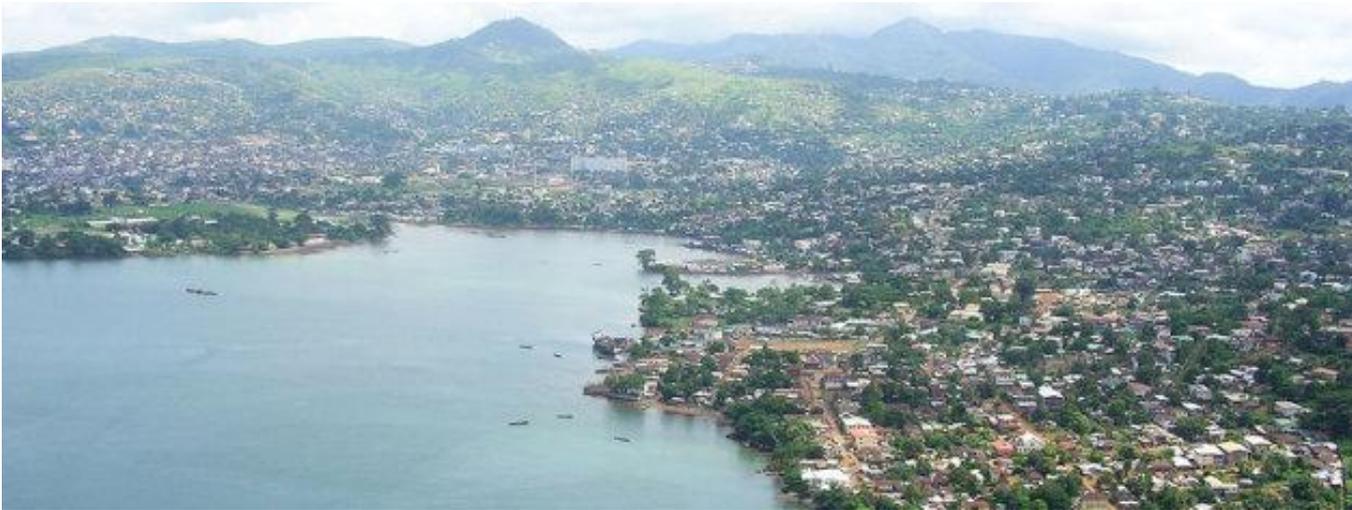


# Ebola Virus Disease in Sierra Leone

## Reports from the Field



Jessica Hancock-Allen, RN, MSN-FNP, MPH

David Cohn, MD

Public Health Emergency Preparedness

Fall Regional Staff Meeting

October 6, 2015

# Outline and Objectives

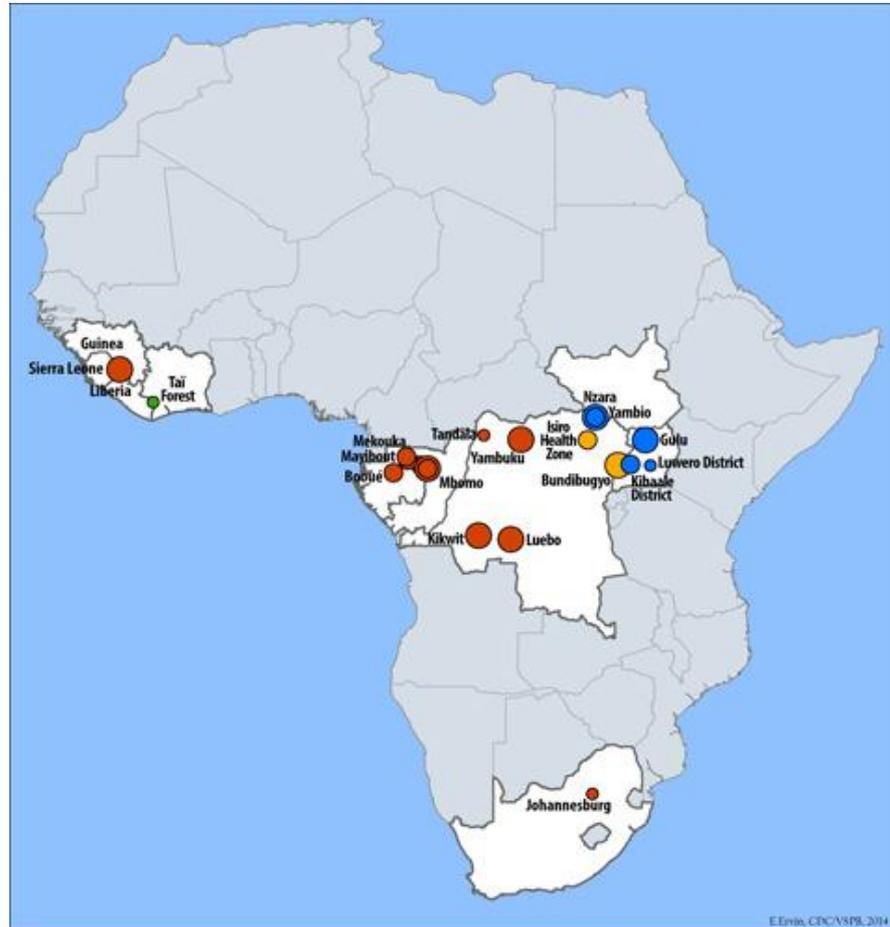
- Overview of Ebola
- Infection prevention and control; Ebola transmission investigations
- Life in the field
- Case presentation and case definition
- Epidemiology of Ebola virus disease in West Africa
- Clinical care and training at the Ebola Treatment Centre in Lunsar
- Survivors' stories: triumph 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:

