

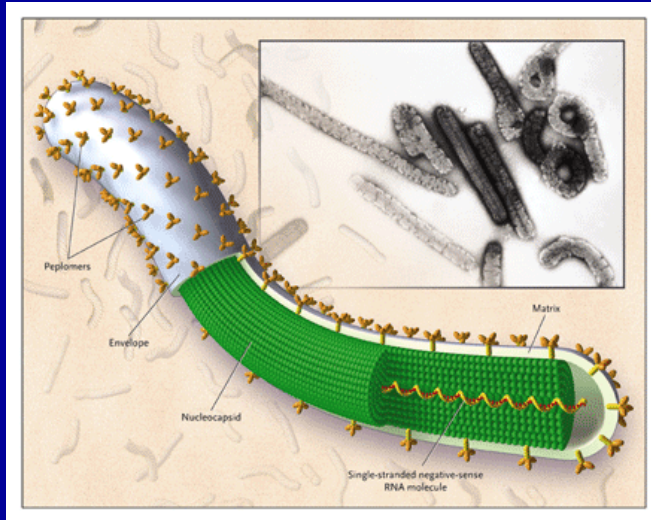
A critical assessment of past and current Ebola Outbreaks

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Family Filovirus



Named after the Ebola river in Zaire where it was discovered in 1976
Four species of Ebola discovered
Ivory Coast, Sudan, Zaire and Reston

It is an enveloped RNA virus
They are called Filovirus because they appear as filaments but can be pleomorphic



Lessons from 1976 outbreaks

- **Ebola Fever resembles many many diseases**
 - Malaria, typhoid, yellow fever, influenza
- **Virus was spread through unsterilized needles**
 - 13/17 staff became infected, 11/13 died
- **Some quarter of a million people were quarantined**
 - Villages were isolated in huts as in smallpox days
- **House-to-house visit contact tracing**
 - Visited 550 villages and identified 50 infected villages
 - Team relied on legacy of smallpox manpower
- **Team from Atlanta, Antwerp and Kinshasa worked in coordination with DRC government**

HOW IS EBOLA TRANSMITTED

- No evidence, personal contact with a non-febrile, non-symptomatic, infected individual during the incubation or convalescent periods (except sexual)
- **DIRECT TRANSMISSION:** from person-to-person with virus-infected body fluids such as:
 - blood, saliva, vomitus, stools and possibly sweat.
 - Contacts with body fluid during preparation for burial
 - Sexual transmission: from genital secretions of convalescents several weeks after illness.
- **INDIRECT TRANSMISSION THROUGH:**
 - Infected fomites (surgical instruments, needles etc.)
 - Infected aerosol especially in laboratory maneuver

When is someone able to spread the disease to others?

Ebola only spreads when people are sick.

