

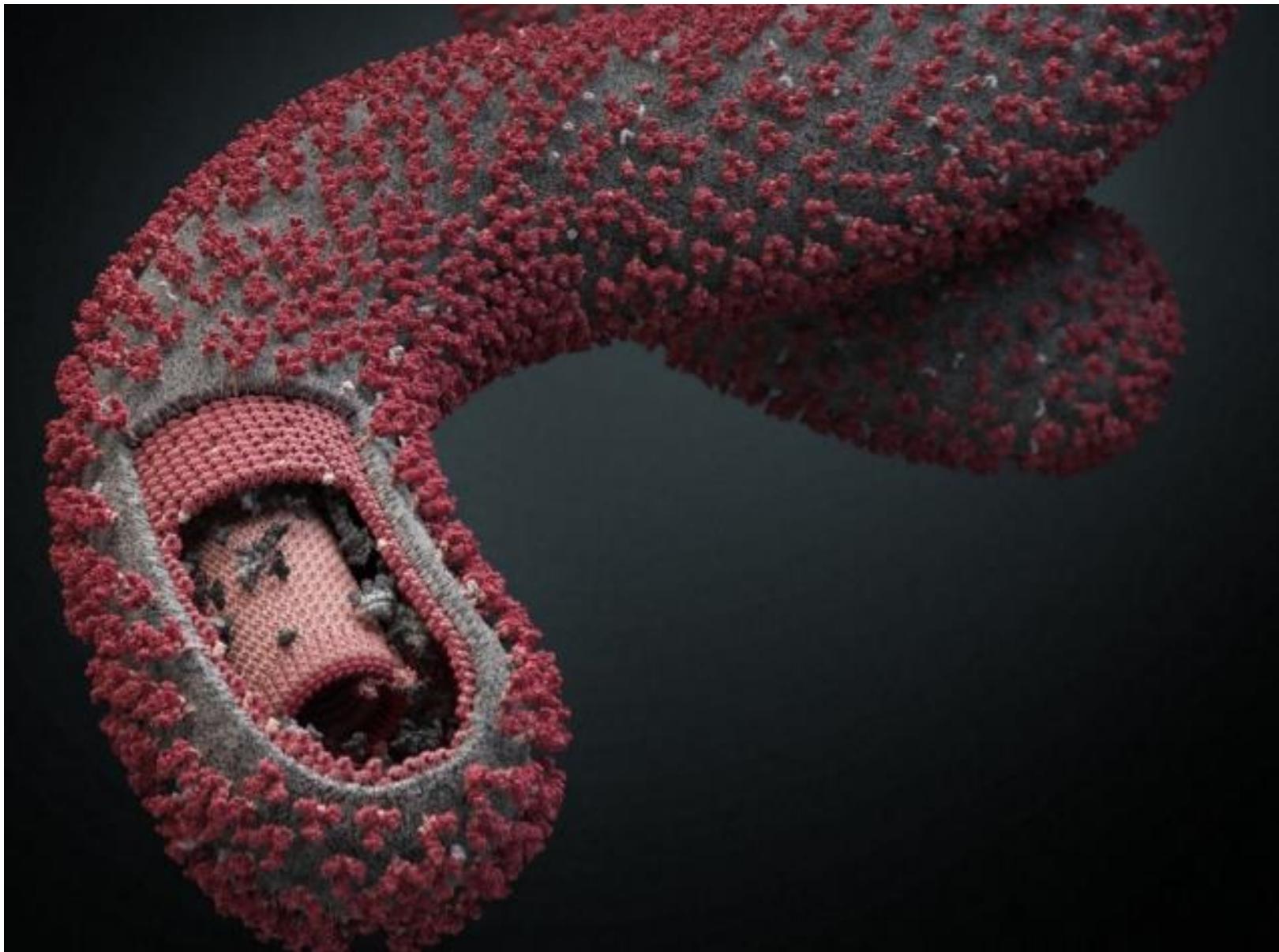
# **PREVENTION AND CONTROL OF EBOLA VIRUS DISEASE: LESSONS LEARNT FROM THE WEST AFRICAN EXPERIENCE**

**Presented at NAATs Regional  
Conference Opening Ceremony,  
UNIOSUN 2015.**

# Outline

- Prevalence and pattern of EVD in West Africa
- Epidemiology of EVD
- Management of EVD
- Prevention and control
- International partnerships in EVD control
- Lessons learnt from the West African experience
- Conclusion

# The Virus





Centers for Disease Control and Prevention

Office of the Director

# Chronological major outbreaks

Dates	Country	Case fatality rate
1976	DRC (Zaire)	88%
1976	Sudan (South Sudan)	53%
1995	DRC, Gabon	60%
2001	Uganda	53%
2003	Republic of Congo	83%
2007	Republic of Congo	71%
2012 Jan	Uganda	71%
2012 Nov	DRC	47%
2014 till date	Multiple countries in West Africa Outside Africa	65-80% depending on country

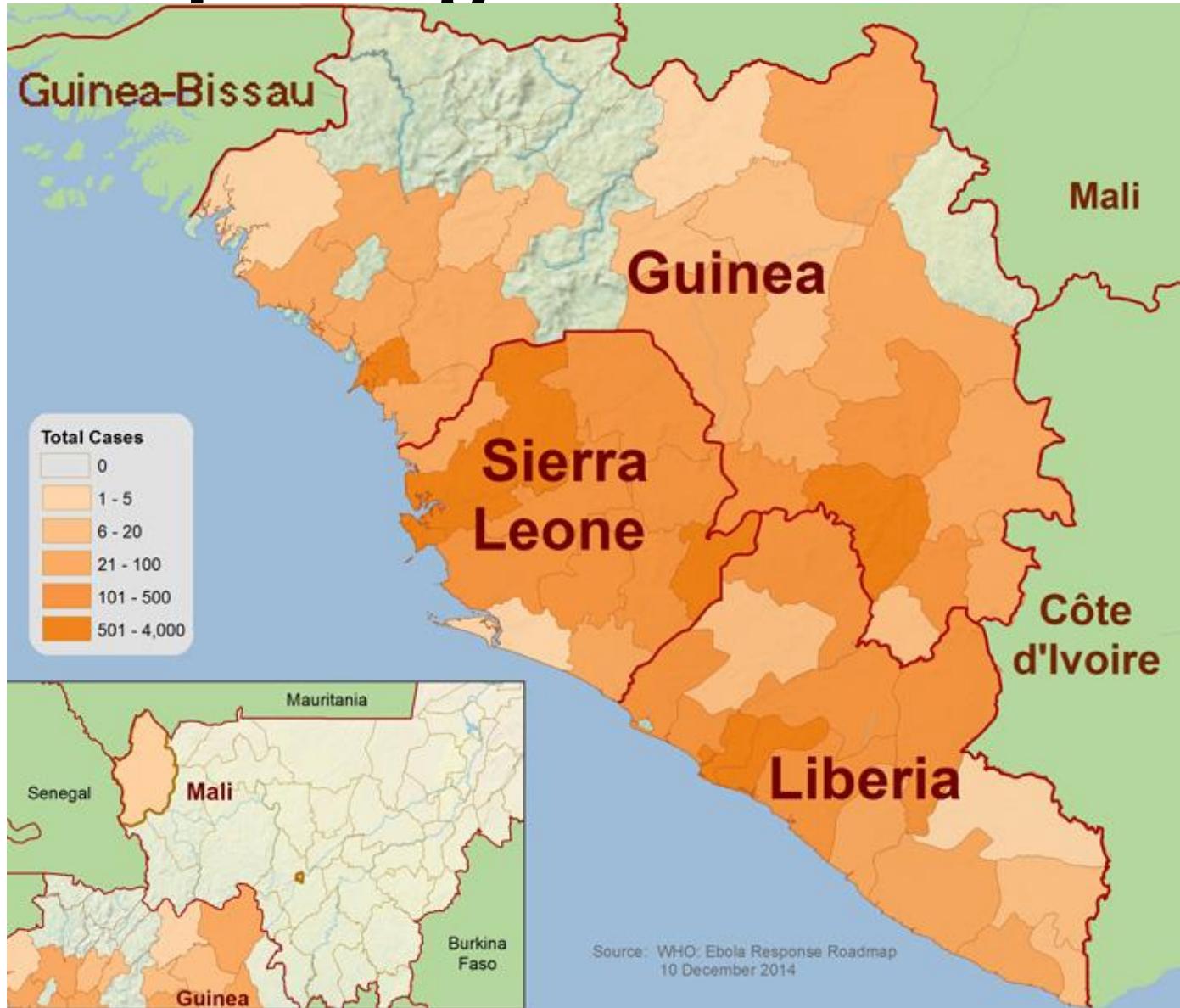
Single/isolated case were reported from many countries of the world since 1976.

