

Ebola Preparation and Response

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Ebola Overview

- BLUF – to do now
- History
- Current outbreak
- Air travel
- Transmission
- Clinical presentation
- Labs
- Treatment
- Prevention
- Risk to Others
- CDC updates

WEST AFRICA Ebola Outbreak



**1st Ebola outbreak
in West Africa**

4 countries:

- Guinea
- Sierra Leone
- Liberia
- Nigeria



Likely host = bats

Ebola is fatal in
55-60%
of cases reported
in this outbreak.

BLUF – To do now

- Health care facility preparedness
 - Infection control practices (including PPE)
 - Training, equipment, supplies and facilities
 - Providers recognize and treat patients with Ebola infection.
- Public health preparedness
 - Improve public health (PH) passive surveillance, ensuring providers and laboratories report appropriate conditions to PH authorities.
 - Active surveillance of deployers returning to US
 - Plan contact tracing with local public health
 - Ensure clear reporting channels including DRSi, Public Health Command, local community
- Community preparedness
 - Arrange with local EMS and hospitals to care for R/O EVD patients
 - Military and civilian community well informed with town halls, social media, traditional media, etc.

Ebolavirus Ecology

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.

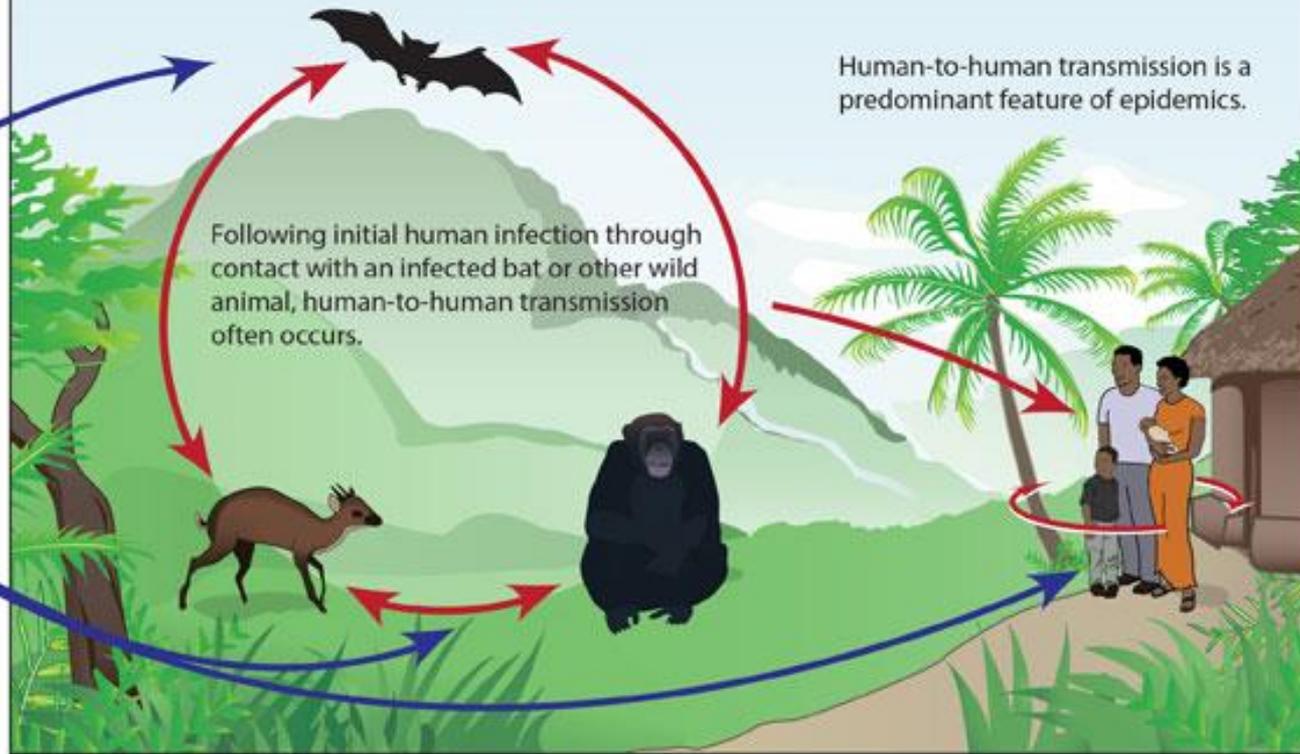
Ebolaviruses:

- 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

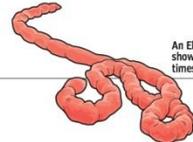
humans, with the exception of Reston virus which does not produce detectable disease in humans. Little is known about how the virus first passes to humans, triggering waves of human-to-human transmission, and an epidemic.