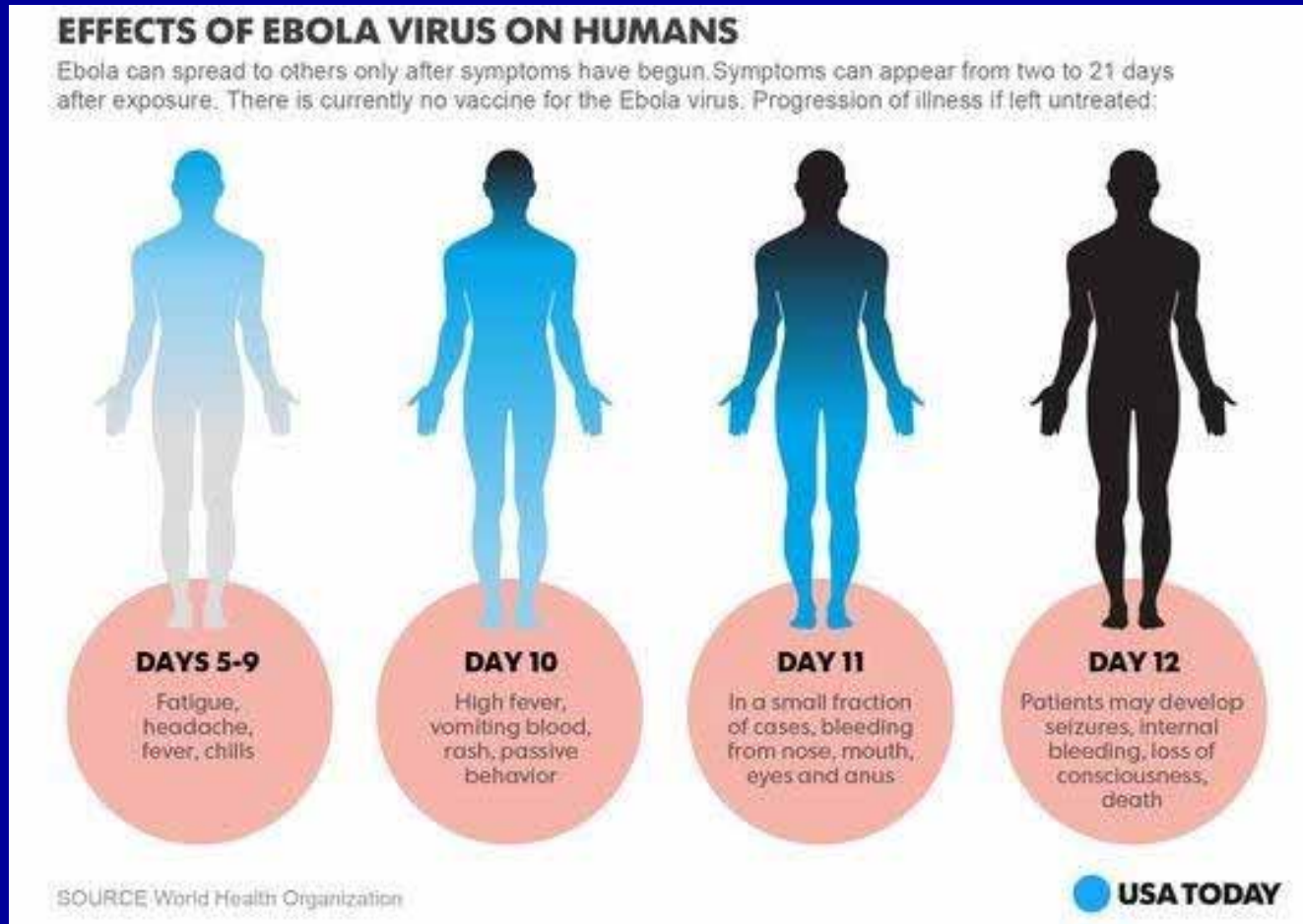
A patient must have symptoms to spread the disease to others.



MONTH						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

After 21 days, if an exposed person does not develop symptoms, they will not become sick with Ebola.