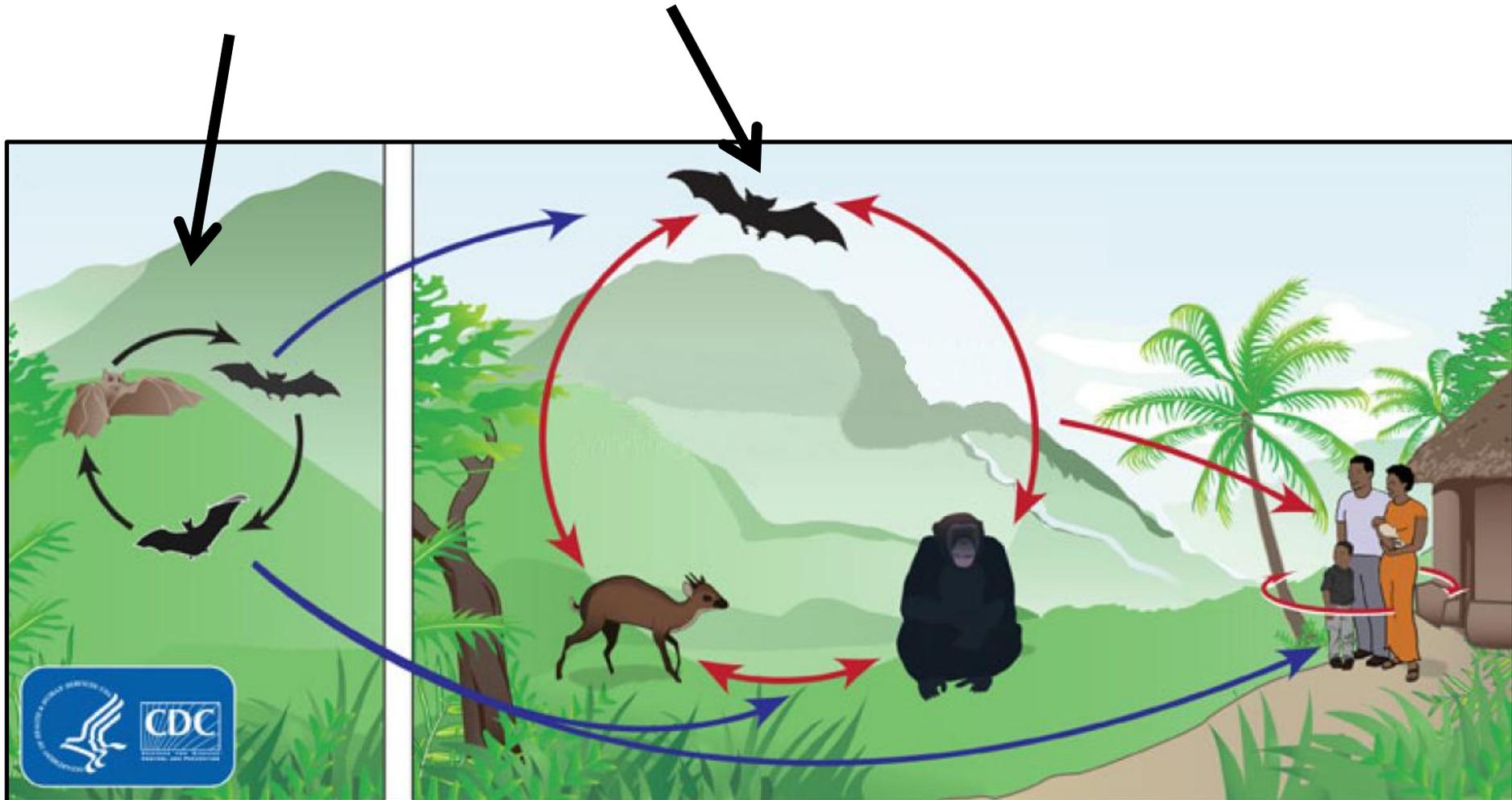
Ebola can only be spread to others after symptoms begin. Symptoms can appear from 2 to 21 days after exposure.

