

## The Threat of a Virus

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## Infectious diseases –continuing threats

- In the 1950's, interest in the infectious diseases diminished as new antibiotics, vaccines, and treatment methods became available.
  - Tropical medicine was not well supported
  - Nobelist Macfarlane Burnett and others:  
*'Infectious diseases are substantially conquered: major efforts should now begin to be diverted to the chronic diseases'*

Expanding populations and advances in virology brought new diseases:  
Lassa, monkeypox, Marburg, Rift Valley, Kyasanur Forest Disease

HIV appeared on the scene (1982) – and others

- Hendra, Nipah, SARS, MERS, dengue, new influenza strains
- **EBOLA (1976)**

## How significant is the Ebola epidemic?

December, 2014

- "A colossus that continues to gather force"  
*Center for Strategic and International Studies*
- "Spiraling out of control"  
*Dr. Tom Frieden, Director of CDC*
- "Moving beyond our grasp"  
*Dr. David Navarro, UN Coordinator*
- "The world is losing the battle to contain it"  
*Dr. Joanne Lieu, President MSF*



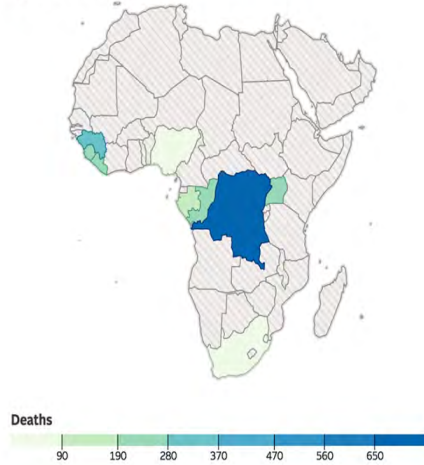
## The Zaire Ebola epidemic--1976

- First case – Sept. 1: WHO organized team arrived Oct. 18  
*"Hemorrhagic fever epidemic : 11 of 17 hospital staff are dead"*  
 280 cases in 55 of 550 rural villages (pop. 238,000)  
 Many cases due to contact in hospital (120 beds)  
 Only 20% of household contacts but rapid spread at funerals
- Measures taken  
 Isolation of ill patients in the hospital wards  
 Gowns and masks for hospital staff  
 Traditional burial practices strongly discouraged
- Last case on Nov. 9 (duration– 3 months)

## Ebola outbreaks– 1976 to 2012

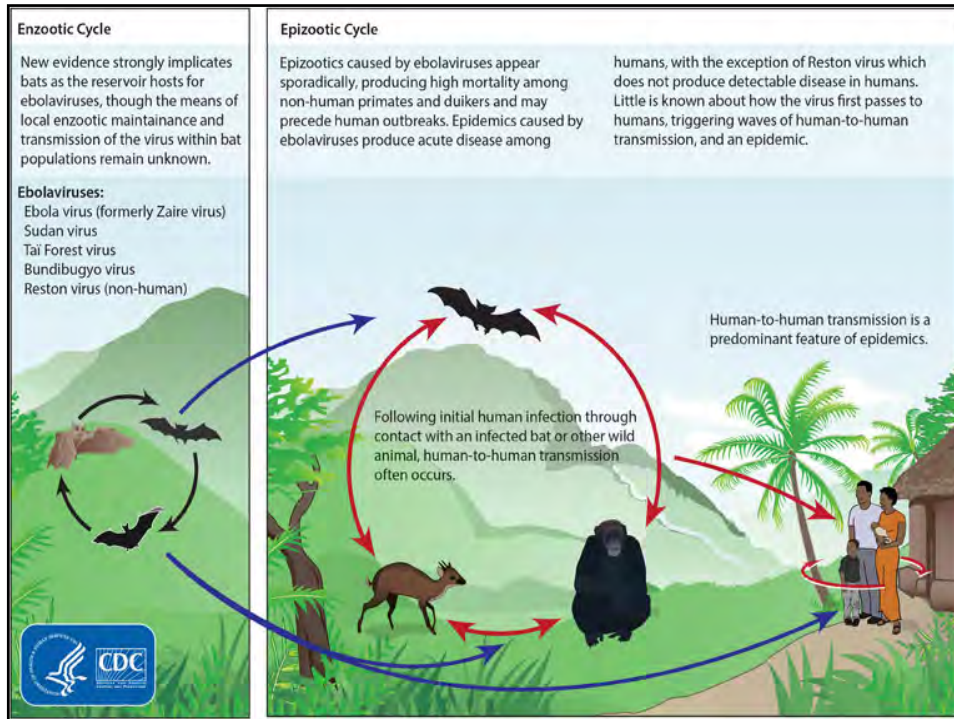
- Over the 36 year period, 17 outbreaks
- Size of outbreaks – 17 cases to 425 cases
- Countries involved -- all in central part of Africa  
 Primarily in Democratic Republic of the Congo (Zaire)  
 Also in bordering areas of Uganda, Sudan, Gabon
- Case-fatality rates: generally 50 to 75%
- Pattern of spread: household, burial practices, hospital  
*Note: No outbreaks in major urban area*  
*All were stopped within weeks to a few months*
- Small-scale laboratory research programs began