Most major outbreaks were either the Zaire or Sudan strain of the virus

# Prevalence and pattern

- Dec 2013-23rd November 2014:
- >15 000 cases of EVD were reported in eight affected countries -WHO
- There have been >5 500 reported deaths
- WHO believes cases are under reported
- The West African sub-region was badly hit by this outbreak

# Still reporting in December 2014



# 3 types of EVD countries as @ Dec 2014

- Countries with Widespread Transmission
- Countries with an Initial Case or Cases and/or Localized Transmission
- Previously Affected Countries

# Countries with Widespread Transmission

Country	Total Cases	Laboratory - Confirmed Cases	Total Deaths
Guinea	2292	2051	1428
Liberia	7719	2830	3177
Sierra Leone	7897	6375	1768
<b>Total</b>	<b>17908</b>	<b>11256</b>	<b>6373</b>

# Countries with an Initial Case or Cases and/or Localized Transmission

Country	Total Cases	Laboratory-Confirmed Cases	Total Deaths
United States	4	4	1
Mali	8	7	6
<b>Total</b>	<b>12</b>	<b>11</b>	<b>7</b>

# Previously Affected Countries

Country	Total Cases	Laboratory-Confirmed Cases	Total Deaths
Nigeria*	20	19	8
Senegal*	1	1	0
Spain*	1	1	0
<b>Total</b>	<b>22</b>	<b>21</b>	<b>8</b>

# Situation in Specific WA Countries by end of 2014

- Reported case incidence seems stable in Guinea,
- stable or declining in Liberia,
- still increasing in Sierra Leone.
- All administrative districts in Liberia and Sierra Leone have reported at least one confirmed or probable case of EVD since the start of the epidemic.

# **Epidemiology of EVD**

# The Ebola Virus

- Viral disease
- Flavi group of viruses: Marburg and Ebola causing Viral Haemorrhagic Fever
- Ebola strains: Ebola Zaire, Sudan, Bundibugyo, tail forest, reston
- 1<sup>st</sup> case: 1976, Congo DRC near Ebola River
- Sporadic outbreaks since then
- It is now the epidemics of our time
- The ongoing epidemic is the largest ever

# Epidemiological determinants

- Incubation: 2-21 days
- High fatality up to 80-90%
- Virus highly infective, even the dead
- Most outbreaks was observed to be associated with person to person transmission
- Host-Agent- Environment concept less clear
- Natural reservoir unknown
- Reservoirs: fruit bats, chimpanzee, gorilla

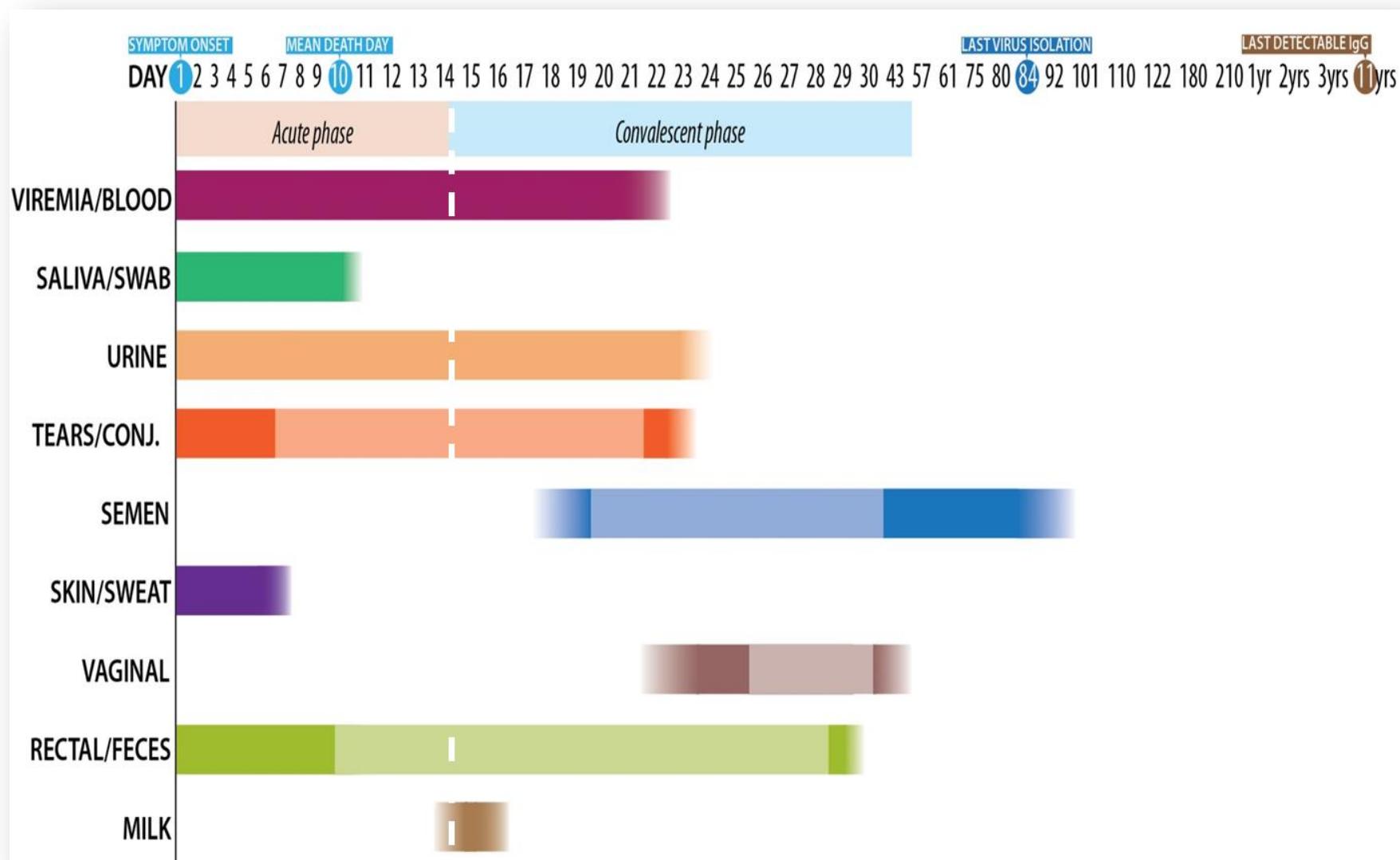
# Risk of exposure: everyone



# Ebola Virus Transmission

- Virus present in high quantity in blood, body fluids, and excreta of *symptomatic* EVD-infected patients
- Opportunities for human-to-human transmission
  - Direct contact (through broken skin or unprotected mucous membranes) with an EVD-infected patient's blood or body fluids
  - Sharps injury (with EVD-contaminated needle or other sharp)
  - Direct contact with the corpse of a person who died of EVD
  - Indirect contact with an EVD-infected patient's blood or body fluids via a contaminated object (soiled linens or used utensils)
- Ebola can also be transmitted via contact with blood, fluids, or meat of an infected animal
  - Limited evidence that dogs become infected with Ebola virus
  - No reports of dogs or cats becoming sick with or transmitting Ebola

# Detection of Ebola Virus in Different Human Body Fluids over Time



# Ebola Virus Pathogenesis

- Direct infection of tissues
- Immune dysregulation
- Hypovolemia and vascular collapse
  - Electrolyte abnormalities
  - Multi-organ failure, septic shock
- Disseminated intravascular coagulation (DIC) and coagulopathy

# Why is EVD so important

- No effective treatment or cure:
- No preventive human vaccines
- Contagious, bloody, deadly, high case fatality
- Direct and indirect consequences on the economy and productivity are diverse
- Real natural reservoir not yet identified
- Diagnostic facilities limited in West Africa
- Health Care Workers and systems are afraid
- Many ‘Nigerian factors’ favours transmission

# The Nigerian predisposing factor

- Huge interacting population, so cross infection possible e.g in Lagos with population of 20m
- Porous borders
- Huge travel population
- Weak health systems: strike, PPE poor
- Highly religious and traditional group
- Myths and misconceptions
- Habits such as burial ceremony
- Management concepts such as quarantine, contact tracking, isolation are new or alien to us in Nigeria
- Stigma and discrimination easily occurred

# Recognition of EVD

- High incidence of suspicion, EVD mimics other febrile illnesses
- Long incubation period: led to lengthy period of diagnosis
- Abrupt onset
  - Fever, headache, chills, weakness, and body aches
  - GI symptoms common: vomiting, diarrhea, abdominal pains
  - Hemorrhagic symptoms in  $\approx$  45% of cases
    - Mild: bruising, nose bleed, etc.
    - Severe: bloodily stools, multi-organ shock
  - Less commonly seen: rash (trunk, shoulders), red eyes, sore throat, cough, hiccups
- Early reporters/ clients may recover with symptomatic treatments