History

- First identified in Zaire and Sudan in 1976.
- Ebola typically infects fewer than 1000 people per year but has a case fatality ratio nearing 90%
- CDC classified Category A bioterror agent
- Confirmed cases have been reported in Guinea, Liberia, Sierra Leone, Nigeria, Democratic Republic of the Congo (DRC), Gabon, South Sudan, Ivory Coast, Uganda, Republic of the Congo (ROC), and South Africa (imported)
- Three cases have occurred due to contamination in a laboratory (1 in the UK and 2 in Russia).
- Until recently, no cases have originated in the US

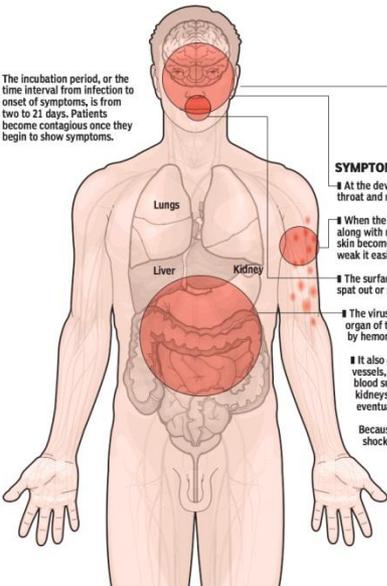
THE EBOLA EPIDEMIC



An Ebola virus particle, shown 1.55 million times its actual size

One of the world's deadliest diseases, the ebola virus is currently sweeping the African continent, which is experiencing its worst outbreak ever. Symptoms can be horrific, and it has a case fatality rate of up to 90%, making it a nightmare for health officials.

The incubation period, or the time interval from infection to onset of symptoms, is from two to 21 days. Patients become contagious once they begin to show symptoms.



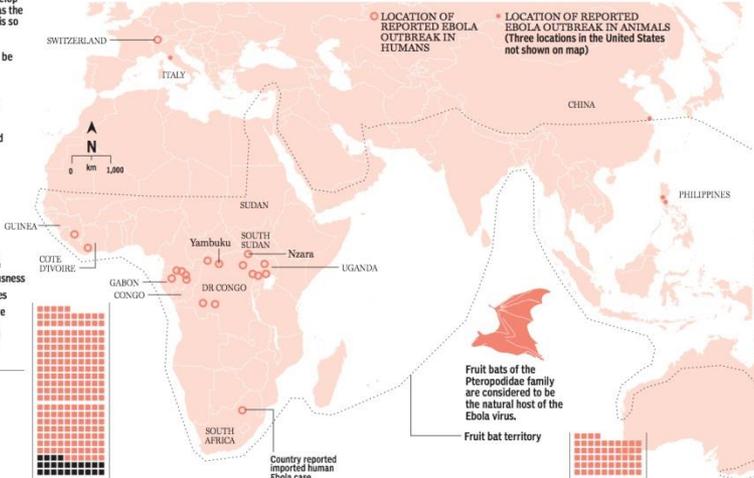
SYMPTOMS AND EFFECTS

- At the development stage of ebola virus disease (EVD), patients have inflammation of the throat and mucous membranes of the eyes (conjunctivitis), abdominal pains and vomiting.
 - When the infection attacks, it causes severe damage to the skin. Small white blisters develop along with red spots, referred to as maculopapular rash. These spots develop into bruises as the skin becomes puffy in texture. Rips randomly appear, allowing blood to pour out. The skin is so weak it easily tears with any movement of the patient.
 - The surface of the tongue becomes a brilliant red and eventually sloughs off. It may even be spat out or swallowed.
 - The virus is known to be systemic, which means the infection attacks every tissue and organ of the body, except the skeletal muscles and bones. The virus is also characterized by hemorrhaging and blood clotting.
 - It also causes blood clots in the bloodstream. These clots tend to get stuck in the blood vessels, which in turn causes the red spots on the skin. The clots also slow down the blood supply to most organs of the body, such as the lungs, brain, liver, intestines, kidneys, testicles and breasts. All these organs become severely damaged and eventually stop functioning.
- Because of the many devastating effects on the body, death may be caused by shock, renal failure or loss of blood.

DAY 7-9	DAY 10	DAY 11	DAY 12
<ul style="list-style-type: none"> Headache Fatigue Fever Muscle soreness 	<ul style="list-style-type: none"> Sudden high fever Vomiting blood Passive behaviour 	<ul style="list-style-type: none"> Bruising Brain damage Bleeding from nose, mouth, eyes and anus 	<ul style="list-style-type: none"> Loss of consciousness Seizures Massive internal bleeding Death

DISTRIBUTION OF PREVIOUS OUTBREAKS

Ebola first appeared in 1976 in two simultaneous outbreaks, in Nzara, Sudan, and Yambuku, Democratic Republic of Congo. The latter was in a village situated near the Ebola River, from which the disease takes its name.