Ebola disease progression

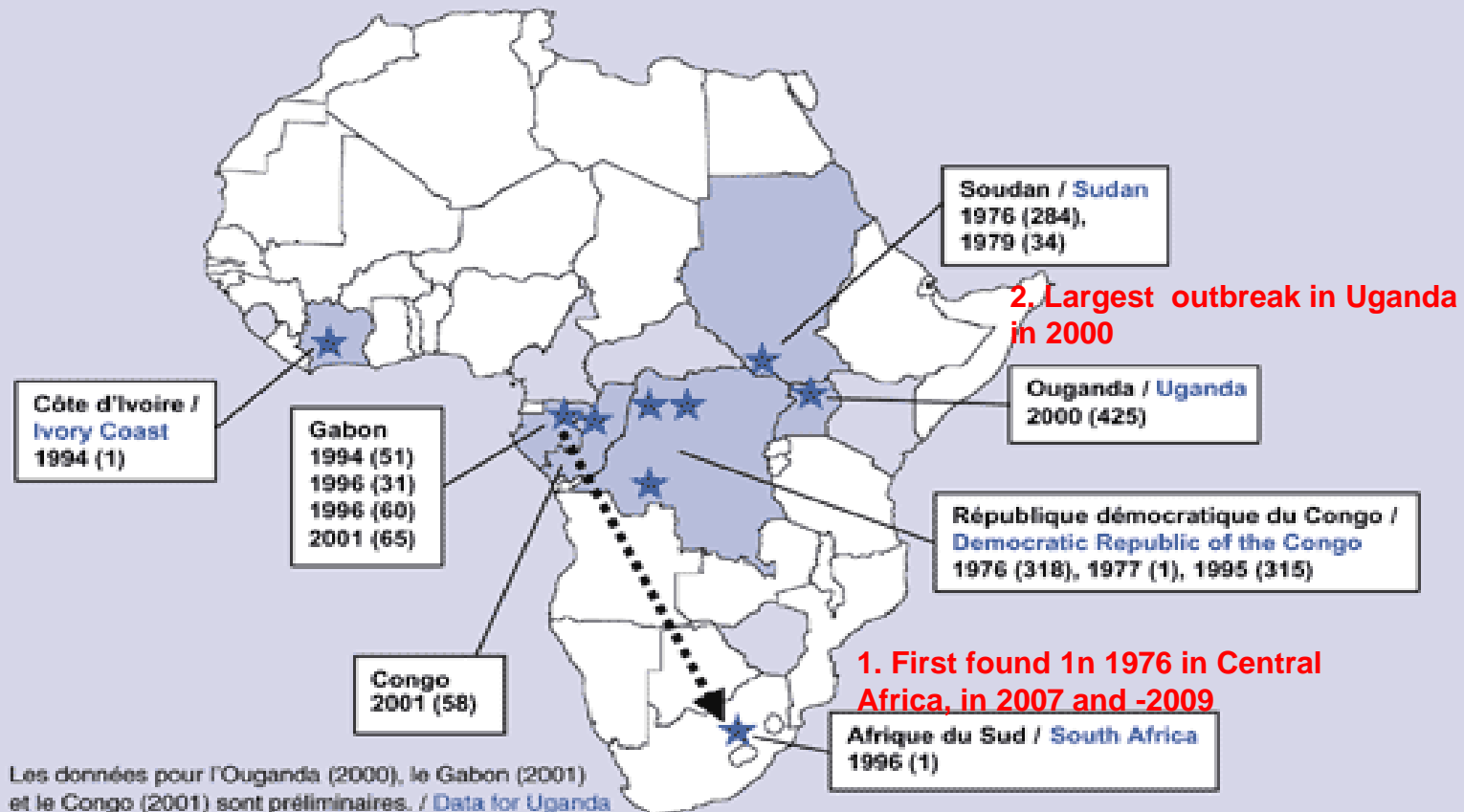


IT MAY TAKES 2 TO 21 DAYS FOR THE DISEASE TO APPEAR AFTER EXPOSURE

Subsequent outbreaks occurred in Zaire

Figure

Fièvre hémorragique Ebola en Afrique 1996-2002. Année de l'identification de l'épidémie et nombre de cas /
Ebola haemorrhagic fever in Africa 1996-2002. Year of outbreak recognition and number of cases



Ebolavirus Ecology

GOT MORE DEFINED WITH RESEARCH

Enzootic Cycle

New evidence strongly implicates bats as the reservoir hosts for ebolaviruses, though the means of local enzootic maintenance and transmission of the virus within bat populations remain unknown.

Ebolaviruses:

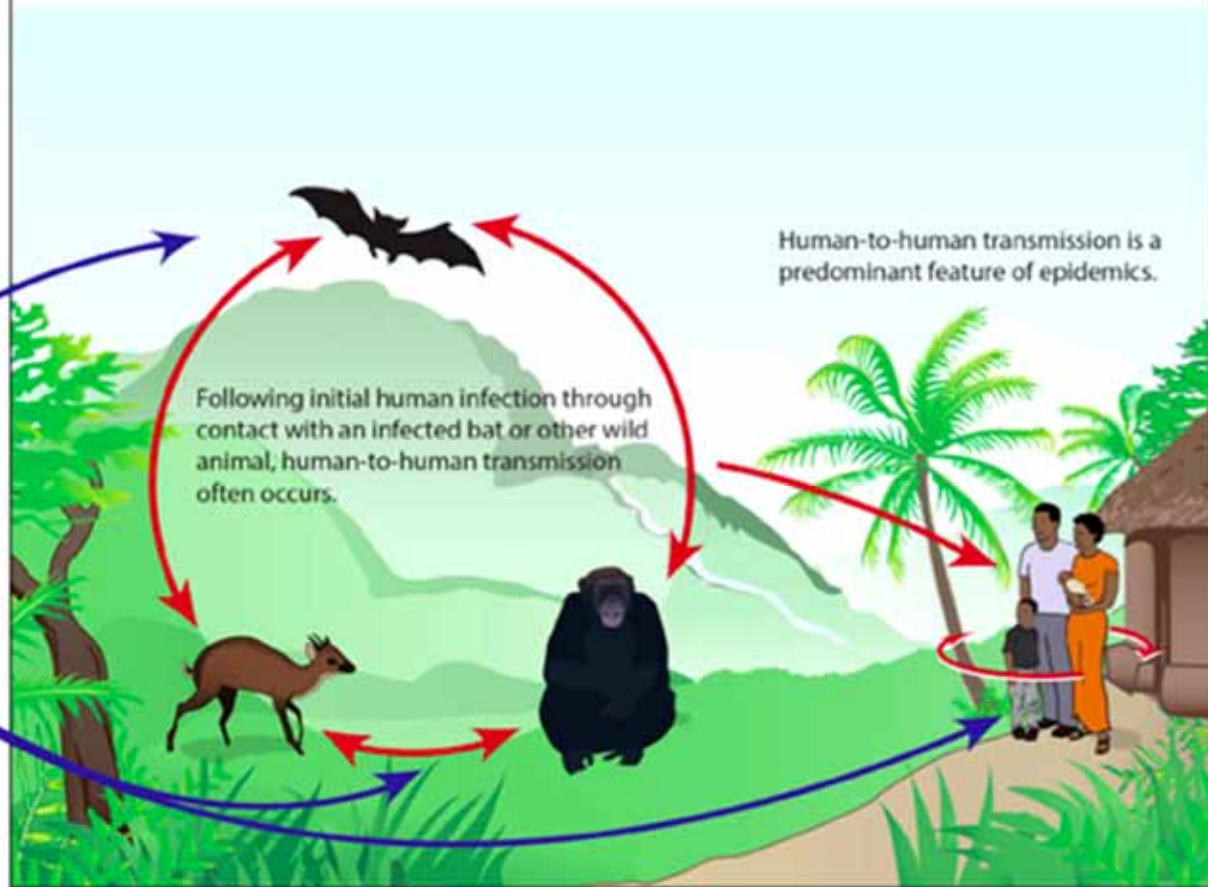
- Ebola virus (formerly Zaire virus)
- Sudan virus
- Tai Forest virus
- Bundibugyo virus
- Reston virus (non-human)