# Clinical Manifestations by Organ System in West African Ebola Outbreak

Organ System	Clinical Manifestation
General	Fever (87%), fatigue (76%), arthralgia (39%), myalgia (39%)
Neurological	Headache (53%), confusion (13%), eye pain (8%), coma (6%)
Cardiovascular	Chest pain (37%),
Pulmonary	Cough (30%), dyspnea (23%), sore throat (22%), hiccups (11%)
Gastrointestinal	Vomiting (68%), diarrhea (66%), anorexia (65%), abdominal pain (44%), dysphagia (33%), jaundice (10%)
Hematological	Any unexplained bleeding (18%), melena/hematochezia (6%), hematemesis (4%), vaginal bleeding (3%), gingival bleeding (2%), hemoptysis (2%), epistaxis (2%), bleeding at injection site (2%), hematuria (1%), petechiae/ecchymoses (1%)
Integumentary	Conjunctivitis (21%), rash (6%)

# Examples of Hemorrhagic Signs

Hematemesis



Gingival bleeding



Bleeding at IV Site



# Ebola Virus Diagnosis

## □ Real Time PCR (RT-PCR)

- Used to diagnose acute infection
- More sensitive than antigen detection ELISA
- Identification of specific viral genetic fragments
- Performed in select CLIA-certified laboratories

## □ RT-PCR sample collection

- Volume: minimum volume of 4mL whole blood
- Plastic collection tubes (not glass or heparinized tubes)
- Whole blood preserved with EDTA is preferred
  - Whole blood preserved with sodium polyanethol sulfonate (SPS), citrate, or with clot activator is acceptable

# Other Ebola Virus Diagnostics

- Virus isolation
  - Requires Biosafety Level 4 laboratory;
  - Can take several days
- Immunohistochemical staining and histopathology
  - On collected tissue or dead wild animals; localizes viral antigen
- Serologic testing for IgM and IgG antibodies (ELISA)
  - Detection of viral antibodies in specimens, such as blood, serum, or tissue suspensions
  - Monitor the immune response in confirmed EVD patients



# EVD case definitions

- Alert case: Sudden onset of high fever or sudden death or any bleeding tendencies.
- Suspected case: Acute onset of fever, malaise, myalgia, headache, followed by pharyngitis, vomiting, diarrhea, maculo-papular rash and may OR may not be accompanied by any of the following signs:
- Probable case: A case with symptoms compatible with clinical illness and a history within the 3 weeks before onset of fever of some sort
- Confirmed case: Clinical illness with laboratory confirmation of infection or a probable case with laboratory confirmation of infection.

# Drugs used to support conservative treatments

## Zmapp

- Experimental drug
- Biotech firm (Mapp Biopharm Inc.).
- The drug consists of an anti-Ebola antibody that is part mouse-part human antibody.
- shown to protect the monkeys from early Ebola virus exposure.
- Successfully reducing or eliminating Ebola viral symptoms in monkeys
- Ongoing safety or effectiveness human trials
- Used in the Nigerian epidemic

# **Some other drugs**

## **Nanosilver**

- Discovered in August 2014:
- Discovered by a Nigerian in the Diaspora
- Experimental drug
- Slows down disease progression??
- Ethical issues : FMoH 1<sup>st</sup> disallows it

## **BCX4430**

- USA
- Some proven effectiveness
- Even among Marburg, other viruses

**Since no effective treatment,  
so whats next ?**

**PREVENTION**

**CONTROL**

# SI: Reducing the risk of wildlife-to-human transmission

- Avoid consumption of infected animals.  
Nigerians unlike Liberians had less fruit-bats
- Handle susceptible animals with protective clothing such as gloves.
- **Fruit bats**, Monkey, chimpanzee, Gorilla etc
- Animal products (blood and meat) should be thoroughly cooked before consumption.
- Eat food of known source. No more bushmeat???

## S2: Reducing risk of human-to-human transmission in the community

- Avoid close physical contact with EVD pt
- Personal protective equipment should be worn when taking care of ill patients.
- Avoid areas of known outbreaks
- Avoid sharing clothes with strangers.
- Careful with fomites: handkerchiefs etc
- Avoid sexual contact with EVD persons
- Watch out for symptoms of Ebola around your neighborhood
- Report yourself, Report suspects

# Universal precaution/Hand washing

- Regular handwashing
- After visiting patients
- After taking care of patients at home.
- Soap and water
- Sanitizers
- Alcohol based solutions
- Use correct method of hand-washing
- Reduce hand shake or hand contacts
- Culture of handwashing is poor in Nigeria, we look at it as too simple

# Personal Protection: Hand hygiene



Alcohol based hand rubs are gold standard in health care settings (if hands not visibly soiled)  
Must complement with hand washing with normal soap

Photos: WHO

## S3: Improved community awareness

- Nature of disease should be explained to all citizens
- Transmission- modes and non modes
- Ebola containment measures
- Safe burial of the dead
- The media is important here
- What to do
- What not to do

# Myths and misconceptions: fueling the epidemic

The following misconceptions are unfounded cure or prevention for EVD

- Hot water bath with salt
- Weekly hot salt water bath
- Bitter cola
- Miracle cola
- Cow urine
- Condensed milk, Onions
- Antibiotics
- Airborne/waterborne

## S4: Improved Environmental hygiene

- Regular disinfection of your surrounding
- Fumigate your environment
- Safe disposal of dead carcass of animals
- Wash fruits/vegetables properly
- Burial: infected/suspected
  - Avoid touching
  - Wear protective clothing
  - Deep burial if possible
  - Cremation

# **S5: Encouraging partnerships**

## **Government: of Nigeria (GoN)**

- Near daily appraisal of the epidemic
- Committees set up at all levels of govt
- Stepping up surveillance
- Coordinating response
- Funding by governments
- Relevant policies and pronouncements  
e.g delayed resumption of schools
- The media carried along
- Establishment of EVD alert and reporting centers, isolation and treatment centers

# **Partnerships cont.....**

## **Health Care systems**

- Doctors urgently resumed from strike
- Protective clothing
- Humanitarian aid by health care workers
- Improved awareness

**Other systems:** used infrared thermometers, provides handwashing kits, sanitizers

- Airports
- Schools
- Banks

# **Government**

## **State of Osun:**

- Stakeholders presentation and meetings
- State level coordinating committee set up
- Osun festival celebrated low key
- UNIOSUN website: ongoing awareness

**WHO/Other Partners:** Assessing epidemics response      Giving technical inputs

# **International partnerships in EVD control**

## **WHO objectives for EVD Response**

Improved case finding, contact identification and follow up in each country

- Improved database management (Epi Info VHF module utilization)
- Improved health messaging in the affected areas
- Improved coordination with WHO, MSF, Country MoHs, CDC and other USG partners

# WHO guidelines, Active surveillance

- During EVD outbreak, disease surveillance is active
- These includes
  - Alert management system/call centers
  - Active case search at community level by trained CH volunteers, Community verbal autopsy
  - Daily active case search at health facility level + prevention
  - Get cases into isolation ward to provide care, prevent transmission and protect health care workers
  - Outbreak investigation
  - Contact tracing and follow up for 21 days. If contact becomes febrile – get him into treatment center; test the person and isolate if positive for EVD

# Contact tracking

- What is contact tracking: Identification and follow up of persons who may have come into contact with an infected person
- Who is a contact: one who had physical contact with a case (alive or dead) or the body fluids of a case within the last three weeks. Sharing same room??