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



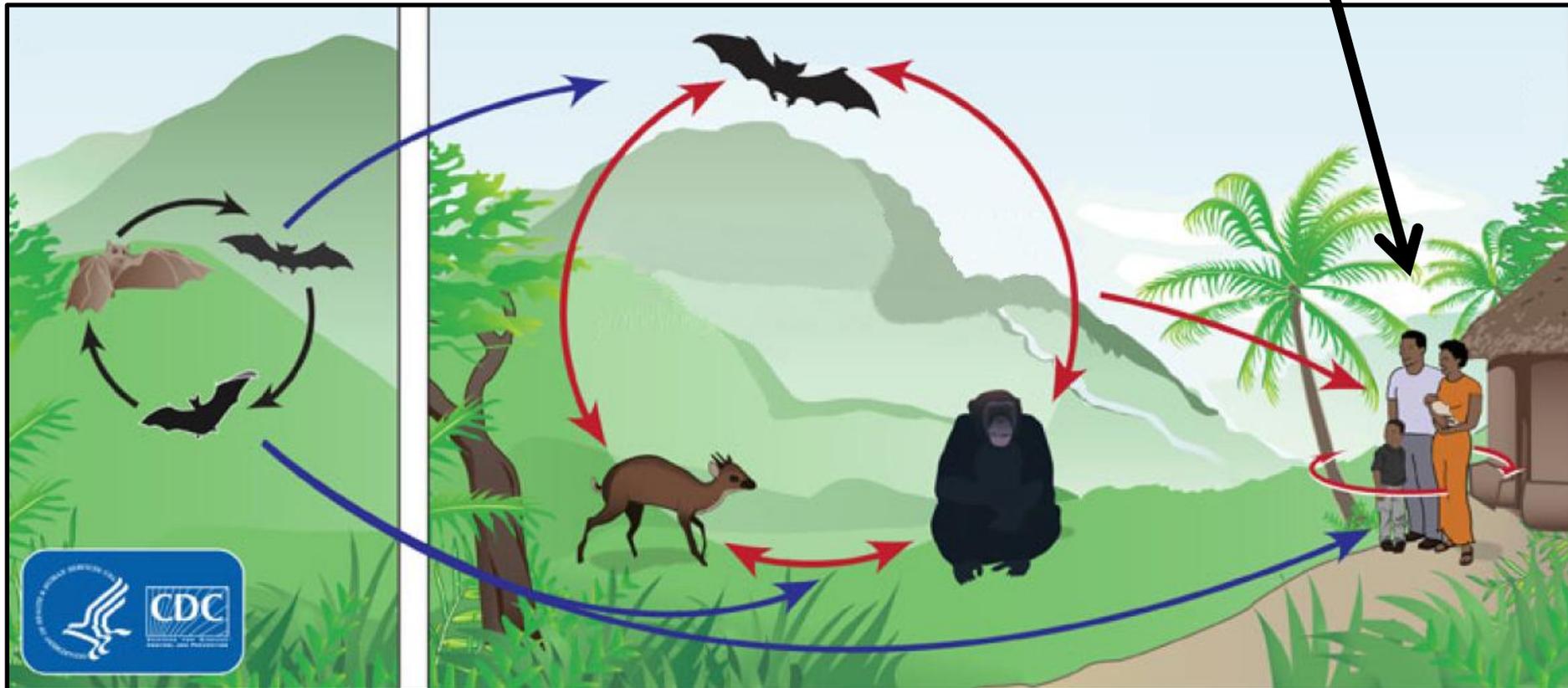
# Transmission

Index case Transmission comes from animals



# Transmission

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

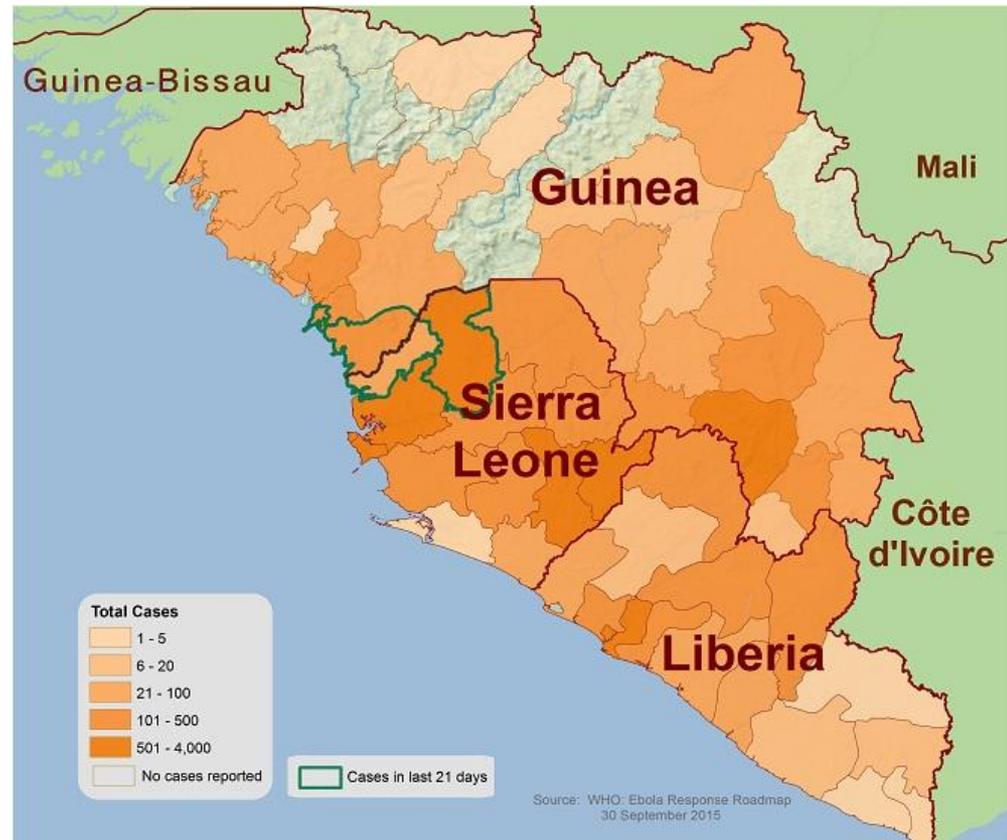


# Ebola Incubation Period

- 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 affected (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

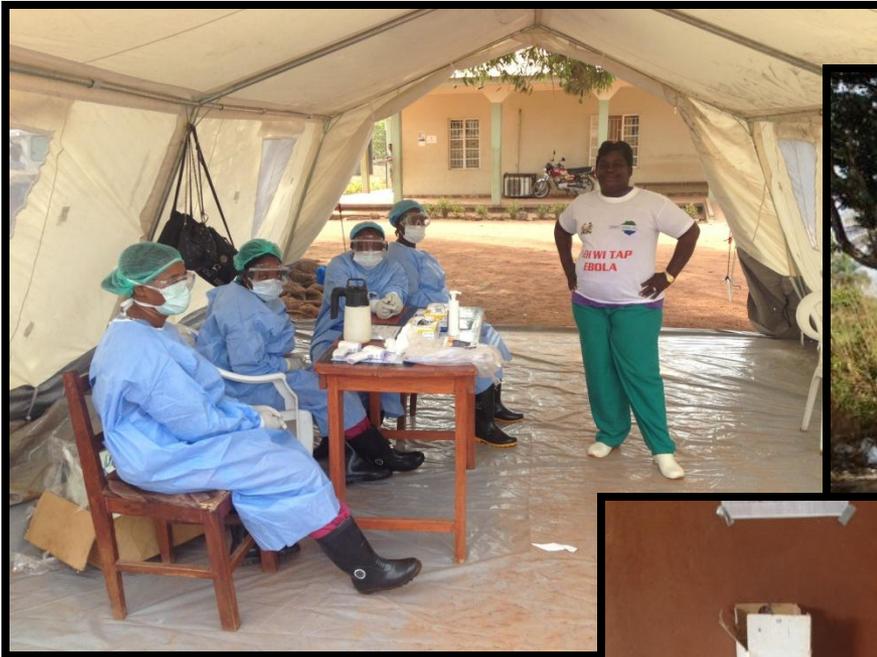
## Assessment of a decontamination team



# 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 27<sup>th</sup> CDC and WHO teams were notified that a woman died in District Hospital X on March 23<sup>rd</sup> 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?

- 1<sup>st</sup> 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?

- 1<sup>st</sup> 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

Contact Name	Type contact	Date	Phone Number	Village	Notes on Contact
AA	Sister	3/22/15	1234567	AAAAAAA	Helped while vomiting
BB	Taxi Driver	3/23/15	2345678	AAAAAAA	Drove to Hospital
CC	Triage Nurse 1	3/23/15	3456789	BBBBBBB	Admitted to Hospital
DD	Laboratorian	3/23/15 3/24/15	9876543	BBBBBBB	Draw blood x 2