RECENT OUTBREAKS IN WEST AFRICA JAN. - JULY 2, 2014

Guinea: 412 cases (305 deaths)
Liberia: 115 cases (75 deaths)
Sierra Leone: 252 cases (101 deaths)



These figures are current estimates for EVD cases in three countries.

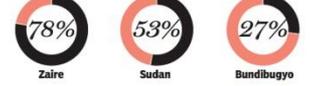
TRANSMISSION

Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals. In Africa, infection has occurred through the handling of infected chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest. Once a person comes into contact with an animal that has Ebola, it can spread within the community from human to human. Infection occurs from direct contact (through broken skin or mucous membranes) with the blood, or other bodily fluids or secretions (stool, urine, saliva, semen) of infected people.

DEADLY EBOLA SPECIES

There are five known species of Ebola virus. The Bundibugyo, Zaire and Sudan species have been associated with large EVD outbreaks in Africa, whereas Reston and Tai Forest have not. The Reston species, found in Philippines and the People's Republic of China, can infect humans, but no illness or death in humans from this species has been reported to date.

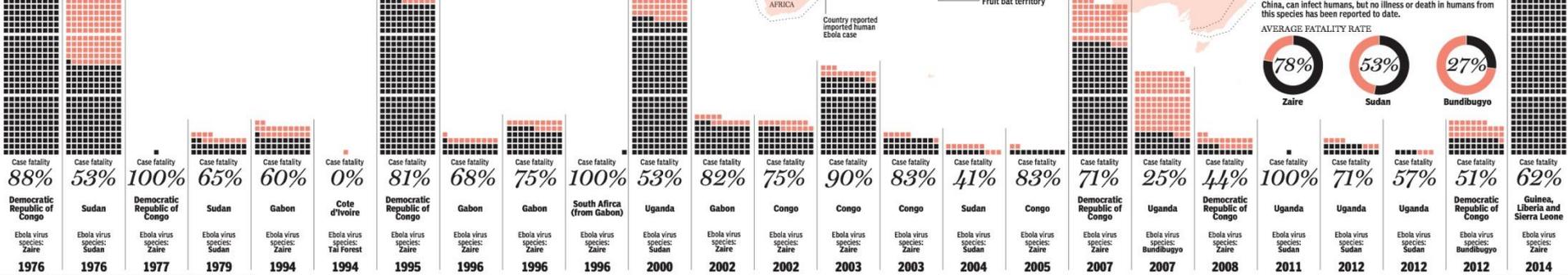
AVERAGE FATALITY RATE



CHRONOLOGY EBOLA OUTBREAKS

NUMBER OF CASES, 1976 - 2014

■ SURVIVED ■ DIED



SOURCES: WORLD HEALTH ORGANIZATION, THE HUFFINGTON POST, SUPPERPAGES.COM

MIKE FAHLE / NATIONAL POST

2014 Ebola Outbreak

On 8 August 2014, the Ebola outbreak in West Africa was declared by the World Health Organization (WHO) to be a Public Health Emergency of International Concern (PHEIC)

Genetic analysis of the virus indicates that it is closely related (97% identical) to variants of Ebola virus (species *Zaire ebolavirus*) identified earlier in the Democratic Republic of the Congo and Gabon

Ebola: a killer fever

The Ebola haemorrhagic virus was discovered in 1976

Transmission: direct contact with bodily fluids of infected people or animals

Symptoms

The virus aggressively attacks the blood coagulation system and spreads quickly to all organs, especially the liver and kidneys.

Symptoms: Sudden fever, headache, muscle pains, vomiting, diarrhoea, chest pain, shock, haemorrhages

Incubation period: 2-21 days

Death rate: 50-90% of victims die within 10 days

Precautions

Protective clothing, gloves, breathing equipment.

Treatment

No available vaccine or effective treatment.