## Three basic elements

- Contact identification ; index to all cases and contacts-pry, sec
- Contact listing for 21 day follow up
- Contact follow up: until suspect test negative

Advise all contacts to adhere to the following:

- Remain as much as possible at home and restrict close contact with other people
- Avoid crowded places, social gatherings, and public transport
- Report any suspicious signs and symptoms immediately such as fever, bleeding ,etc (provide telephone numbers e.g. the Ebola hotline, numbers of the supervisor or the contact follow up team)

# **LESSONS LEARNT FRON THE WEST AFRICAN EXPERIENCE**

# LESSONS LEARNT

Nigeria was declared EVD free on 16<sup>th</sup> October 2014

- More virulent diseases may emerge or re-emerge, the world should be ready for war with infective microorganisms that would cut across countries. EVD is now a re-merging disease. Are we prepared????
- No effective treatment for EVD. Its more or less a death sentence. No known vaccine. There is need for more extensive collaborative research in these areas to discover solutions

# Lessons cont....

- International collaboration on public health issue (EVD in this case) in which all stakeholders including the public takes part led to EVD success in Nigeria. Such collaboration should be on-going with WHO coordinating effectively. Liberia felt neglected by the international community
- Volunteer health work needed to be redefined. In the EVD outbreak, many health care workers resigned from work while many refused humanitarian work, Lagos offered incentives of N50,000 per day for volunteer HCW in EVD care

# Lessons cont....

- Good political will and leadership was responsible for the Nigerian success. Nigerian FMoH showed concerns. There are standard operating procedures (SOPs) for PPEs use, Home based care kits, EVD screening, contact tracking etc. This is an importance lesson for ongoing epidemics. Seirra Leone sacked the Minister for health for poor leadership
- Improved general awareness would assist any disease control including EVD. Even infected health care workers came out on TV to share testimonies and allay people's fears

# **Lessons cont....**

- There is a need to strengthen our Primary health care and general health systems. Patrick Sawyer (Nigerian index case) left Liberia for Lagos when he found out that the weak health system there may not be able to manage his case
- Liberia, Sierra Leone and Guinea became aid recipient. For how long will some countries continue to live and survive only with the aid of support from developed countries?

# **Lessons cont....**

- Now EVD is over, we are now in post disaster phase. Are the countries planning for another bout of potential outbreak? Are the preventive gadgets on ground and working,
- Stigma and discrimination against those infected could be due to misconceptions about EVD. So there is need to improve awareness about EVD
- EVD outbreak has improved the culture of handwashing in Nigeria

# Lessons cont....

- EVD outbreak affected the economy and development. Air-ports and borders closed, economic cooperation suspended, internal business suffered, schools closed. Isolation and quarantine measures and fears of infection would lead to slowing of normal economic activity and cross-border trade
- In the three hardest-hit countries – Liberia, Sierra Leone and Guinea – there are only one to two doctors available per 100, 000 people, with so much concentration in urban areas. There is a need to strengthen the health system

# Lessons cont....

- Friendship and international politics may not hold during epidemics as countries economically known to be friends, closed borders against each other during the EVD outbreak for fear of transmission
- Most of the outbreaks are common or point source epidemics, meaning it could be traced to the first case. There is a need to improve our port health system and disease reporting systems

# Lessons cont....

- If Nigeria with all attending problems such as insecurity and poverty can do it, other countries should also be. The 1<sup>st</sup> case in Dallas USA was theoretically managed and outcome was bad. The second case in new York was managed the Nigerian way using the 4 principles (1) trace, isolate and treat (2)detect early,(3) strong leadership and political will (4) community involvement. The American now borrows experience from the Nigerian success.
- Poor access to diagnostic facilities in Senegal, Guinea and Liberia worsened situation, as most cases were not diagnosed early. . EVD diagnosis used a high technology laboratory diagnostics methods

# **Lessons cont....**

- Myths and misconceptions would further fuel the worse impact of any disease
- Self reporting habit is low in Nigeria. Even health care workers refused to notify of their being infected
- Africa's medical resources are very much focused on treatment, which is the most urgent need right now. But we need to invest more in prevention and building health systems that enable us to cope with any eventuality.

# Take Home Messages

EVD is deadly

*But*

*The good news is that it is controllable and preventable. There are lots of lessons for the world to learn from the West African/Nigerian experience*

# **Help-lines**

- **0802 316 9485**
- **0803 308 6660**
- **0803 306 5303**
- **0805 528 1442**
- **0805 532 9229**
- **[www.ebolanigeria.com](http://www.ebolanigeria.com)**

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- CDC. 2014 Ebola Outbreak in West Africa—case counts. Available at <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html>.
- [Sharma A, Heijenberg N, Peter C, et al. Evidence for a decrease in transmission of Ebola virus—Lofa County, Liberia, June 8–November 1, 2014. MMWR Morb Mortal Wkly Rep 2014;63\(Early Release\):1–5.](#)
- [Nyenswah T, Fahnbulleh M, Massaquoi M, et al. Ebola epidemic—Liberia, March–October 2014. MMWR Morb Mortal Wkly Rep 2014;63\(Early Release\):1–5.](#)



**Ebola greeting.....**

*THANK YOU*

*FOR*

*YOUR ATTENTION*

# Ebola Virus Disease (EVD)

**Ebola Virus Disease (EVD) is a rare and deadly disease most commonly affecting people and nonhuman primates (monkeys, gorillas, chimpanzees).**

There are six known species of viruses within the genus *Ebolavirus*: Ebola virus (*Zaire ebolavirus*), Sudan virus (*Sudan ebolavirus*), Tai Forest virus (*Tai Forest ebolavirus*, formerly *Cote d'Ivoire ebolavirus*), Bundibugyo virus (*Bundibugyo ebolavirus*), Reston virus (*Reston ebolavirus*), and Bombali virus (*Bombali ebolavirus*). Of these, **only four are known to cause disease in people** (Ebola, Sudan, Tai Forest, and Bundibugyo viruses). Reston virus is known to cause disease in nonhuman primates and pigs, but not in people. It is unknown if Bombali virus, which was recently identified in bats, causes disease in either animals or people.

Ebola virus was first discovered in 1976 near the Ebola River in what is now the Democratic Republic of the Congo. Since then, outbreaks have occurred sporadically in Africa. The natural reservoir host of Ebola viruses remains unknown. However, based on the nature of similar viruses, experts think the virus is animal-borne, with bats being the most likely reservoir.

## Transmission

How the virus first infects a person at the start of an outbreak is not known. However, experts think the first patient becomes infected through contact with an infected animal such as a fruit bat or nonhuman primate.

People can be infected with the Ebola virus through direct contact (like touching) with:

- Blood or body fluids (urine, saliva, sweat, feces, vomit, breast milk, semen) of a person who is sick with or has died from EVD
- Objects (such as clothes, bedding, needles, and syringes) contaminated with body fluids from a person sick with EVD or a body of a person who died from EVD
- Blood or body fluids of infected fruit bats or nonhuman primates such as apes and monkeys
- Semen from a man who recovered from EVD (through oral, vaginal, or anal sex)

Ebola virus CANNOT spread to others when a person has no signs or symptoms of EVD. Additionally, the virus is not spread through the air, by water, or in general, by food. However, in certain parts of the world, Ebola virus may spread through the handling and consumption of bushmeat (wild animals hunted for food). There is no evidence that mosquitos or other insects can transmit Ebola virus.

## Signs and Symptoms

Symptoms of EVD may appear 2 to 21 days after exposure to the virus, but the average is 8 to 10 days. A person infected with Ebola virus is not contagious until symptoms appear. Signs and symptoms of EVD include:

- |                                                                                                                                              |                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Fever</li><li>• Severe headache</li><li>• Fatigue</li><li>• Muscle pain</li><li>• Weakness</li></ul> | <ul style="list-style-type: none"><li>• Diarrhea</li><li>• Vomiting</li><li>• Stomach pain</li><li>• Unexplained bleeding or bruising</li></ul> |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|

## Risk of Exposure

Healthcare providers, family, and friends in close contact with EVD patients are at the highest risk of getting sick with EVD because they may be exposed to infected blood and body fluids. During an outbreak, EVD can spread quickly within healthcare settings. Infection control measures, like screening patients for signs/symptoms of EVD and practicing proper personal protective equipment procedures, must be in place to ensure exposure to Ebola virus does not occur.

Ebola viruses are found in several countries. Past EVD outbreaks have occurred in the following countries:

- |                                                                                                                                                                   |                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Democratic Republic of the Congo (DRC)</li><li>• Gabon</li><li>• Guinea</li><li>• Ivory Coast</li><li>• Liberia</li></ul> | <ul style="list-style-type: none"><li>• Republic of the Congo (ROC)</li><li>• Sierra Leone</li><li>• Sudan</li><li>• Uganda</li></ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|

## Diagnosis

Early symptoms of EVD such as fever, headache, and weakness are not specific to Ebola virus infection and are seen in patients with more common diseases, like malaria and typhoid fever. To determine whether Ebola virus infection is a possible diagnosis, there must be a combination of 1) symptoms suggestive of EVD **AND** 2) a possible exposure to the virus within 21 days before onset of symptoms.

If a person has early symptoms of EVD and there is reason to believe the virus should be considered, the patient should be isolated and public health professionals notified. Samples from the patient should be collected and tested to confirm infection. Ebola virus can be detected in blood **after** onset of symptoms. It may take up to three days after symptoms start for the virus to reach detectable levels.

## Treatment

Symptoms of EVD are treated as they appear. When used early, basic interventions can significantly improve the chances of survival. These include:

- Providing fluids and electrolytes (body salts) through infusion into the vein (intravenously).
- Offering oxygen therapy to maintain oxygen status.
- Using medication to support blood pressure, reduce vomiting and diarrhea and to manage fever and pain.
- Treating other infections if they occur.