# What to do

## 2) Contact Tracing

# What is contact tracing?

Contact tracing can stop the Ebola outbreak in its tracks

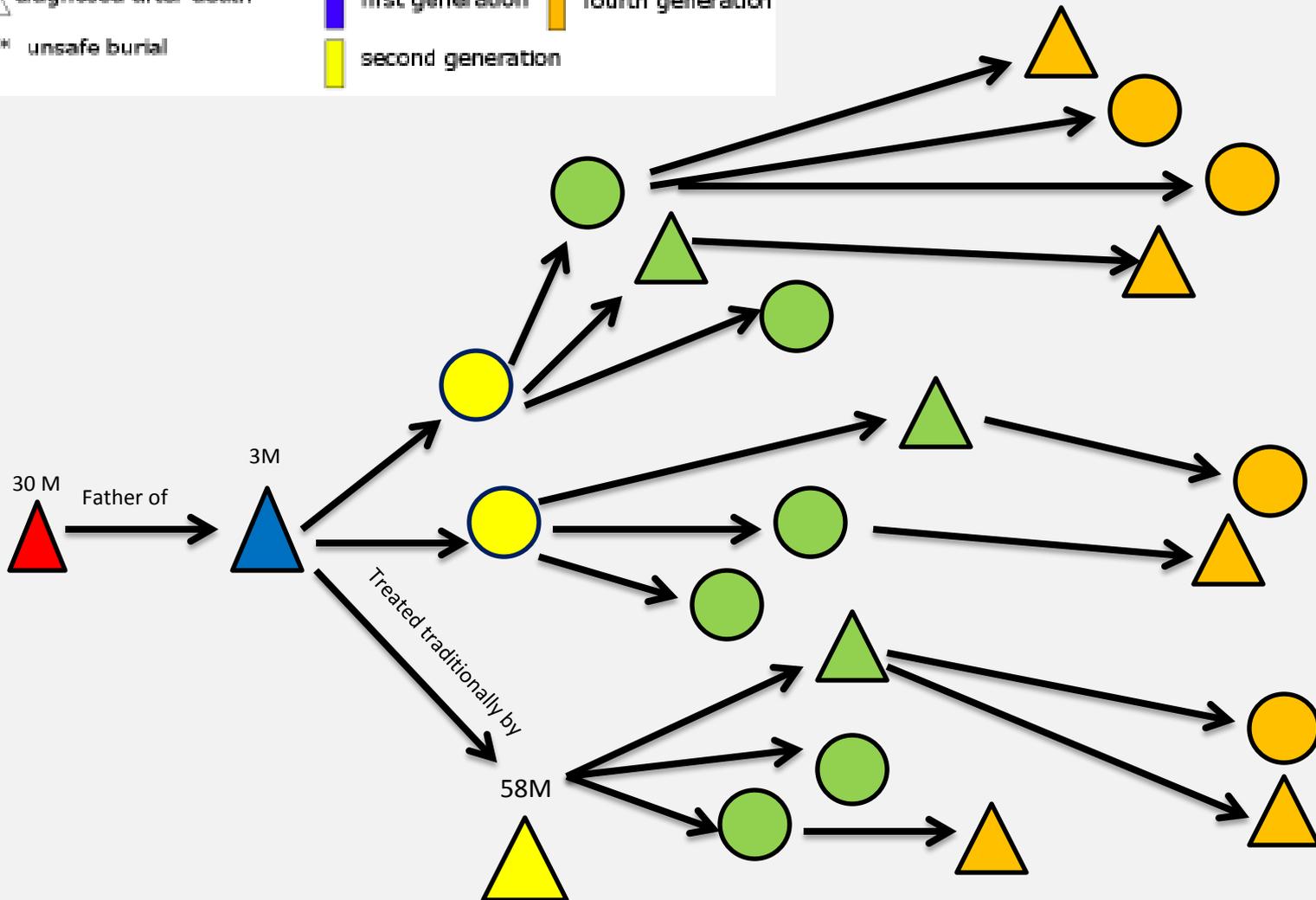


U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention

**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.**



# Village A Cluster



# Things to consider during contact tracing

- Who will do follow-up every day for 21 days?
- How will this be done/documentated (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?

# Life in the Field



LOTS of collaboration: CDC, WHO, WFP, MOH, MSF, UNICEF, GOAL, IMC, UNMEER, etc (loosely based off the cluster system)

# Life in the Field



# Life in the Field



# 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

# Ebola Virus Disease

## Case Definition

A **SUSPECTED CASE** is any person:

- Having had contact with a clinical case **AND**
- Presenting with acute fever ( $>38^{\circ}$  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