at 160,000 magnification

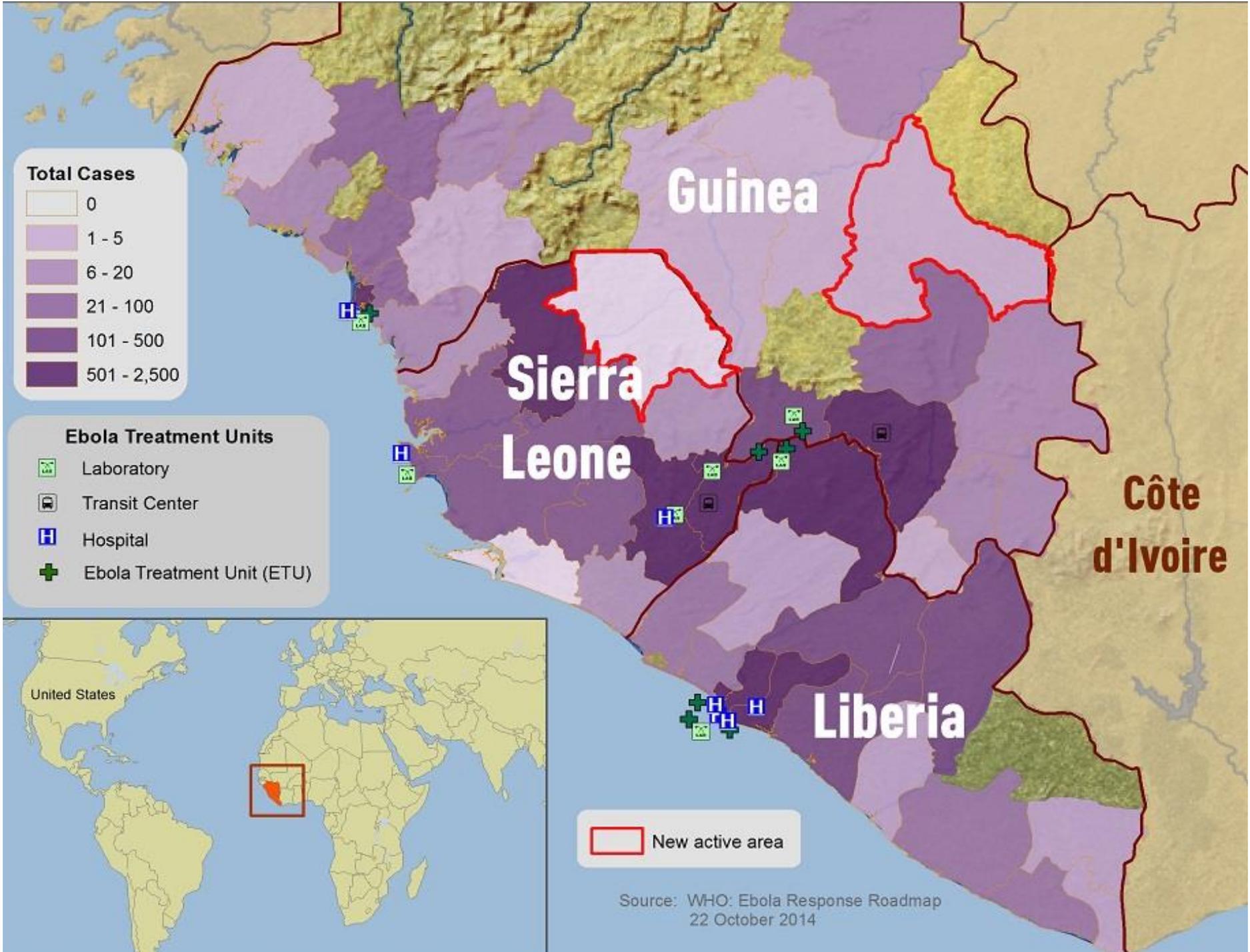
Source: WHO

AFP

The infographic features a central illustration of a person in a yellow protective suit and mask. To the right, a human silhouette is shown with yellow starburst icons indicating the virus's impact on various organs. A circular inset at the top left shows a magnified view of the virus particle.

Ebola Current Outbreak (CDC 25 Oct)

Country	Cases (suspected and confirmed)	Deaths
Guinea	1553	926
Liberia	4665	2705
Sierra Leone	3896	1281
Travel associated only		
Mali	1	1
Senegal	1	0
Travel and Localized Transmission		
Nigeria	20	8
Spain	1	0
United States	4	1