Recovery from EVD depends on supportive care and the patient's immune response. People who recover from EVD develop antibodies that can last for 10 years. It is not known if people who recover are immune for life or if they can become infected with a different species of Ebola virus. Some survivors may have long-term complications such as joint and vision problems.

There is currently no antiviral drug licensed by the U.S. Food and Drug Administration (FDA) to treat EVD in people. Drugs that are being developed to treat Ebola virus infection work by stopping the virus from making copies of itself.

## Prevention

When living in or traveling to a region affected by the Ebola virus, there are ways to protect yourself and prevent the spread of the virus. Practicing good hand hygiene is an effective method of preventing the spread of dangerous germs, like the Ebola virus. Proper hand hygiene means washing hands often with soap and water or an alcohol-based hand sanitizer.

**While in an area affected by Ebola virus, you should AVOID:**

- Contact with blood and body fluids (such as urine, feces, saliva, sweat, vomit, breast milk, semen, and vaginal fluids).
- Items that may have come in contact with an infected person's blood or body fluids (such as clothes, bedding, needles, and medical equipment).
- Funeral or burial rituals that require handling the body of someone who died from EVD.
- Contact with bats and nonhuman primates or blood, fluids, and raw meat prepared from these animals (bushmeat) or meat from an unknown source.
- Contact with semen from a man who had EVD until you know the virus is gone from the semen.

**After returning from an area affected by Ebola virus, monitor your health for 21 days and seek medical care immediately if you develop symptoms of EVD.**

There is currently no vaccine licensed by the FDA to protect people from Ebola virus. However, an experimental vaccine, proven highly protective against the virus in trials, is currently approved for use during an outbreak while awaiting FDA approval.

**Healthcare workers who may be exposed to people with EVD should:**

- Wear appropriate personal protective equipment (PPE).
- Practice proper infection control and sterilization measures.
- Avoid direct contact with the bodies of people who have died from EVD.
- Notify health officials if you have direct contact with blood or body fluids of a person sick with EVD.

**For more information about Ebola Virus Disease, visit [www.cdc.gov/vhf/ebola/](http://www.cdc.gov/vhf/ebola/)**



# Ebola Virus Disease (EVD): Overview, Diagnosis & Clinical Management

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# Outline

1. Introduction
2. UN Resources
3. Clinical & Lab Diagnosis
4. Contact Management
5. Clinical Management

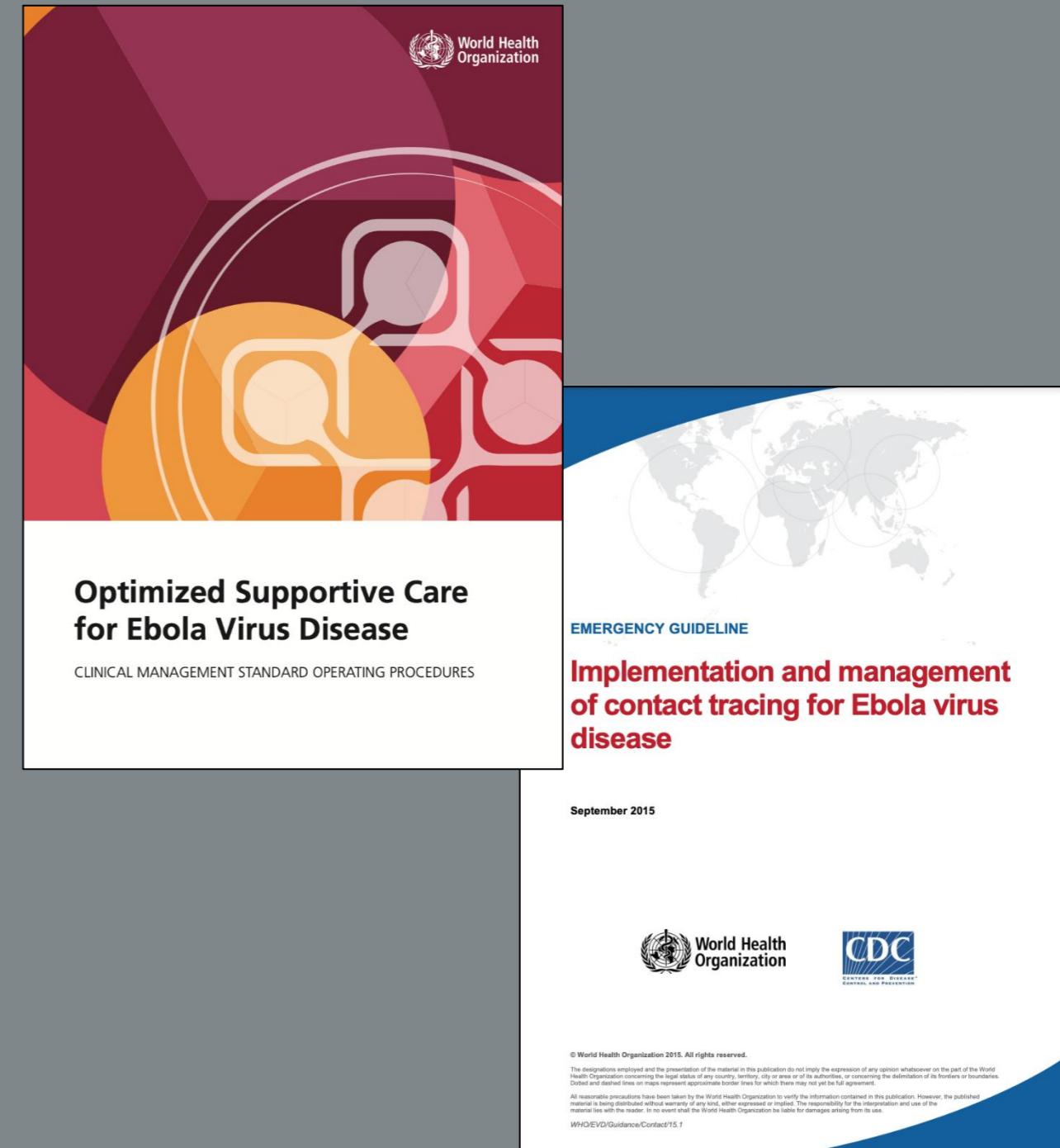
**Note:** Complete WHO guidelines for the management of EVD patients can be found here:

**Optimized Supportive Care for Ebola Virus Disease**

<https://apps.who.int/iris/handle/10665/325000>

**Implementation and management of contact tracing for Ebola virus disease**

<https://www.who.int/publications/i/item/WHO-EVD-Guidance-Contact-15.1>





# Introduction

# Introduction



- First appeared in 1976 in 2 simultaneous outbreaks in South Sudan and DRC
- DRC outbreak occurred in a village near the Ebola River
- Virus family Filoviridae includes three genera: Cuevavirus, Marburgvirus and Ebolavirus
- Within the genus Ebolavirus, six species identified including Zaire and Sudan
- 2014-2016 outbreak in West Africa was the largest outbreak since – starting from Guinea and moving across to Sierra Leone and Liberia