Epizootic Cycle

Epizootics caused by ebolaviruses appear sporadically, producing high mortality among non-human primates and duikers and may precede human outbreaks. Epidemics caused by ebolaviruses produce acute disease among

humans, with the exception of Reston virus which does not produce detectable disease in humans. Little is known about how the virus first passes to humans, triggering waves of human-to-human transmission, and an epidemic.



Water, air and food do NOT transmit the virus

Facts *about* Ebola

You can't get Ebola through air



You can't get Ebola through water



You can't get Ebola through food



Successful Infection control measures stamped out past epidemics

Prevent Healthcare infection control and safe burial practices



INFECTION CONTROL



SAFE BURIAL PRACTICES



BUSH MEAT

The image is a graphic with a teal background. At the top, a dark grey bar contains the word 'Prevent' in white. Below this, a white box contains the text 'Healthcare infection control and safe burial practices'. The main area features three icons: 1) A person wearing a mask with a cross, goggles, and gloves, with an apron, labeled 'INFECTION CONTROL'. 2) A bottle of bleach, a pair of boots, and a pair of gloves, labeled 'SAFE BURIAL PRACTICES'. 3) A red prohibition sign with a bat silhouette and the text 'BUSH MEAT' in a white box, indicating a ban on bush meat.

Barrier nursing technique to handle the infected patient



- 1) Face-shield or surgical mask and 2) eye protection to prevent droplet contact
- 3) Gloves to prevent skin or mucous membrane contact with organic fluid of the patient for any one coming within 3 feet of the patient

Isolation ward and strict bio-safety precautions

Or Make shift hospital (*note cordon sanitaire*)

Isolation ward if available



Isolation ward Gulu, Uganda



MSF Isolation ward



Bio-safety for handling and testing specimens

Proper barrier technique (PPE) *universal precautions during specimen collection from sick, dead or transport



- Field Laboratory BSL-3-4 facilities are



Observe strict biosafety level 4 precautions during disinfection and incineration procedure

Disinfect re-usable medical items
Wear protective clothing



Incinerate infected items



Also disinfect household items with a registered hospital disinfectant or 1:100 household bleach

Use Safe and culturally acceptable burial practice: preparation, transport and burial


The corpse should be wrapped in sealed leak proof materials and cremated or buried promptly in a sealed casket
Do not embalm the corpse



Allow relative to watch from a safe distance or else they say "Astronauts" came to exterminate