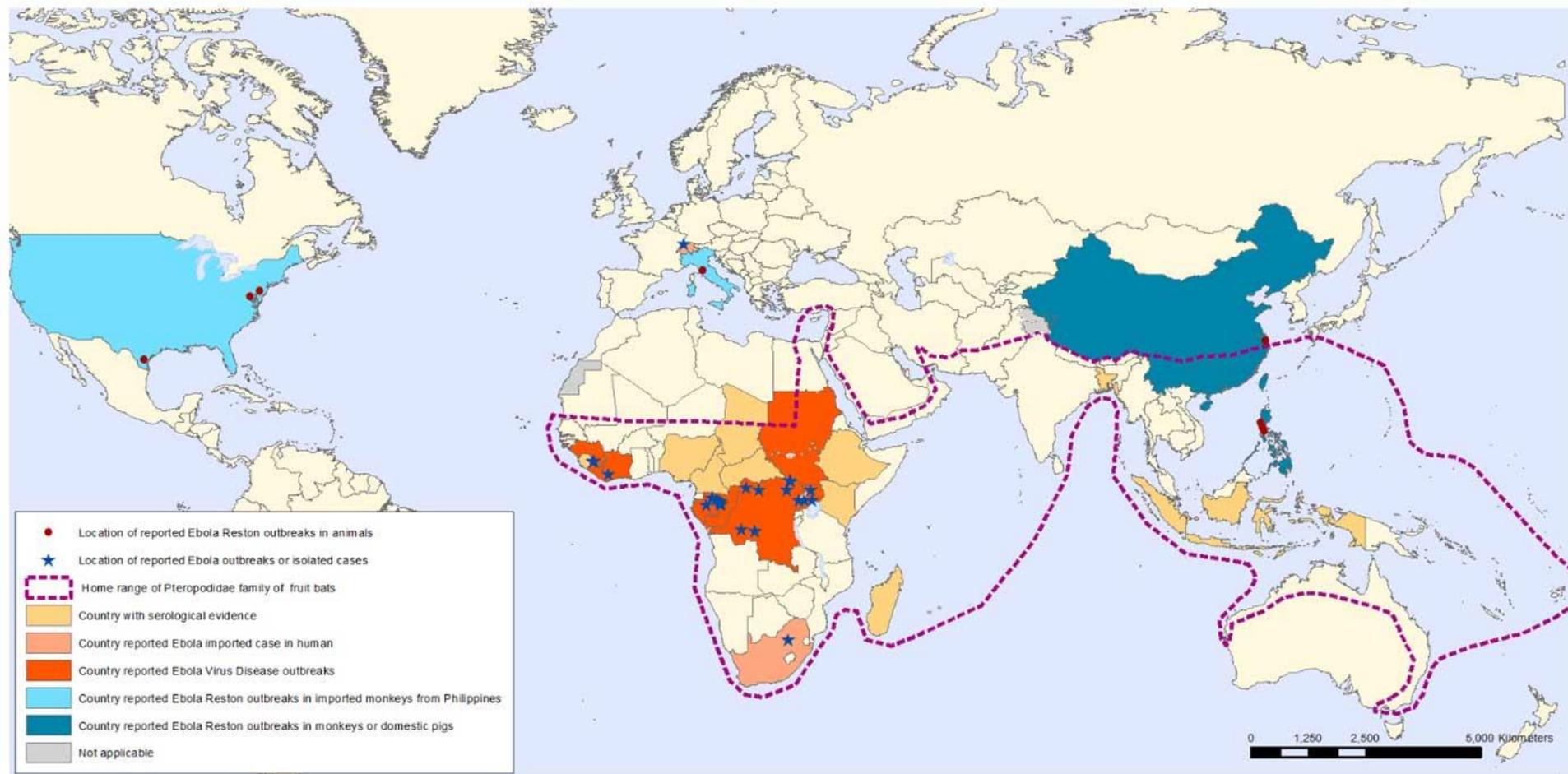
Air Travel

- Air travel from Sierra Leone (Freetown), Guinea (Conakry), Nigeria (Abuja) and Liberia (Monrovia) to major airports is a likely way for Ebola-infected patients to get to the US.
- Highest number of passengers into east coast airports (in order): Atlanta, NY (JFK), Charlotte, Miami, Newark, Orlando, Boston, Philadelphia, NY (LaGuardia)
 - Thomas Duncan flew into Dulles and then on to Dallas.
- Guidance for monitoring and movement of patients with possible Ebola:
 - <http://www.cdc.gov/vhf/ebola/hcp/monitoring-and-movement-of-persons-with-exposure.html>

Transmission

- Direct contact with the blood or secretions of an infected person
- Exposure to objects (such as needles) that have been contaminated with infected secretions
- Incubation period can be 2-21 days but 8-10 days is most common

Geographic distribution of Ebola virus disease outbreaks in humans and animals



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization



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Ebola: reducing the risk of transmission

As long as the epidemic of Ebola virus disease is continuing and expanding in West Africa, the risk of importation of contagious cases to European and other countries increases. The risk of further transmission in Europe is extremely low, but cannot be excluded. To minimise this risk, public health efforts in the EU focus on early case detection and isolation.



Exit screening

Passengers departing from affected countries have their temperature checked to prevent a contagious case from boarding a plane.



- Person at risk
- Person not at risk
- Infected, asymptomatic person (not infectious)
- Infectious sick person
- Contact tracing
- Isolation
- Movement



Information to travellers

At the point of entry, travellers coming from affected areas are informed about the disease and advised to seek medical care if they experience symptoms.

From first symptoms to detection

The incubation period ranges from 2 to 21 days. As soon as symptoms appear, people become infectious and can spread the virus to others. People can only get infected if they come in contact with contaminated blood or bodily fluids. Healthcare workers and close contacts are therefore at higher risk of getting infected. Identifying infectious sick persons as soon as possible ensures that the chain of transmission is stopped.