### Stage 1

Intermittent fever, no pattern, not very high

Headache

Back pain, joint pain, myalgia

Intense fatigue, severe progressive weakness

### Stage 2

Vomiting, diarrhea, abdominal & chest pain

Liver tenderness

Hiccups ? paralytic ileus

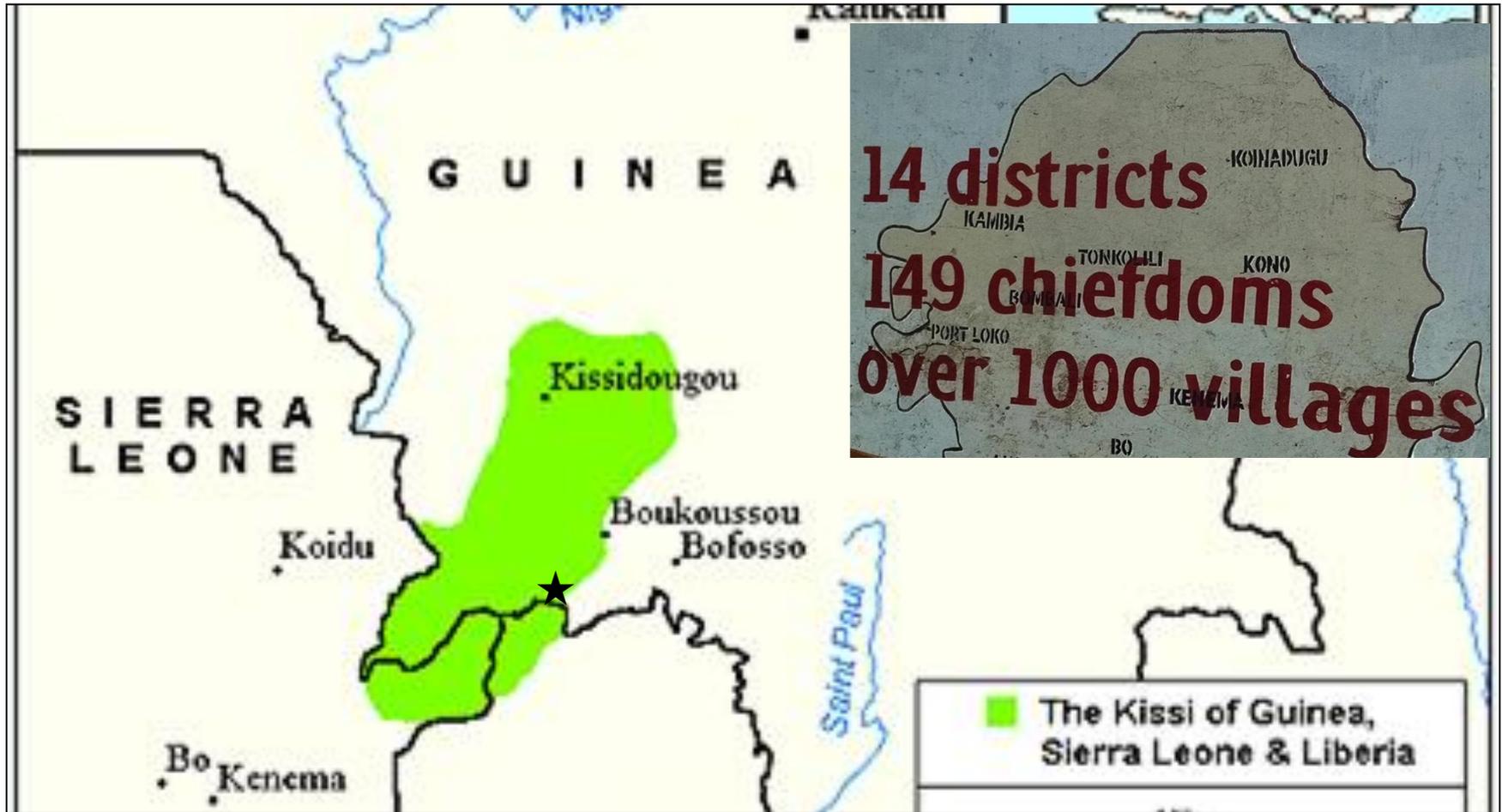
### Stage 3

Conjunctivitis

Cognitive slowing – “Ebola stare”, disorientation, confusion, falling over, lying on floor

Bleeding rare – from gums, cannula sites, IM injections, epistaxis, vaginal bleeding

# Sierra Leone Geography



# Sierra Leone: A Small Country

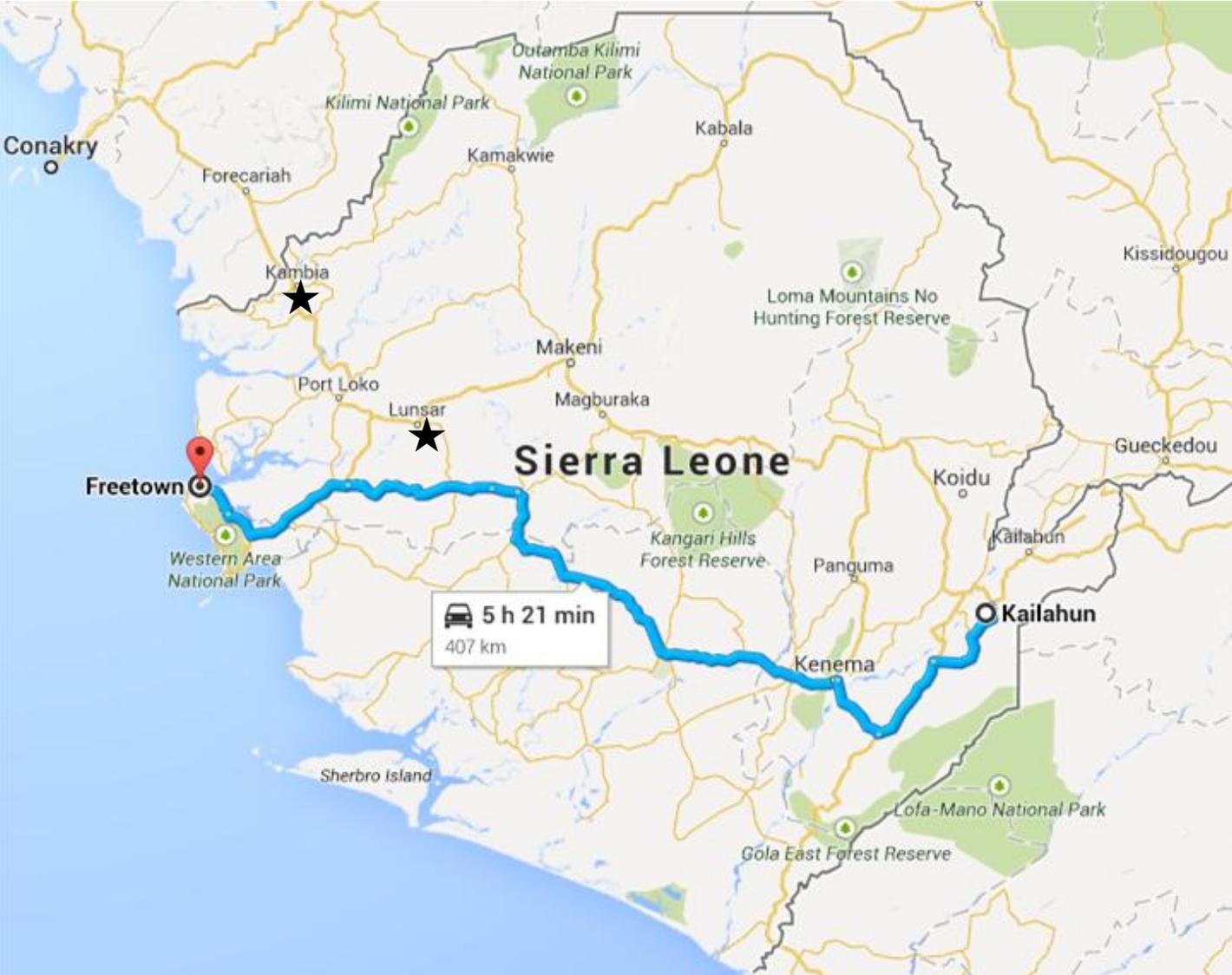
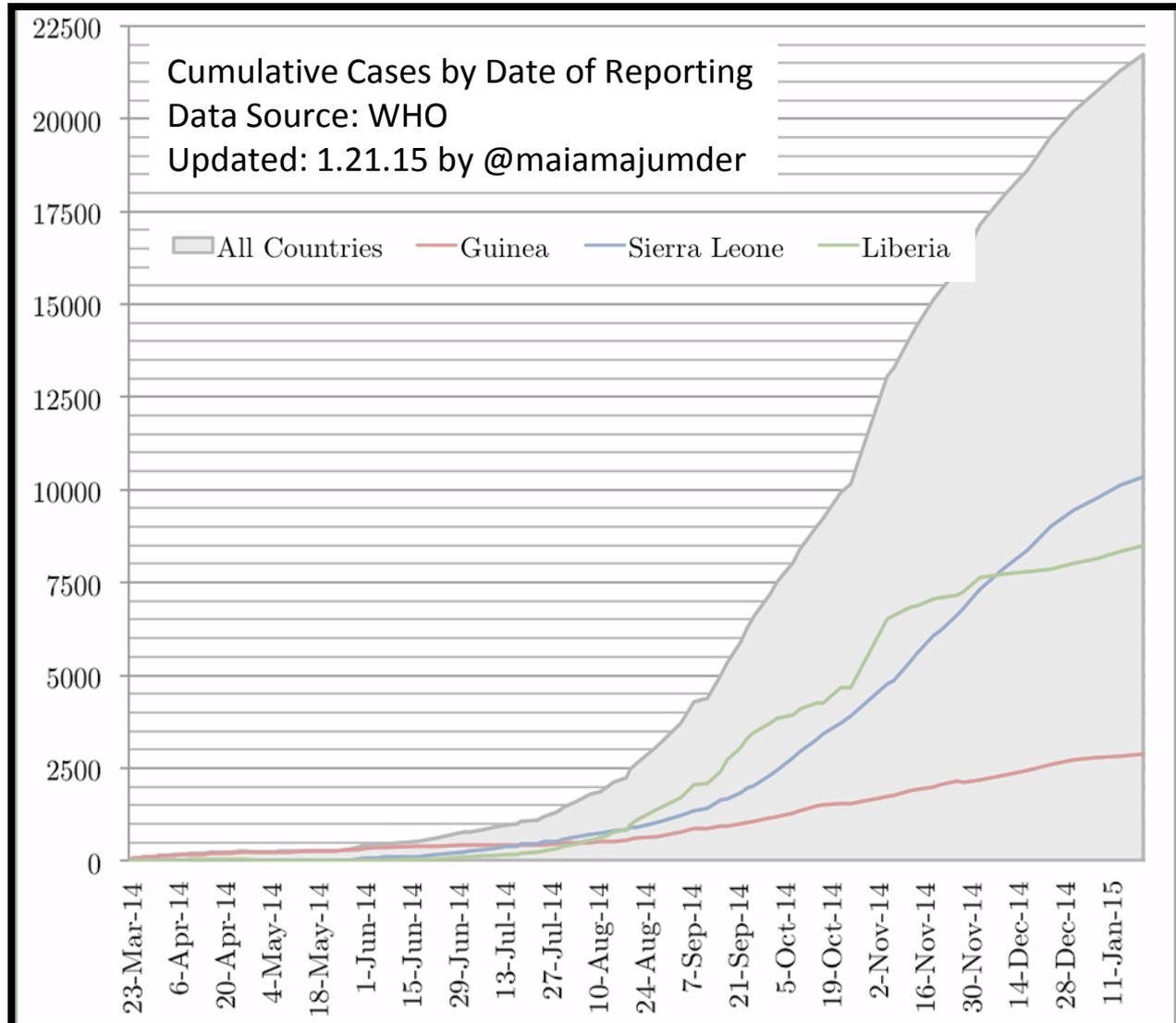
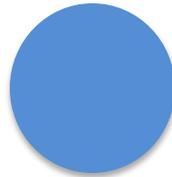