Current Outbreaks

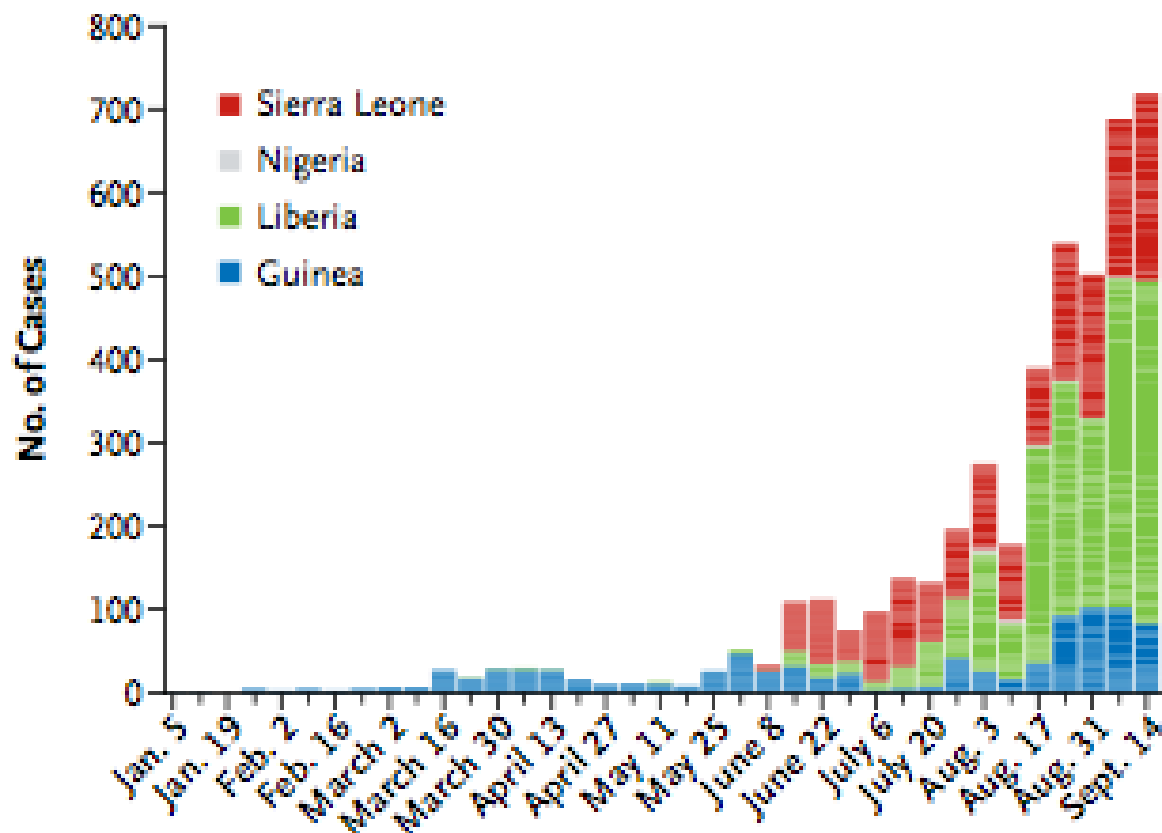


1st Ebola outbreak in West Africa

Multiple countries:

- Guinea
- Liberia
- Nigeria
- Senegal
- Sierra Leone

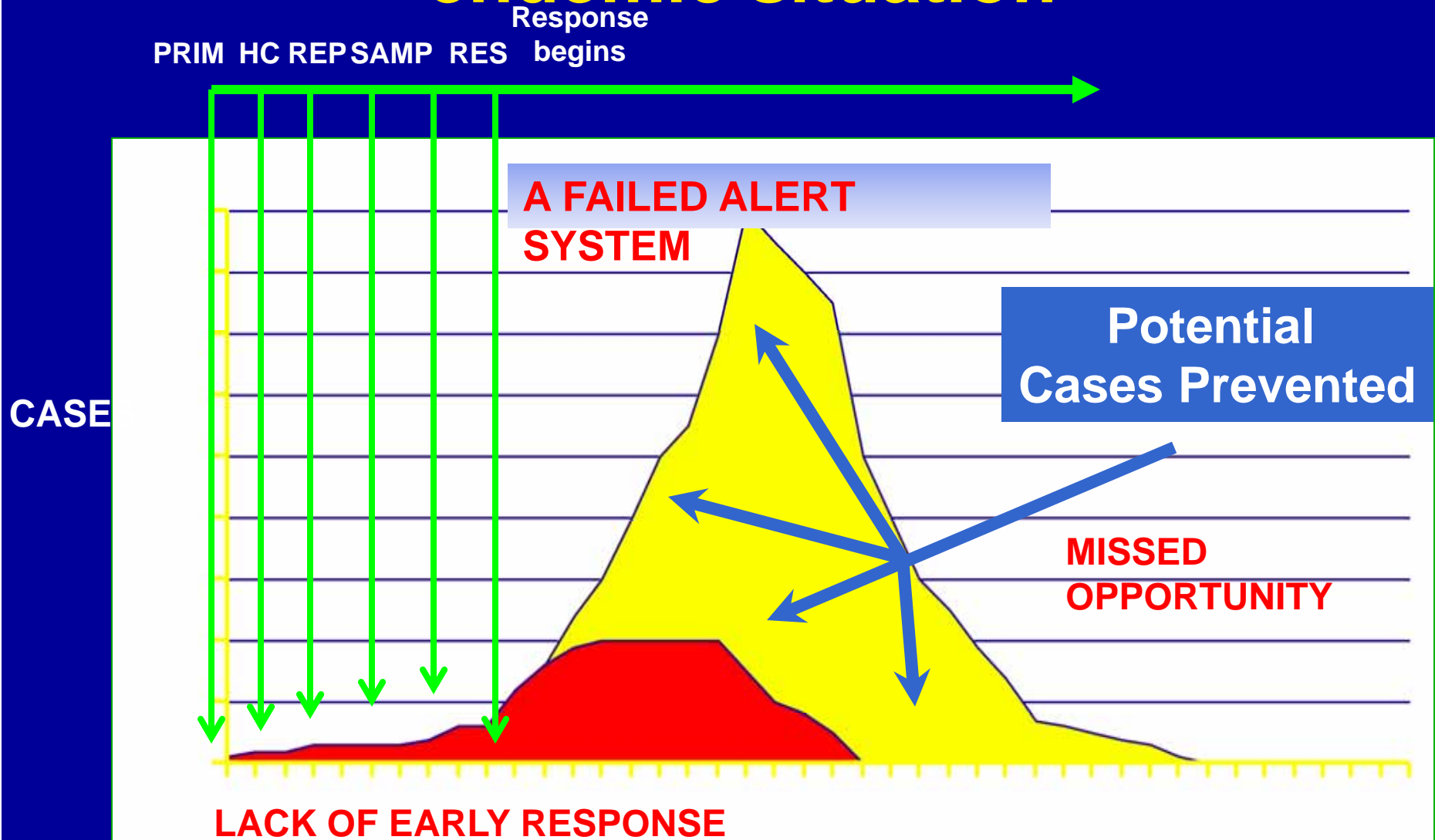
A West Africa



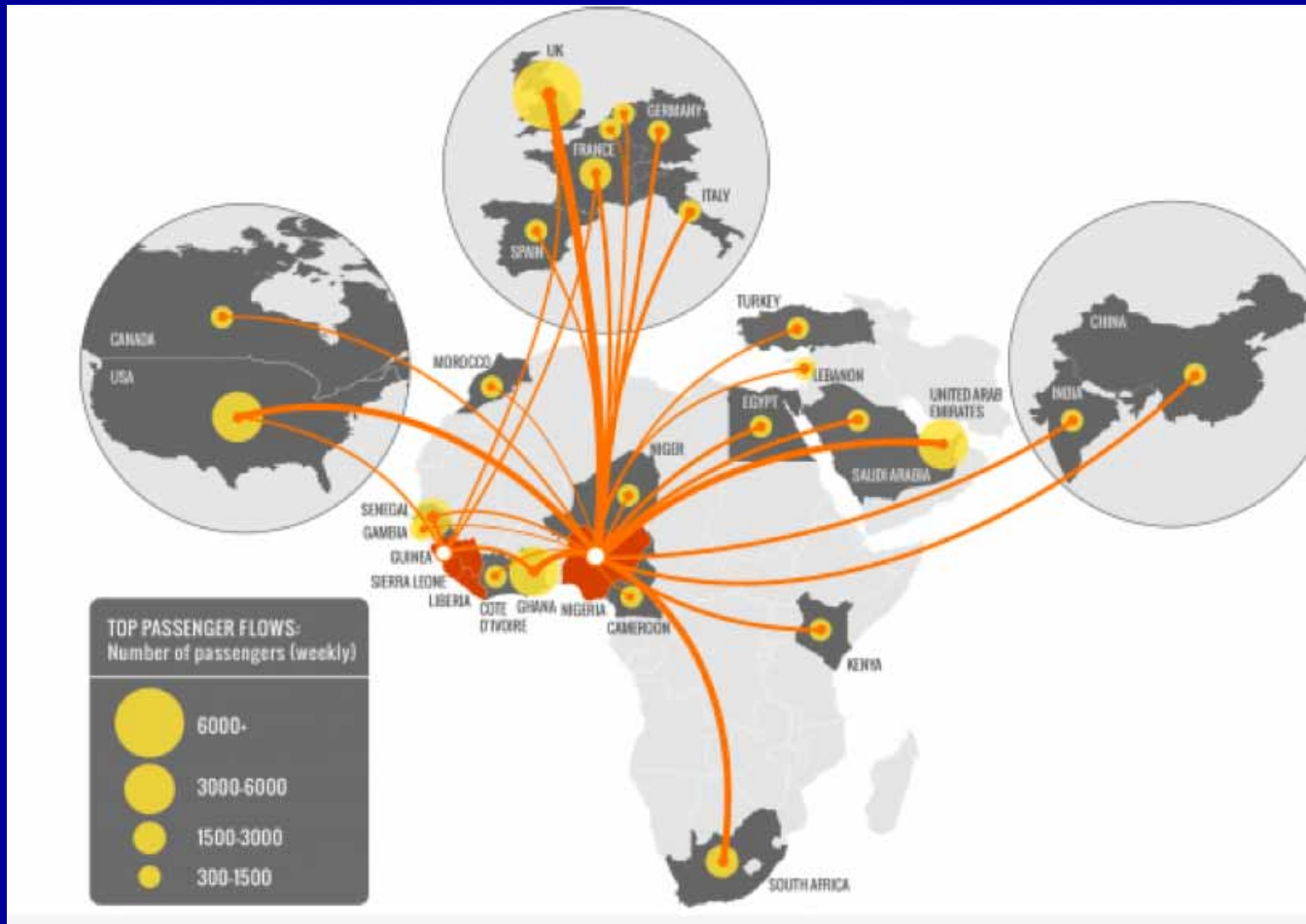
Why the current outbreaks are recalcitrant to control?

- **It is not a new virus, the virus has not mutated**
- **The face of Africa has changed**
 - **More urbanization**
 - **More invasion of forest for food and agriculture**
 - **More commute from village to cities**
 - **Less developed health infrastructure**

Also late response created an endemic situation



Risk of Spread depends on geography and traffic volume



Note: Kenya and South Africa are at moderate risk

Projection of Trend

- **CDC**
 - has made a grim projection of 1.5 million people being infected by 30th September 2014
- **WHO**
 - projects more than 20,000 cases by November 2nd 2014
- **Gomes et al**
 - Over 1000 deaths by August 2014

WHO travel advisory



WHY WAS A TRAVEL BAN PUT ON TORONTO FOR SARS OUTBREAK WITH LOWER NUMBER OF CASES?

Barriers to Control Measures

1. Cultural practices
2. Handling/washing the dead
3. Initially no time for education or talking to families
4. Rush to bury the infected dead
5. Families hid ill relatives
6. Humanizing burials,
 1. allow family to attend at a distance or use protective gear
7. Suspicion, lack of trust
8. Marburg/Ebola was hard to differentiated from other typical illnesses. Malaria, yellow fever
9. Lack of adequate infection control resources

International response: critical to locally contain the outbreak

Partners in 2007 DRC outbreaks

- 1.WHO: World Health Organization
- 2.GORAN: Global Alert and Response Network
- 3.MSF: Medecins sans Frontiere
- 4.Red Cross
- 5.PHAC: Public Health Agency of Canada
- 6.Centre National de Recherche Scientifique, France
- 7.SDC: Swiss Agency for Development and cooperation
- 8.CDC: Centers for Disease Control and Prevention
- 9.Ministry of health, DRC
- 10.Others

Team: 1) epidemiologist, 2) virologist, 3) logisticians, 4) experts in social mobilization, 5) infection control, 6) medical anthropology, 7) laboratory diagnostician



Social mobilization

Use locally accepted media

Meeting with community leaders



No cases at the end of 2 incubation period (*how long is that?*): end of outbreak