Travelling from affected areas

An infected person not experiencing symptoms is not contagious and therefore does not pose a risk to other travellers.



Putting medical staff on alert

Frontline medical staff asks patients about recent travel. Patients with a compatible travel history and Ebola-like symptoms are immediately isolated.



Contact tracing

Identifying and following-up those who had contact with an ill person is essential to prevent the spread of the disease.

Medical evacuation

Patients are safely isolated during medical evacuation and do not pose a risk to others.

Healthcare facilities

Infected patients are isolated under vigorous infection control measures.

European
Centre for
Disease
Prevention
and
Control

Clinical Presentation

- Official CDC case definition:
 - A person who has both consistent signs/symptoms and risk factors as follows:
 - Elevated body temperature or subjective fever or symptoms, including severe headache, fatigue, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained hemorrhage; **AND**
 - An epidemiologic risk factor within the 21 days before the onset of symptoms.

<http://www.cdc.gov/vhf/ebola/exposure/risk-factors-when-evaluating-person-for-exposure.html>

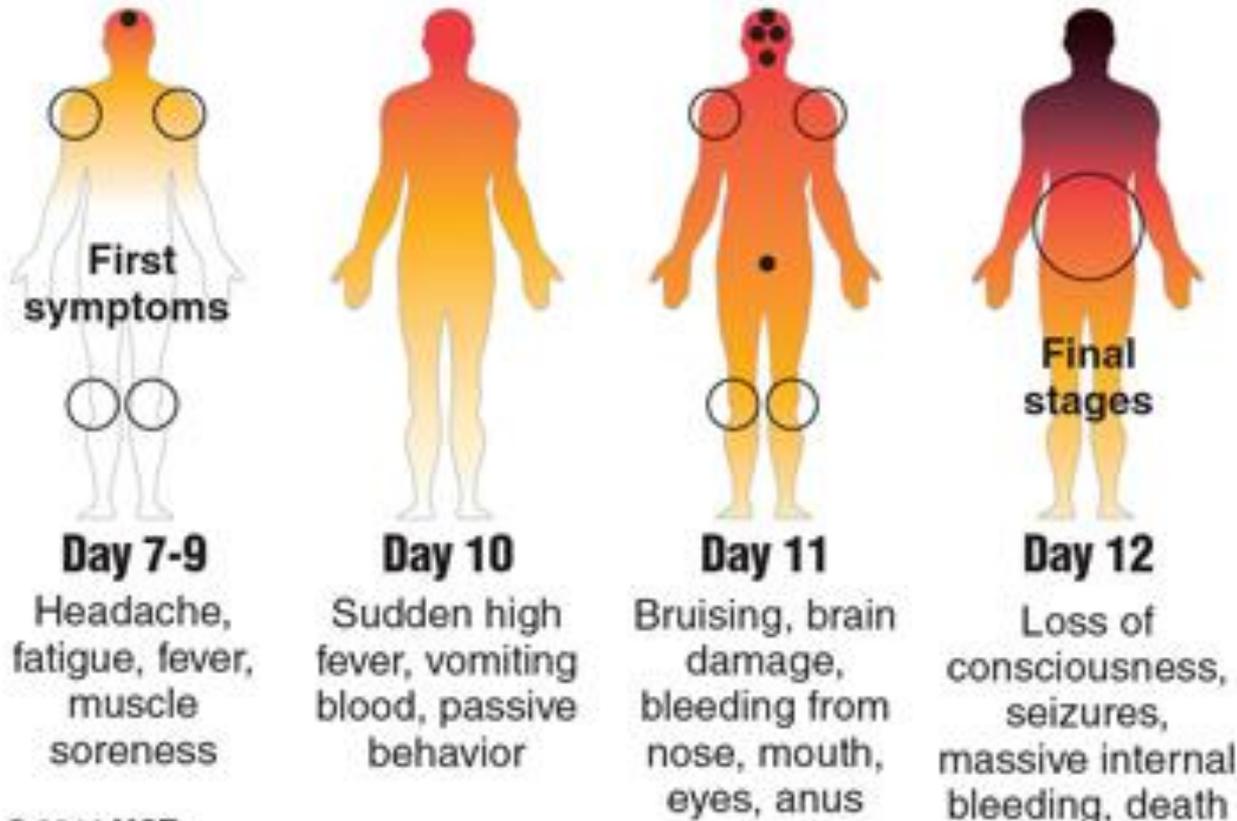


Ebola outbreak

An outbreak of the deadly Ebola virus has killed at least 59 people in Guinea. Ebola is spread by close contact and kills between 25 and 90 percent of victims; there is no cure or vaccine.