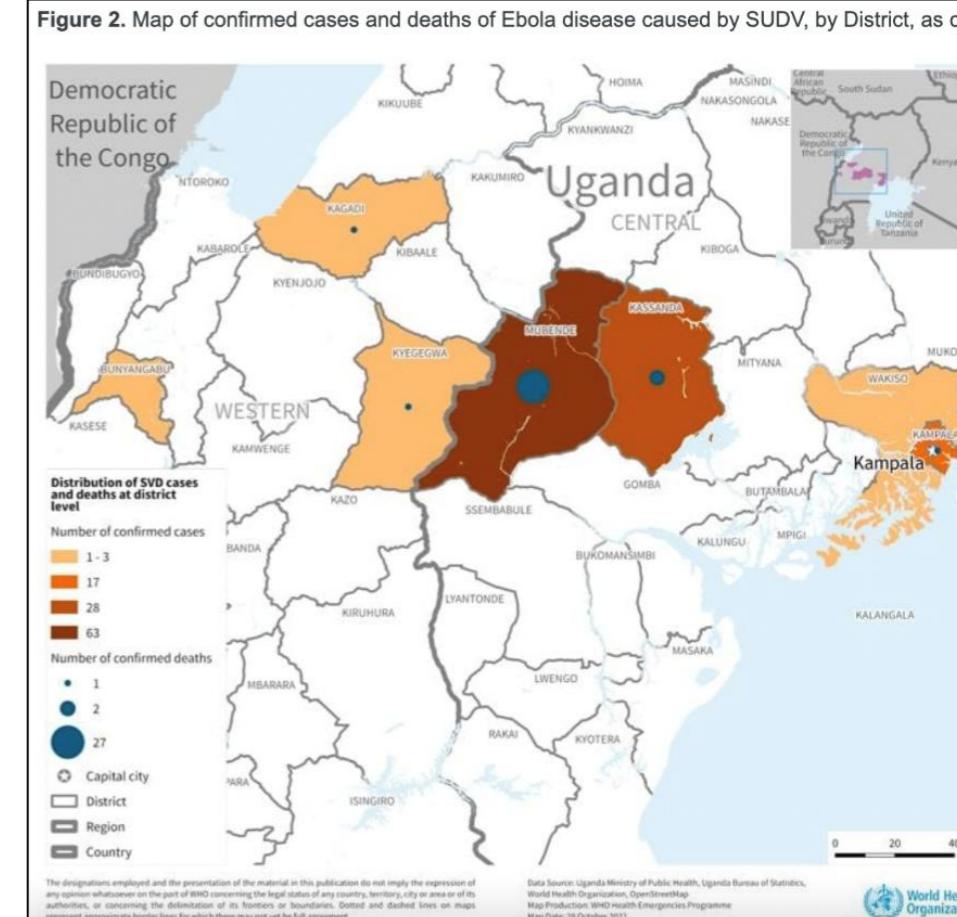
# Introduction

- Ebola virus disease, formerly known as Ebola haemorrhagic fever
- Fruit bats of Pteropodidae family are natural Ebola virus hosts
- Rare, but severe and often fatal illness in humans
- Transmitted from wild animals, and spread into human population through human-to-human transmission
- Average CFR is around 50% (range 25-90%)
- Community engagement key to successful control
- Case management, infection prevention and control practices, surveillance and contact tracing, good lab service, safe and dignified burials, mobilisation



# Current Outbreak in Uganda

- On 20 September, health authorities in the Republic of Uganda declared an outbreak of EVD caused by **Sudan ebolavirus (SUDV)**
- As of today, 2 November, there were:
  - Confirmed cases: **129**
  - Confirmed Deaths: **37**
  - CFR = **28%**
  - Recoveries: **43**
- This is not the first Ebola outbreak caused by the **Sudan** strain. 7 previous outbreaks have been reported, **four** of which occurred in Uganda and three in Sudan



# Current Sudan Strain Has No Approved Vaccine

- EVD vaccine has only been approved to protect against the **Zaire** strain of Ebola
- **Three** candidate vaccines **may be trialed** but have yet to be specifically tested against the Sudan strain





# Helpful UN Resources on EVD

# UN Medical Directors' EVD Risk Mitigation Plan (English/French available)

[https://hr.un.org/sites/hr.un.org/files/file/refmaterials/ID\\_Ebola\\_UNMDRMP\\_2021-08-%2027.pdf](https://hr.un.org/sites/hr.un.org/files/file/refmaterials/ID_Ebola_UNMDRMP_2021-08-%2027.pdf)

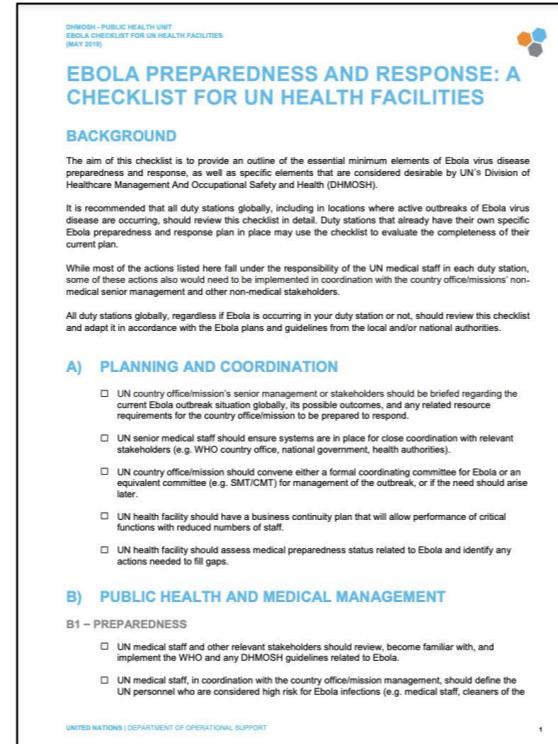
[https://hr.un.org/sites/hr.un.org/files/file/refmaterials/ID\\_Ebola\\_UNMDRMP\\_2021-08-%2027%20FR.pdf](https://hr.un.org/sites/hr.un.org/files/file/refmaterials/ID_Ebola_UNMDRMP_2021-08-%2027%20FR.pdf)

United Nations Medical Directors Reducing the Risk of Acquiring Ebola Virus Disease (EVD) in Countries/Areas with the Outbreak Recommendations for All UN Personnel	
<ul style="list-style-type: none"><li>• The following occupational health recommendations are provided by the UN Medical Directors to all Organizations and UN personnel to reduce the risk of UN personnel acquiring Ebola virus disease (EVD) in countries/areas with the outbreak.</li><li>• These recommendations should be applied to all UN personnel travelling to or residing in countries/areas with an outbreak of EVD</li><li>• If this is a hard copy of the document, please be sure to check the <a href="https://hr.un.org/page/travel-health-information">https://hr.un.org/page/travel-health-information</a> on the United Nations HR Portal for the latest version.</li><li>• Please contact <a href="mailto:dos-dhmosh-public-health@un.org">dos-dhmosh-public-health@un.org</a> if you have any questions on this document.</li></ul>	
UN Personnel Risk Categories	UN Medical Directors Recommendations
<b>1 UN personnel travelling into or residing in countries / areas with an EVD outbreak</b>	<p>Ensure that you are <b>aware of, and implement, the following EVD precautionary measures:</b></p> <ul style="list-style-type: none"><li>• Avoid contact with other people's blood or bodily fluids.</li><li>• Avoid funeral or burial rituals that require handling a dead body.</li><li>• Do not handle items that may have come in contact with an infected person's blood or bodily fluids (e.g. clothes, bedding, needles, and medical equipment).</li><li>• Avoid contact with animals or raw bush meat.</li><li>• Wash your hands often or use hand sanitizer, and avoid touching your eyes, nose or mouth.</li><li>• Follow any malaria prophylaxis treatment recommended by your UN physician.</li><li>• Ensure you get all recommended vaccines before travel (including against measles and diphtheria).</li><li>• Follow the social distancing practices recommended for the area you will be in (such as avoiding handshakes, avoiding kissing as a greeting, avoiding visits to crowded markets, etc)</li><li>• Avoid visits to hospital environments, funerals or visiting a sick person with fever. But if these activities are necessary, do strictly follow all the infection prevention guidance and avoid direct contact with the patient or items.</li></ul> <p>Know the <b>contact information of the local/UN medical services</b> or whom you should contact for health care should the need arise during your stay in the EVD-affected country/area.</p>

# UN Ebola Preparedness and Response: A Checklist for UN Health Facilities (English & French available)



[https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist\\_DHMOSPH\\_2019-05\\_FINAL\\_Eng\\_2.pdf](https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist_DHMOSPH_2019-05_FINAL_Eng_2.pdf)  
[https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist\\_DHMOSPH\\_2019-05\\_FINAL\\_Fr\\_0.pdf](https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist_DHMOSPH_2019-05_FINAL_Fr_0.pdf)



The image shows the first page of the 'EBOLA PREPAREDNESS AND RESPONSE: A CHECKLIST FOR UN HEALTH FACILITIES' document. The page header includes the title, the date (May 2019), and the DHMOSPH logo. The main content area starts with a 'BACKGROUND' section, followed by a 'PLANNING AND COORDINATION' section with several bullet points, and a 'PUBLIC HEALTH AND MEDICAL MANAGEMENT' section with a 'B1 – PREPAREDNESS' subsection. The footer contains the United Nations and DHMOSPH logos.

EBOLA PREPAREDNESS AND RESPONSE: A  
CHECKLIST FOR UN HEALTH FACILITIES

BACKGROUND

The aim of this checklist is to provide an outline of the essential minimum elements of Ebola virus disease preparedness and response, as well as specific elements that are considered desirable by UN's Division of Healthcare Management And Occupational Safety and Health (DHMOSPH).

It is recommended that all duty stations globally, including in locations where active outbreaks of Ebola virus disease are occurring, should review this checklist in detail. Duty stations that already have their own specific Ebola preparedness and response plan in place may use the checklist to evaluate the completeness of their current plan.

While most of the actions listed here fall under the responsibility of the UN medical staff in each duty station, some of these actions also would need to be implemented in coordination with the country office/missions' non-medical senior management and other non-medical stakeholders.