Image: Google Maps



# To Scale: Doctors Here, Doctors There

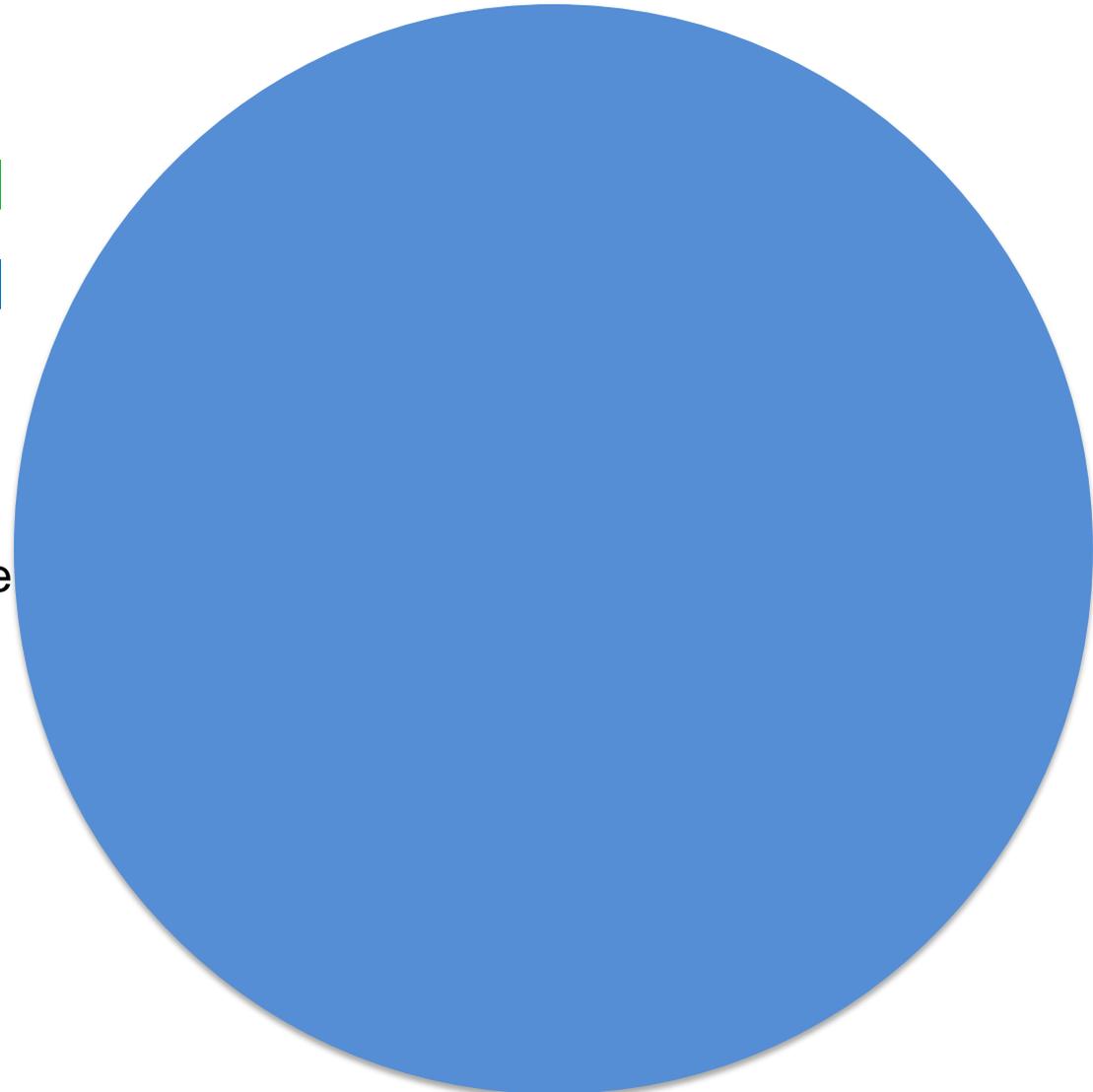


Liberia  
51

Guinea  
46

Sierra Leone  
136

West Africa  
**TOTAL DOCTORS!**  
(pre-epidemic)