Ebola virus' typical path through a human being



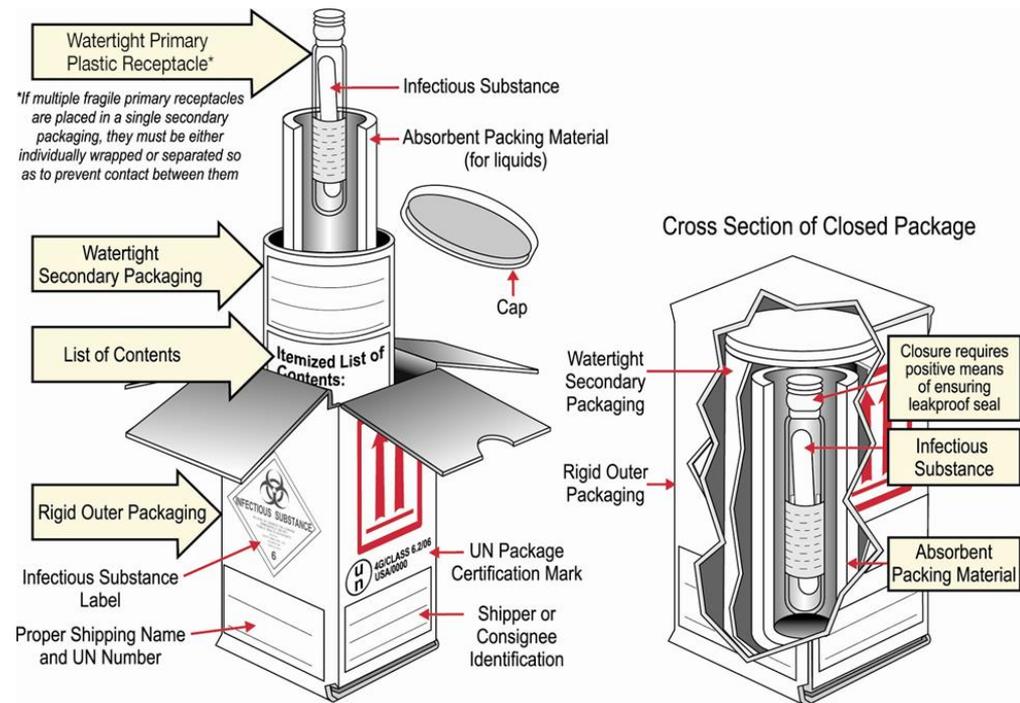
Ebola symptom progression

Labs

- FDA approval to use DoD EZ1 real time RT PCR assay
 - Authorized for use abroad on military personnel, aid workers and emergency responders in laboratories designated by the Department of Defense to respond to the Ebola outbreak
- The link includes the FDA Emergency Use authorization and a useful fact sheet on the test
 - <http://www.fda.gov/MedicalDevices/Safety/EmergencySituations/ucm161496.htm#ebola>
- Specimen handling for patients with suspected Ebola:
- <http://www.cdc.gov/vhf/ebola/hcp/interim-guidance-specimen-collection-submission-patients-suspected-infection-ebola.html>

More on Labs

- Currently within DoD, diagnostic laboratory testing for Ebola virus (EV) in clinical specimens is available only at USAMRIID's Special Pathogens Laboratory (SPL).
- State Public Health Labs can test for Ebola
- The SPL Specimen Collection and Submission Manual, as well as specimen submission forms and contact information, are available here:
<http://www.usamriid.army.mil/education/instruct.cfm>.
- Be certain to contact the SPL prior to shipping specimens. PCR testing is anticipated to be available shortly at NAMRU-3 and LRMC.



Treatment

- Supportive care – fluid management, treating complications such as bacterial superinfections
- Chemotherapy
 - Z-Mapp – experimental monoclonal antibody serum derived from mice
 - Biopharmaceutical developed commercially with DTRA and NIH.
 - Used successfully to treat two American medical missionaries with Ebola
 - Used unsuccessfully in Spanish priest with Ebola
 - No more is available
 - <http://mappbio.com/zmapinfo.pdf>
 - TKM-Ebola – Experimental RNA interference drug, <http://www.tekmira.com/pipeline/tkm-ebola.php>



Prevention

- Good infection control practices are the single most important measure:
 - <http://www.cdc.gov/vhf/ebola/hcp/infection-prevention-and-control-recommendations.html>
- CDC and US Army Public Health Command web sites have useful information
- Robust passive or even active surveillance for cases can limit disease spread.
- Experimental vaccine being tested
 - Millions of doses hoped for in 2015

Understanding Your Risk

SCPH
SUMMIT COUNTY PUBLIC HEALTH

APS
AKRON PUBLIC SCHOOLS

All other residents of Akron

Had **NO** contact with person with confirmed or suspected Ebola

Friends and family members of Tier 1, 2 & 3 living inside or outside the house. Had **NO** contact with person with confirmed or suspected Ebola

TIER 2 & 3

NO direct skin/membrane contact in same space (ex., bridal shop, airplane, etc.)