All duty stations globally, regardless if Ebola is occurring in your duty station or not, should review this checklist and adapt it in accordance with the Ebola plans and guidelines from the local and/or national authorities.

**A) PLANNING AND COORDINATION**

- UN country office/mission's senior management or stakeholders should be briefed regarding the current Ebola outbreak situation globally, its possible outcomes, and any related resource requirements for the country office/mission to be prepared to respond.
- UN senior medical staff should ensure systems are in place for close coordination with relevant stakeholders (e.g. WHO country office, national government, health authorities).
- UN country office/mission should convene either a formal coordinating committee for Ebola or an equivalent committee (e.g. SMT/CMT) for management of the outbreak, or if the need should arise later.
- UN health facility should have a business continuity plan that will allow performance of critical functions with reduced numbers of staff.
- UN health facility should assess medical preparedness status related to Ebola and identify any actions needed to fill gaps.

**B) PUBLIC HEALTH AND MEDICAL MANAGEMENT**

B1 – PREPAREDNESS

- UN medical staff and other relevant stakeholders should review, become familiar with, and implement the WHO and any DHMOSPH guidelines related to Ebola.
- UN medical staff, in coordination with the country office/mission management, should define the UN personnel who are considered high risk for Ebola infections (e.g. medical staff, cleaners of the

UNITED NATIONS | DEPARTMENT OF OPERATIONAL SUPPORT

# UN Guidance: PPE Stocks & Calculation of Quantities Needed

- Use the following **PPE calculator** to procure needed supplies: <https://www.cdc.gov/vhf/ebola/healthcare-us/ppe/calculator.html>
- This calculator provides you the necessary **number** of individual PPE needed per VHF/EVD patient seen by your facility
- If you need training on how to use the EVD PPE Calculator, please watch this **training video** by DHMOSH Public Health at <https://www.youtube.com/watch?v=EyJqhhLwgX4>



# EVD Online Courses Conducted by WHO

ePROTECT Ebola (EN)	<a href="https://openwho.org/courses/e-protect">https://openwho.org/courses/e-protect</a>
Ebola: Clinical management of Ebola virus disease	<a href="https://openwho.org/courses/ebola-clinical-management">https://openwho.org/courses/ebola-clinical-management</a>
Ebola: GO 2.0	<a href="https://openwho.org/courses/GO-en">https://openwho.org/courses/GO-en</a>



# Clinical and Lab Diagnosis

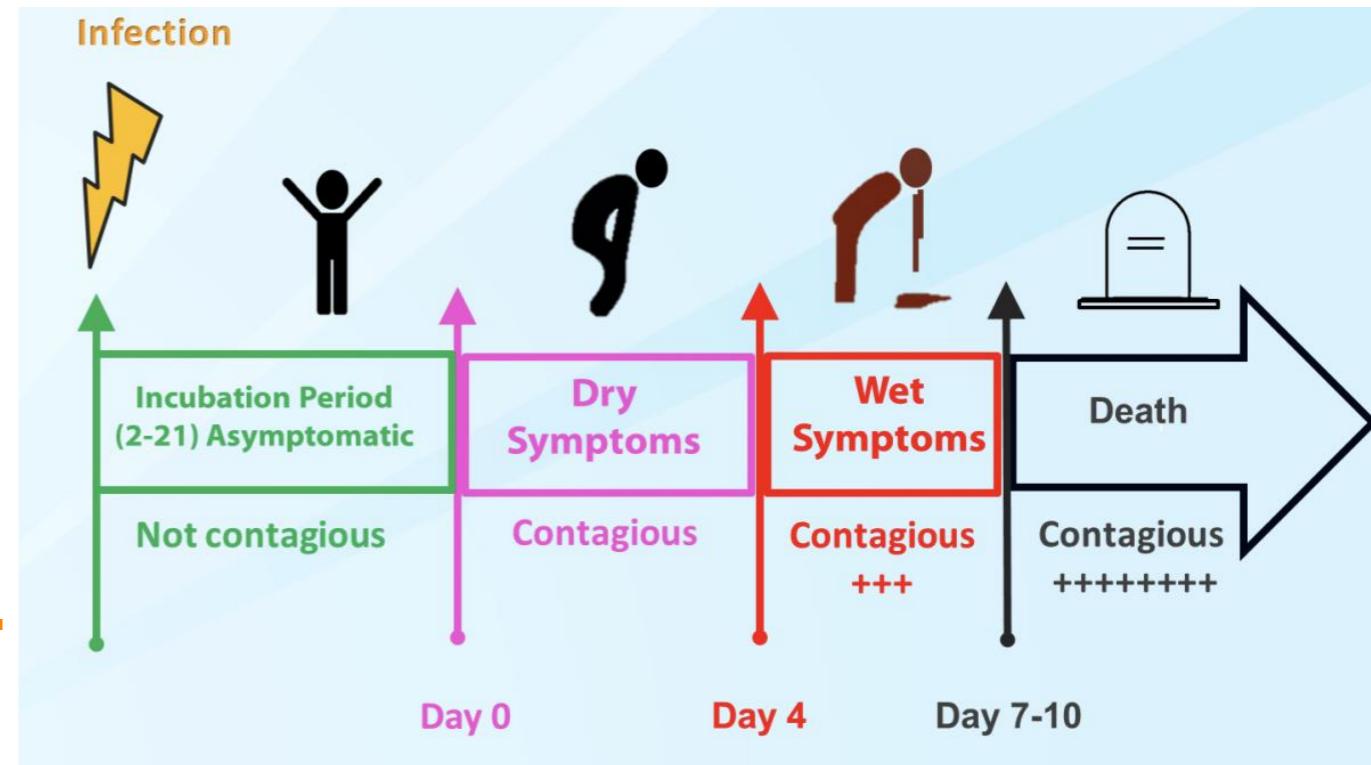
# Signs & Symptoms of EVD

- **Can be sudden and include:**
  - Fever, fatigue, muscle pain,
  - Headache, sore throat
- **This is followed by:**
  - Vomiting, diarrhoea, rash, symptoms of kidney and liver function, internal and external bleeding (e.g. from gums or blood in stools).
  - Lab findings include low white blood cell and platelet counts and elevated liver enzymes



# Disease Progression of EVD

- Not contagious until **symptoms** develop
- Wet symptoms develop approx. **day 4** of illness
- Patient becomes more and more **contagious** as the illness advances
- Without treatment, death occurs **7-10 days** after illness onset
- Amount of Ebola virus in the body is **highest** at the time of death



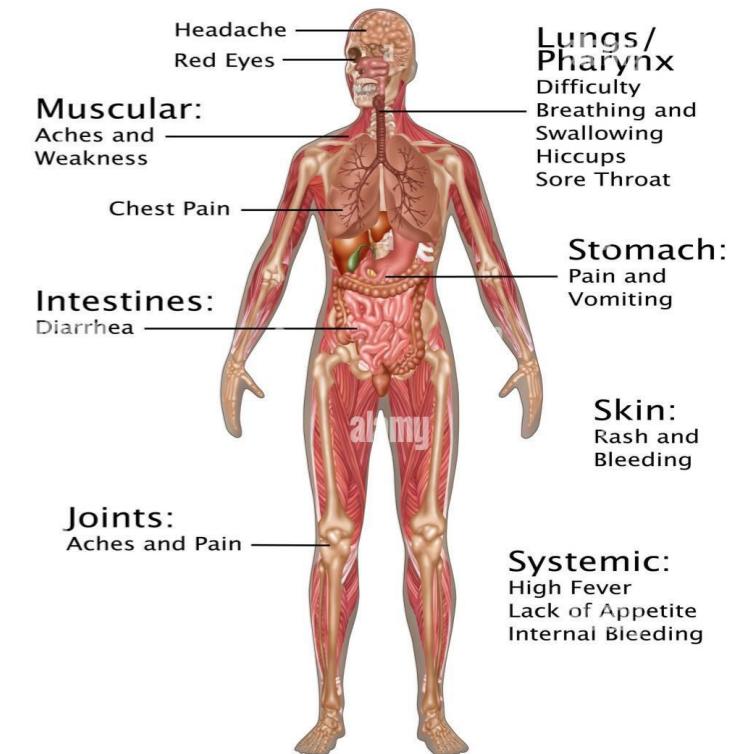
# Suspect / Confirmed Case Definition

## Suspect Case

- Signs and symptoms consistent with Ebola virus infection **AND**
- An epidemiological risk factor (exposure to blood or body fluids of infected person, objects contaminated from infected person, infected fruit bats or non-human primates, semen from a man recovering from Ebola)