University of Colorado / Children's Hospital  
1400 **ATTENDING!**

# Local HCW Ranks Decimated by Ebola



Modupeh Cole, 56,  
attending physician



Martin Salia, 44,  
attending surgeon



Sheikh Khan, 39,  
attending physician

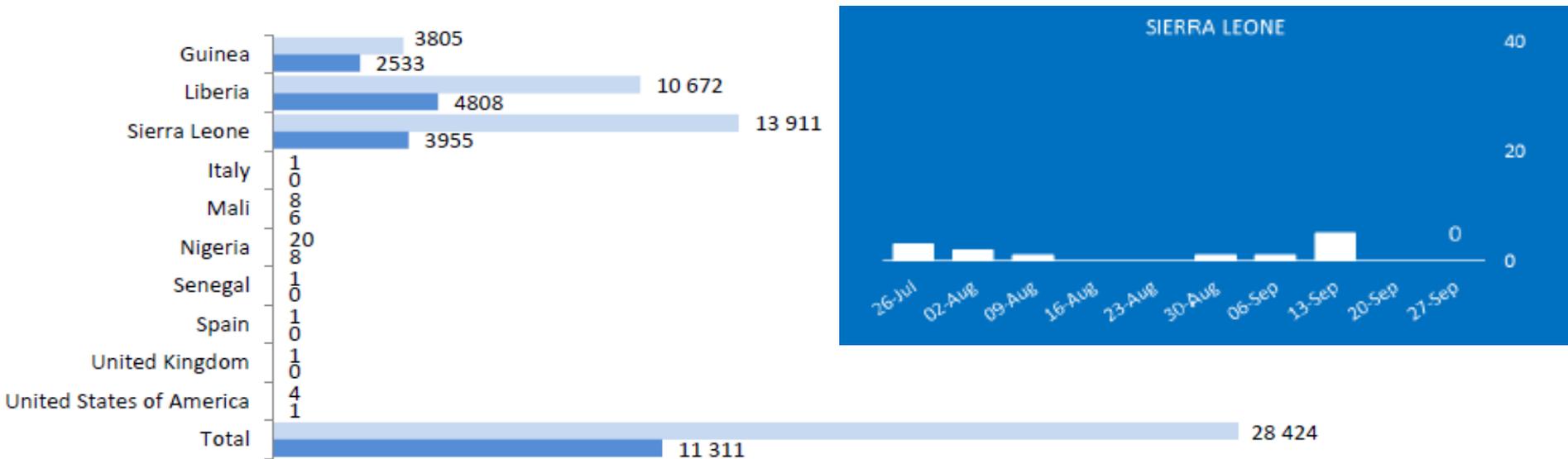
And many others: 881 health care workers from 3 West African countries, 513 deaths

# WHO Situation Report

## Sept 30, 2015

■ Cases ■ Deaths

Sierra Leone Incident Cases, July-Sept 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



*SWZ*

SUSPECT		PROBABLE		CONFIRMED	
7	8	8	9	10	11
6	9	7	10	9	12
5	10	6	11	8	13
4	11	5	12	7	14
3	12	4	13	6	15
2	13	3	14	5	16
1	14	2	15	4	17
	15	1	16	3	18
			17	2	19
				1	20

In Friday: Need to call 15/1





# 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 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



**LUNSAR LOVES TO LEARN!!!!**



Please join us for education sessions to increase our knowledge.

All staff are welcome.

- **Tuesday, January 27**
  - **HIV and Tuberculosis, Dr. David**
- **Thursday, January 29**
  - **Malaria, Dr. Matt**