TIER I

Direct skin/membrane contact
Higher risk

Person with confirmed or suspected Ebola



SCPH Response: Higher risk
Quarantine at home

SCPH Response: Low risk – Monitoring only

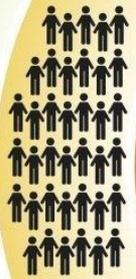
Free to move about community
Check temperature twice daily

SCPH Response: Zero risk

No monitoring
Free to move about community

SCPH Response: Zero risk

No monitoring
Free to move about community



Hundreds of thousands of people in Summit County



Thousands of people in Summit County



Akron Public Schools™

CDC 27 Oct Update

- **High risk**—direct contact of infected body fluids through:
 - needle stick, or splashes to eyes, nose, or mouth
 - getting body fluids directly on skin
 - handling body fluids, such as in a laboratory, without wearing personal protective equipment (PPE) or following recommended safety precautions
 - touching a dead body without correctly wearing PPE in a country with widespread Ebola transmission (In countries with widespread Ebola transmission, it is not always known what a person died of. Therefore touching any dead body in one of these countries is considered a high risk exposure.)
 - living with and caring for a person showing symptoms of Ebola
- **Some risk**—
 - close contact with a person showing symptoms of Ebola such as in a household, health care facility, or the community (no PPE worn). *Close contact means being within 3 feet of the person with Ebola for a long time without wearing PPE.*
 - in countries with widespread Ebola transmission: direct contact with a person showing symptoms of Ebola while wearing PPE
- **Low risk (but not zero)**—
 - having been in a country with widespread Ebola transmission within the previous 21 days and having no known exposure
 - being in the same room for a brief period of time (without direct contact) with a person showing symptoms of Ebola
 - having brief skin contact with a person showing symptoms of Ebola when the person was believed to be not very contagious
 - in countries without widespread Ebola transmission: direct contact with a person showing symptoms of Ebola while wearing PPE
 - travel on an airplane with a person showing symptoms of Ebola
- **No risk**—
 - contact with a person who is NOT showing symptoms AFTER that person was in contact with a person with Ebola
 - contact with a person with Ebola BEFORE the person was showing symptoms
 - having traveled to a country with Ebola outbreak MORE than 21 days ago
 - having been in a country where there is no widespread Ebola transmission (e.g., the United States), and having no other exposures to Ebola

CDC Guidance 27 Oct

- **Action Definitions** - Below are the definitions of actions that are recommended in the new guidance based on risk levels and symptoms. Public health actions, such as isolation of symptomatic people, active monitoring or direct active monitoring of people without symptoms, and travel restrictions when needed, help protect the public by preventing the spread of disease.
 - **Isolation** separates sick people who are confirmed to have a contagious disease from people who are not sick.
 - **Active monitoring** means that public health officials are responsible for checking at least once a day to see if people have a fever or other symptoms of Ebola. People being monitored must take their temperature twice daily, watch themselves for symptoms, report as directed to public health officials, and immediately tell public health officials if they have a fever or other symptoms. Active monitoring must take place until 21 days after the last possible exposure and can occur on a voluntary basis or be required by public health order.
 - **Direct active monitoring** means that public health officials conduct active monitoring by directly observing the person being monitored. This means that a public health official directly observes the individual at least once a day to review symptoms and check temperature; a second follow-up per day can be done by telephone instead of being directly observed. Direct active monitoring should include discussion of plans to work, travel, take public transportation, or go to busy public places to determine whether these activities are allowed.
 - **Travel restrictions** means that people must NOT travel by airplane, ship, or long-distance bus or train, even if they are NOT sick. The reason for this is to prevent possible spread of Ebola if the person develops fever or other symptoms during travel. People on travel restrictions might be allowed to travel by private plane or car as long as they continue to be monitored during travel. Taking local public transport should be discussed with the local health department.

Video Resources

- PBS Ebola Outbreak (27:26) - <http://www.pbs.org/wgbh/pages/frontline/ebola-outbreak/>
- Plague Fighters (54:16) - http://www.dailymotion.com/video/x1d14v1_ebola-the-plague-fighters-nova-discovery-science-history-documentary_tv
- CDC Ebola Videos - [#cdc-videos](http://www.cdc.gov/vhf/ebola/resources/videos.htm)
- US Army Public Health Command EVD Video (10:00) - <https://www.youtube.com/watch?v=mBykHhAojDc>

References

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- WHO, <http://www.who.int/csr/disease/ebola/en/>
- Ciottone et al, Disaster Medicine, Mosby 2006