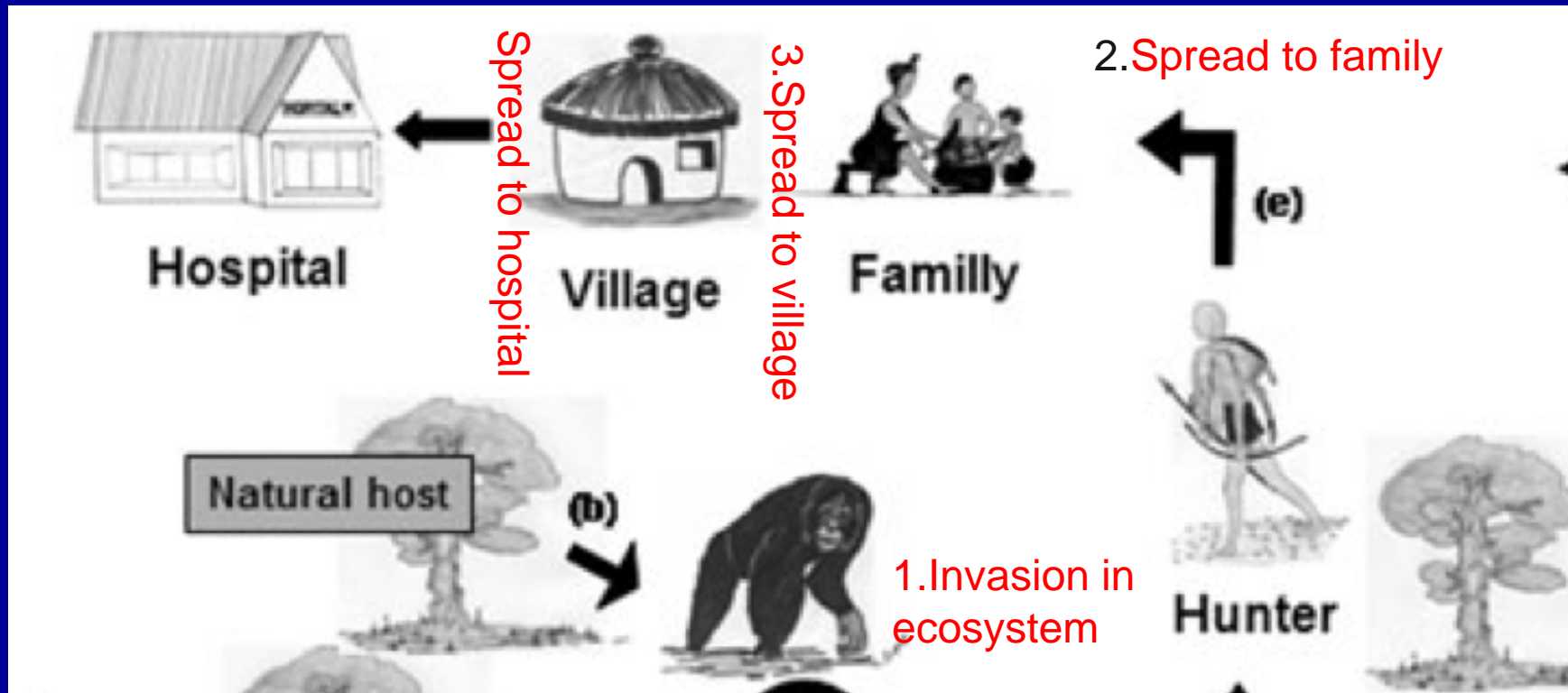
Target person at risk



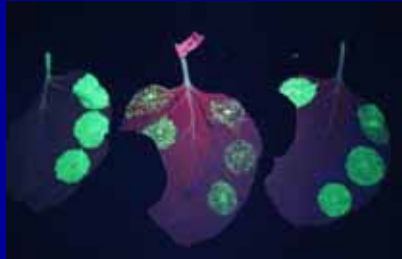
Risk for Mauritius

- **Ebola CAN ONLY enter via an infected persons**
 - Someone who is NOT ILL will NOT transmit the disease
 - Our surveillance system is active
 - Ports of entry
 - In the community
- **Our bat populations are NOT infected with Ebola**
 - A sick person will NOT infect an animal
 - The risk of an infected animal infecting our bat population is almost zero

How the Disease Spreads



Drug and Vaccines Ethical Issues



ZMAP

Drug still in experimental stage

Claimed to be effective on the American patient but not the ? Spanish missionary

3 Vaccines developed

- **Public Health Canada**
 - never tested in humans
 - Donation of 1000 doses got put on hold
- **US-NIH**
 - Vaccine now undergoing human phase 1 trial
- **GSK**
 - Undergoing human phase 1 trial now

Question for Globalization and clinical trial: who will benefit and be able to afford these drugs/vaccine when proven effective?

Who would have served as trials subjects?

Thank you !

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