estimating the Future Number of Cases

- **Projection:** Without additional interventions or changes in community behavior:
  - Approximately 550,000 Ebola cases by Jan 20 2015
  - 1.4 million when corrected for underreporting

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EBOLA PROJECTIONS
LIBERIA & SIERRA LEONE

- 1.4 million infected by January 2015
- Liberia: 2x reported cases every 15-20 days
- Sierra Leone: 2x reported cases every 30-40 days

Source: CDC

EBOLA CONTROL: COST OF DELAY

FIGURE 10. Estimated impact of delaying intervention* on daily number of Ebola cases, with and without correction for underreporting† — EbolaResponse modeling tool, Liberia, 2014–2015

* Intervention: Starting on September 23, 2014 (day 181 in model), and for the next 30 days, the percentage of all patients in Ebola treatment units was increased from 10% to 13%. This percentage was again increased on October 23, 2014 (day 211 in model) to 25%, on November 22, 2014 (day 241 in model) to 40%, and finally on December 22, 2014 (day 271 in model) to 70%. Day 1 in model is March 3, 2014. The impact of a delay of starting the increase in interventions was then estimated by twice repeating the above scenario but setting the start day on either October 23, 2014, or November 22, 2014.

† Corrected for potential underreporting by multiplying reported cases by a factor of 2.5 (Table 4).

§ New Ebola patients at peak of each start date. (Note that when the intervention is started on November 22, 2014, the peak is not reached by January 20, 2014, which is the last date included in the model.)
Phase two: Initial control

- Explosive growth
- Initial control
- Get to zero
- Maintain vigilance

[Graph showing suspected, probable, and confirmed cases from Guinea, Sierra Leone, and Liberia with highlighted periods for explosive growth and initial control phases.]
Phase two: Initial control
(November 2014 - January 2015)

- **Control:**
  - Incident management
  - Laboratory confirmation
  - Provide adequate treatment/burials
  - Infection control training
  - Risk reduction messages
  - Ensure medical care for responders

- **CDC efforts:** Control remote outbreaks
- **28 HSRO determinations:** (all exempt)

Case report forms, investigation forms
Limiting the spread of Ebola

Increase preparedness of all other countries

Nigeria, Senegal, & other countries

Liberia, Sierra Leone, Guinea

Contain the epidemic

Stop spread when importations occur
Rapid isolation and treatment of Ebola (RITE) Strategy — Liberia,

- **Interventions:**
  - Engagement of traditional and community leaders
  - Community education
  - Active case finding, contact tracing and monitoring
  - Quarantine of high risk contacts
  - Isolation and treatment of patients
  - Safe burials

FIGURE 1. Aerial view of the village of Geleyansiesu — Gbarpolu County, Liberia, November 9, 2014

Photo/Kim A. Lindblade

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RITE Strategy - Liberia

- 15 outbreaks in remote areas of nine counties in Liberia
- 236 patients, 155 lab confirmed, 190 deaths
  - Proportion of patients isolated and treated increased from median 28% to 81%
  - Median number of generations fell from 4 to 2
  - Case fatality fell from 87% to 50%

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Phase three: Getting to zero

Explosive growth

Initial control

Getting to zero

Maintain vigilance
Phase three: Getting to Zero (February 2015 to present)

- **Control:**
  - Maintain coordination
  - Continue support for diagnosis, treatment capacity and burial teams as needed, risk reduction messages

- **CDC efforts**
  - Case investigation and contact tracing became feasible
    - Use transmission chains to identify possible missed cases, risk factors
    - Improve contact monitoring
    - Work to improve identification of cases and contacts, including the “ring” approach

- **15 HSRO determinations: 11 exempt, 4 IRB (2 vaccine trials, 2 KAP studies)**
Sierra Leone – cluster

- Index case
- 1st generation
- 2nd generation
- 3rd generation
- 4th generation

Died
Survived
Isolated in care
Alive/contagious
Dead/contact

From Kambia
- KK
- Mok

Hosted by
- MB
- AK

Cared for by
- MK
- NmB
- BK
- GOAL
- OyK (grandmother)
- IB (daughter of MK)
- IMC

Released and healthy

Sister of KK; died one day after giving birth

Delivered MK

Infant died on Day 11 at home. Death swab +.
Sierra Leone College of Medicine and Allied Health Sciences (COMAHS)
Sierra Leone Ministry of Health and Sanitation (MoHS)
U.S. Centers for Disease Control and Prevention (CDC)
STRIVE Study Objectives

- Estimate the efficacy of a single dose of rVSV-ZEBOV vaccine in preventing laboratory-confirmed Ebola virus disease (EVD)
- Assess serious adverse events (SAEs) following administration of the vaccine

Required creation of consortium to ensure human subjects protection
Phase four: Maintain vigilance

Explosive growth

Initial control

Getting to zero

Maintain vigilance

Suspected, probable, and confirmed cases

Probable and confirmed cases

Confirmed cases

Guinea
Sierra Leone
Liberia
Phase four: Maintain vigilance  
(August 2015 to present)

- Risk of reappearance of EVD through:
  - Reintroduction from animal source
  - Travelers from countries with ongoing epidemics
  - Sexual transmission

- CDC efforts: Maintain surveillance among ill persons, people who have died

- 6 HSRO determinations: 4 exempt, 2 IRB (survivor cohorts)
Sexual transmission of Ebola

- **Documented viral persistence among male survivors**
  - Semen: previously documented viral isolation at 82 days, PCR up to 101 days (Rodriguez et al, 1995. J Infect Dis 1999;179 (Suppl 1))

- **Sexually transmitted cases would be difficult to recognize during widespread transmission**

- **Possible sexual transmission event in Liberia, March, 2015**
  - EVD confirmed 30 days after last prior case
  - No travel or exposure to ill persons
  - Sexual contact with an Ebola survivor, semen tested positive by PCR 199 days after his discharge from an ETU, sequences matched sequence of virus from index patient (MMWR, May 8, 2015 / 64(17);479-481)
Other ADS activities during response

- OMB Paperwork Reduction Act (PRA)
  - 110 OMB PRA determinations
  - 46 OMB approvals required (and obtained)

- Scientific review and clearance
  - Scientific content of 449 documents reviewed and cleared
    - 78 manuscripts
    - 59 MMWR articles
    - 164 guidance documents
A health threat anywhere is a health threat everywhere

International Health Regulations (2005)

- Used by countries to prevent and control public health threats
- All countries have committed to achieving the goals of IHR
International Health Regulations

- **Detect:** Ensure surveillance systems and laboratories detect potential threats
- **Assess:** Work together to make decisions about public health emergencies
- **Report:** through a global network of National Focal Points
- **Respond:** To public health events
Less than 1/3 of the world is prepared to respond

- In 2014, only 30% of countries were fully prepared to detect and respond to an outbreak.

Source: Report to the Director-General of the Review Committee on Second Extensions for Establishing National Public Health Capacities and on IHR Implementation, November 2014
Global Health
Security Agenda
Global Health Security

“…We must come together to prevent, and detect and fight every kind of biological danger....”

President Barack Obama, 2011
Vision: A world safe and secure from global health threats posed by infectious diseases…

– Focused leadership and political will
GHSA: Prevent, Detect, Respond

Prevent avoidable catastrophes

Detect threats early

Respond rapidly and effectively
Next Steps

2015:
• Get to zero, maintain vigilance, build back better

Next 3-5 Years:
• Expand GHSA footprint to other at risk countries

By 2020:
• United States to Implement GHSA in 30 countries
Thank You