### Ebola deaths 1976-present



Source: CDC





## Clinical characteristics of Ebola

See: WHO Ebola Response Team: NEJM: 371;1481-1496

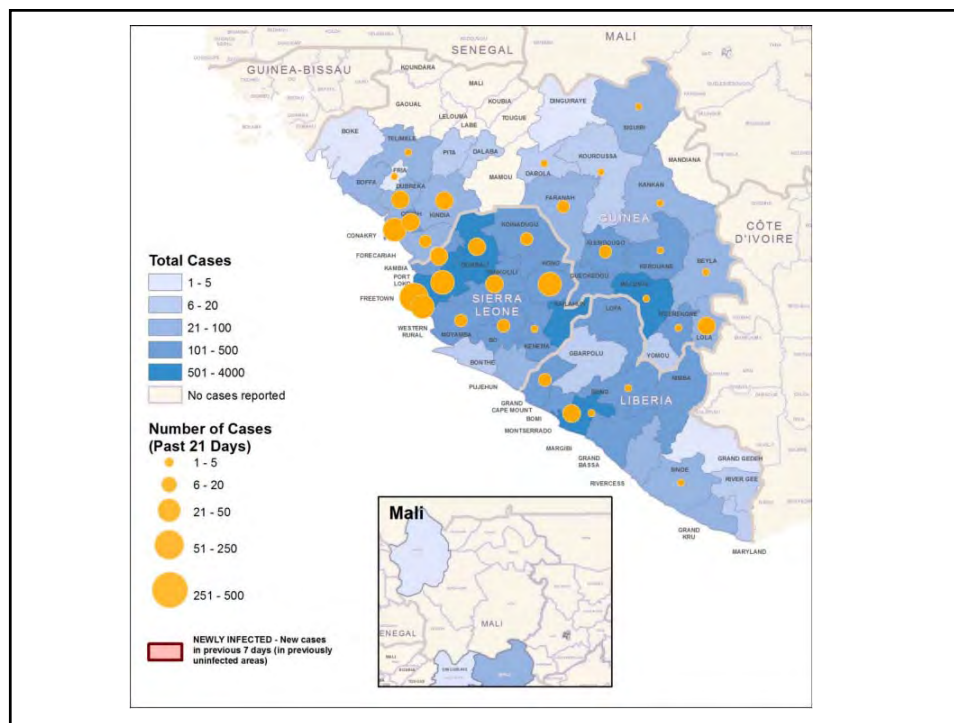
- Clinical manifestations (%) (~500 cases)
 

Fever	87
Headache	53
Anorexia	64
Vomiting	68
Diarrhea	66
Muscle, joint pain	38
Unexplained bleeding	18
- Patients and death rate (~1000 cases)
 

<u>Age</u>	<u>%</u>	<u>Death rate (%)</u>
<15	14	73
15-44	61	66
45+	25	80
- Interval between exposure and death: 5 to 20 days

## Dimensions of the present epidemic

- Began in Guinea -- Dec. 2013; first reports to WHO – March 2014
- Cases and deaths (as of 17 January)
  - 21,171 cases; 8371 deaths (actual-probably 2 to 4 times this)
  - Over 550 cases were health staff– more than half died
- Three countries account for almost all cases
  - Guinea, Liberia, Sierra Leone – 20 million people
  - Area is 85% as large as Thailand; 33% as many people
- Imported into Nigeria\*, Mali\*, Senegal, Spain, U.S., U.K.
  - \*limited local spread of cases



## Basic strategy for control

### SPREAD OF VIRUS IS BY DIRECT CONTACT- not droplets

- Isolate patients in a restricted treatment center or hut
  - Provide food and water
  - No visitors allowed
- Persons who come into contact with patient to wear gown, mask, covering for head and feet
- Dead bodies to be transferred in a sealed bag by special teams
- Bodies to be deeply buried
- Family and close contacts to be checked for next 21 days  
(Attempts to isolate contacts for 21 days abandoned)







## Challenges of gowns and masks

- Extreme shortages of equipment of all types
- Limited time for wearing because of heat (60-90 min.)
- Challenge of removing gowns and masks without skin or eye contact
- Decontamination of gear

## Among other problems

- Patients feared hospitals – many resisted entry and sometimes fled  
Health care staff were masked, wearing identical gowns  
Visitors were not allowed.  
Patients fearful: not more than one in four would leave the hospital alive  
Acute shortages of IV fluids, drugs of all types
- Recruitment of health staff (national and international) is difficult
- Traditional burial rituals are firmly embedded  
May extend over many days and involve numerous friends and family  
Customary practice is for participants to touch or stroke body

## Ebola generated panic and fed a disaster

- Commercial impact
  - Most airlines suspended flights
  - Some shipping lines refused to dock
  - Business and tourist travel came to a standstill
- International restrictions
  - Screening of all travelers from the 3 countries for any suggestive symptoms; possible 21 day isolation and/or daily monitoring
  - Some countries applied these and other stipulations to some or all individuals intending to visit from various countries of Africa
- Economic and development impacts now foreseen to be catastrophic.

## What of the future?

- Will Ebola spread throughout Africa? To other countries?
  - How soon will we have drugs for treatment?
  - What about vaccines?
- Are there other viruses which should concern us?

## Lessons to be learned

- There will be other epidemic threats!  
Increasing densities of population, more frequent and rapid travel, and closer contact with natural ecosystems dictate more viral diseases spreading more rapidly.
- Early detection, diagnosis, and rapid control are essential  
**Infectious disease expertise in major medical centers**  
Laboratories for diagnosis and research  
Field epidemiologists to characterize and respond
- Public Health infrastructure for communication, public mobilization

## An historical perspective

- One of the most feared of epidemic problems was smallpox in a densely populated city -- this was despite the fact that we had a good vaccine to protect contacts and to prevent its spread.
- Last year, the Ebola virus invaded, for the first time, three comparatively small cities -- Conakry, Monrovia, and Freetown. No one in the population had natural immunity and there was no protective vaccine available.
- The results were disastrous.