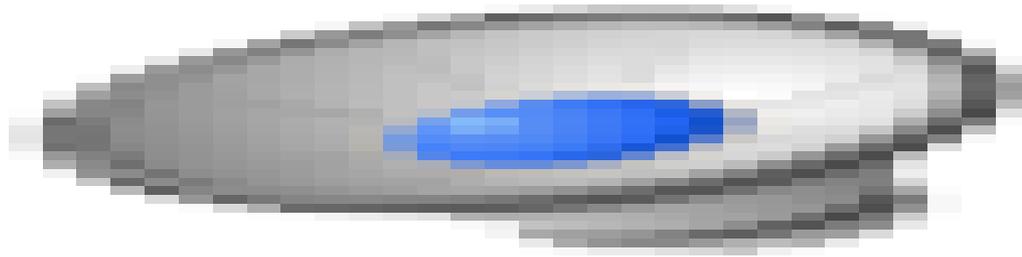
# Ebola Survivor - Aminata



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

# Experts: Ebola Vaccine At Least 50 White People Away



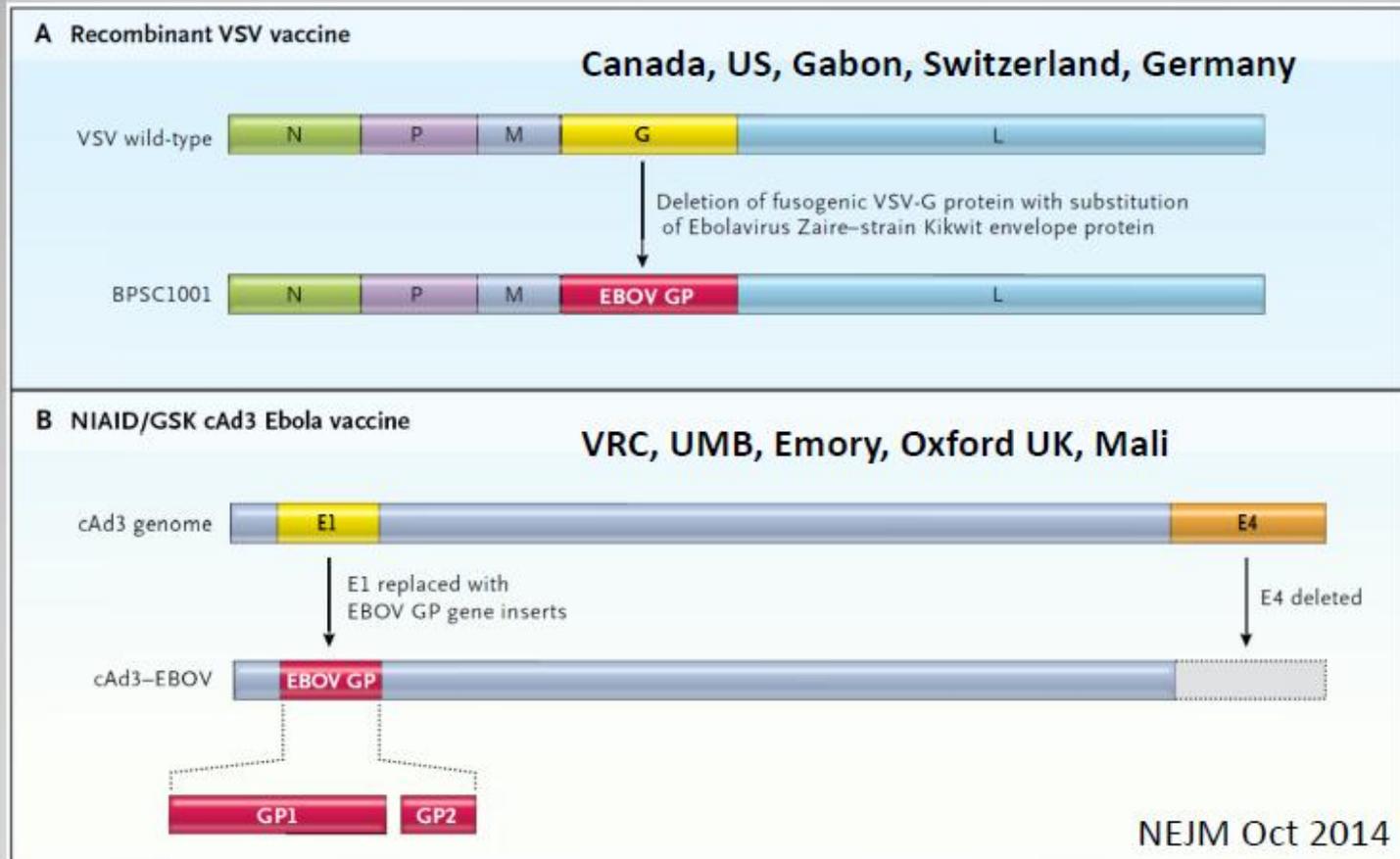
[NEWS IN BRIEF](#) July 30, 2014

[VOL 50 ISSUE 30](#) [Health](#) · [Science & Technology](#) · [World](#) · [Disease](#)

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



**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

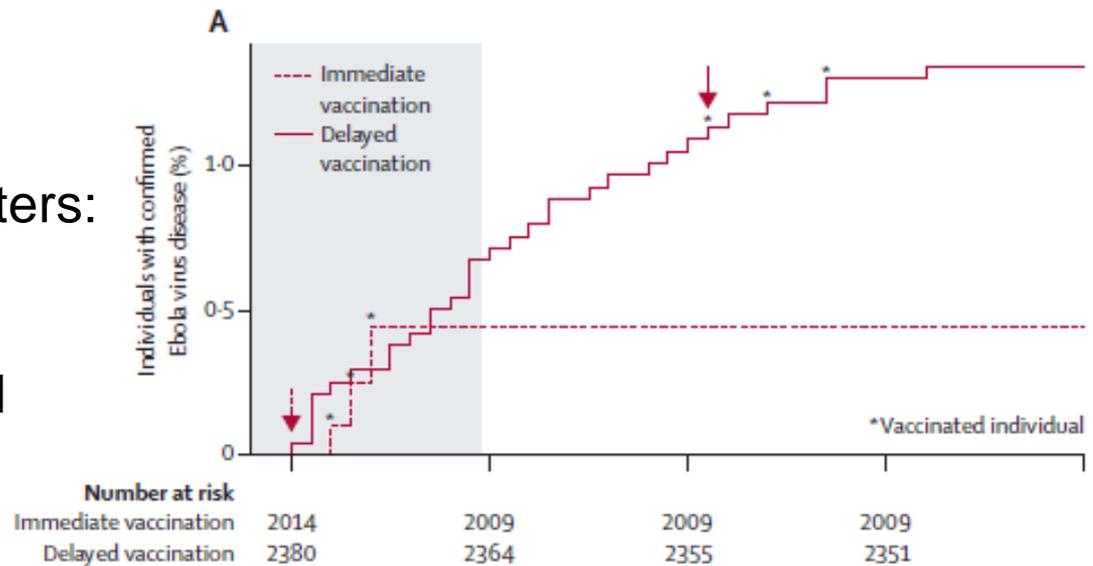
- Safety and efficacy of two Ebola vaccines
- Phase 2 immunogenicity substudy - ELISA and neutralization antigen-specific antibodies at 1 month
- Adults  $\geq 18$  yo in Liberia who are at risk for Ebola infection
- ChAd3-EBO Z vs rVSV-ZEBOV vs placebo, double-blind; randomized 2:1:2:1
- Primary efficacy endpoint: EVD  $\geq 21$  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)

# Sierra Leone Trial to Introduce a Vaccine against Ebola (STRIVE) - CDC/MOH Phase2/3 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  $\geq 18$  yo
- rVSV-ZEBOV vaccine, unblinded, individually randomized, immediate (day of enrollment) vs deferred ( $\approx 6$  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

# *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 ( $\geq 10$  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%,  $p=0.0036$ )

# Complications of EVD - Need for Follow-Up The Saga of Dr. Ian Crozier

The NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

## Persistence of Ebola Virus in Ocular Fluid during Convalescence

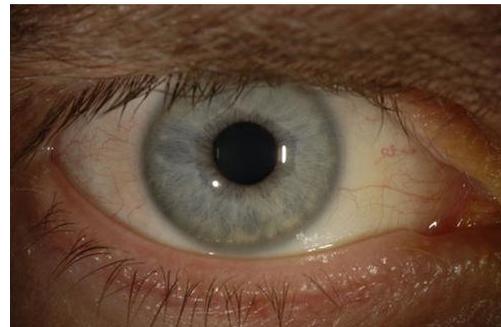
Jay B. Varkey, M.D., Jessica G. Shantha, M.D., Ian Crozier, M.D.,  
Colleen S. Kraft, M.D., G. Marshall Lyon, M.D., Aneesh K. Mehta, M.D.,  
Gokul Kumar, M.D., Justine R. Smith, M.B., B.S., Ph.D.,  
Markus H. Kainulainen, Ph.D., Shannon Whitmer, Ph.D., Ute Ströher, Ph.D.,  
Timothy M. Uyeki, M.D., M.P.H., M.P.P., Bruce S. Ribner, M.D., M.P.H.,  
and Steven Yeh, M.D.

N Engl J Med 2015;372:2423-7. HEALTH

**The New York Times**

## ***After Nearly Claiming His Life, Ebola Lurked in a Doctor's Eye***

By DENISE GRADY MAY 7, 2015



# 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?