## Confirmed Case

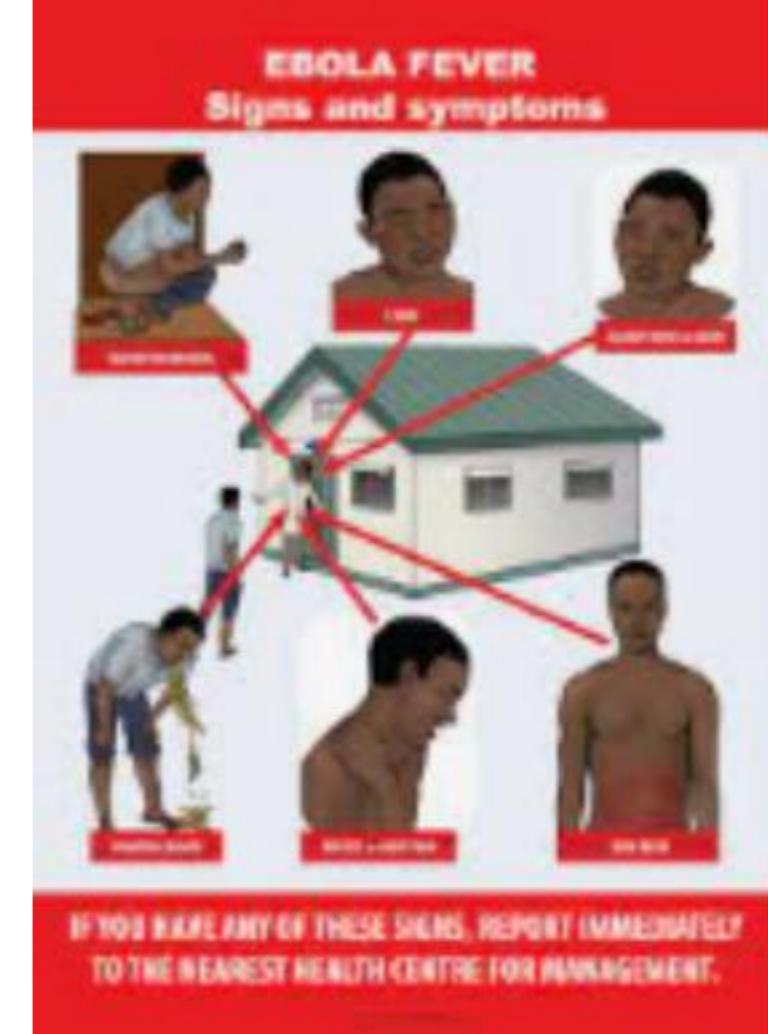
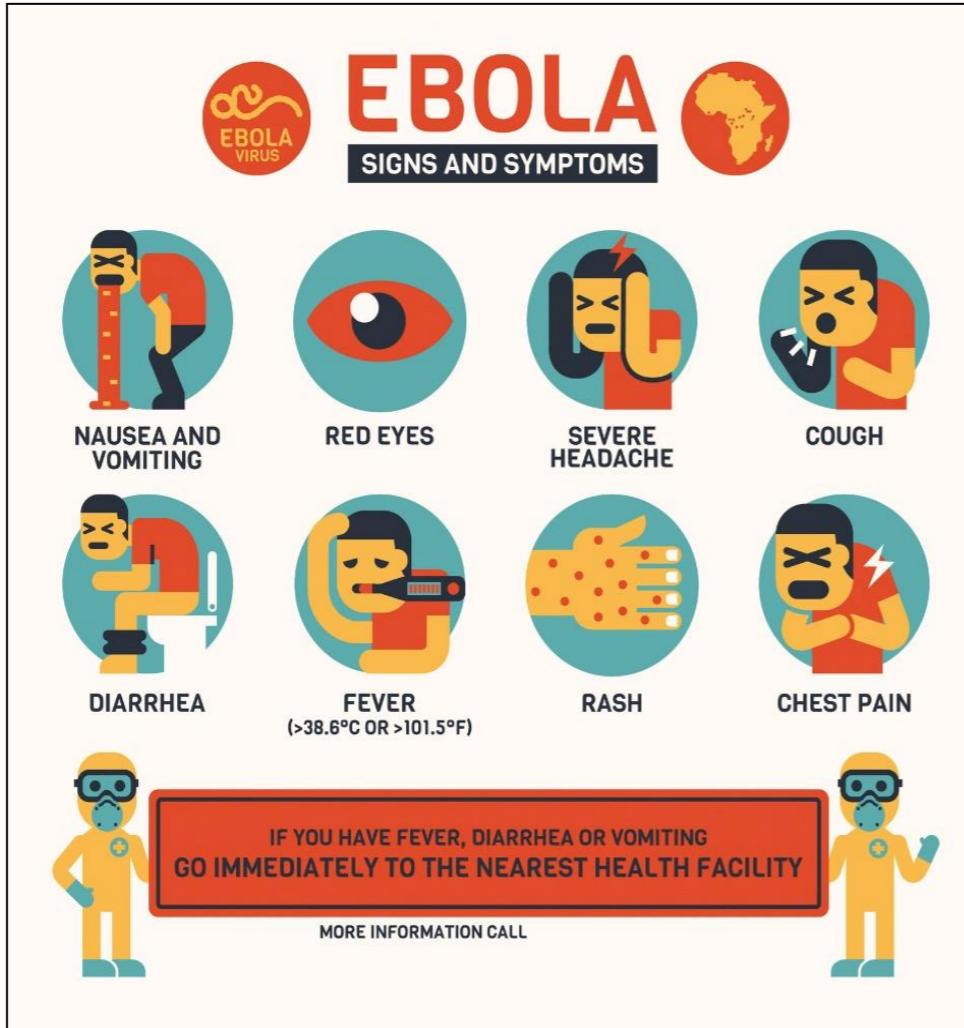
- Laboratory-confirmed diagnostic evidence of Ebola virus infection



Symptoms of EBOLA



# Staff Awareness of Signs/Symptoms



# Considerations for Clinical Diagnosis

- Signs and symptoms of SUDV are **similar** to other infectious diseases and conditions such as:
  - Malaria
  - Typhoid fever
  - Meningitis
  - Pregnancy
- Use proper precautions when testing due to possibility of **co-infection** with the above
- Pregnant women should be tested **rapidly** if Ebola is suspected

# Confirmation of Diagnosis by Lab Testing

- Ebola virus is detected in blood **only after onset of symptoms**, most notably fever,
- However, it may take up to **3 days** after symptoms begin for the virus to reach detectable levels
- **Polymerase chain reaction (PCR)** is one of the most commonly used diagnostic methods because of its ability to detect low levels of Ebola virus.
- **WHO recommends PCR tests as gold standard for Ebola confirmation.**



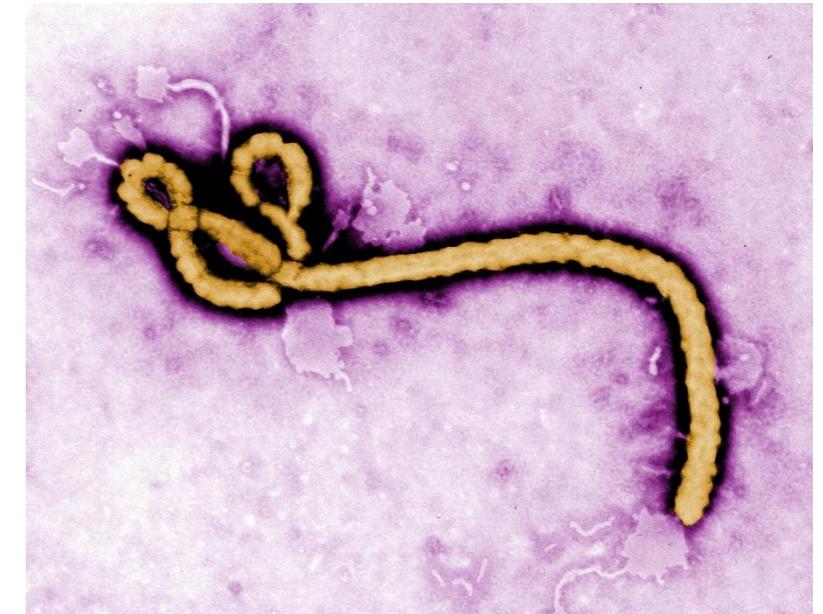
# What To Do for Test-Negative Suspect EVD Cases?

- PCR tests are **often negative in patients with symptoms less than 3 days**
- **Repeat the test at 72 or more hours after onset of symptoms**
- Keep patient in suspect area until a sample taken 72 hours after symptoms begin is negative
- Testing negative does not equal to having immunity
- **Repeat diagnostic testing when indicated**



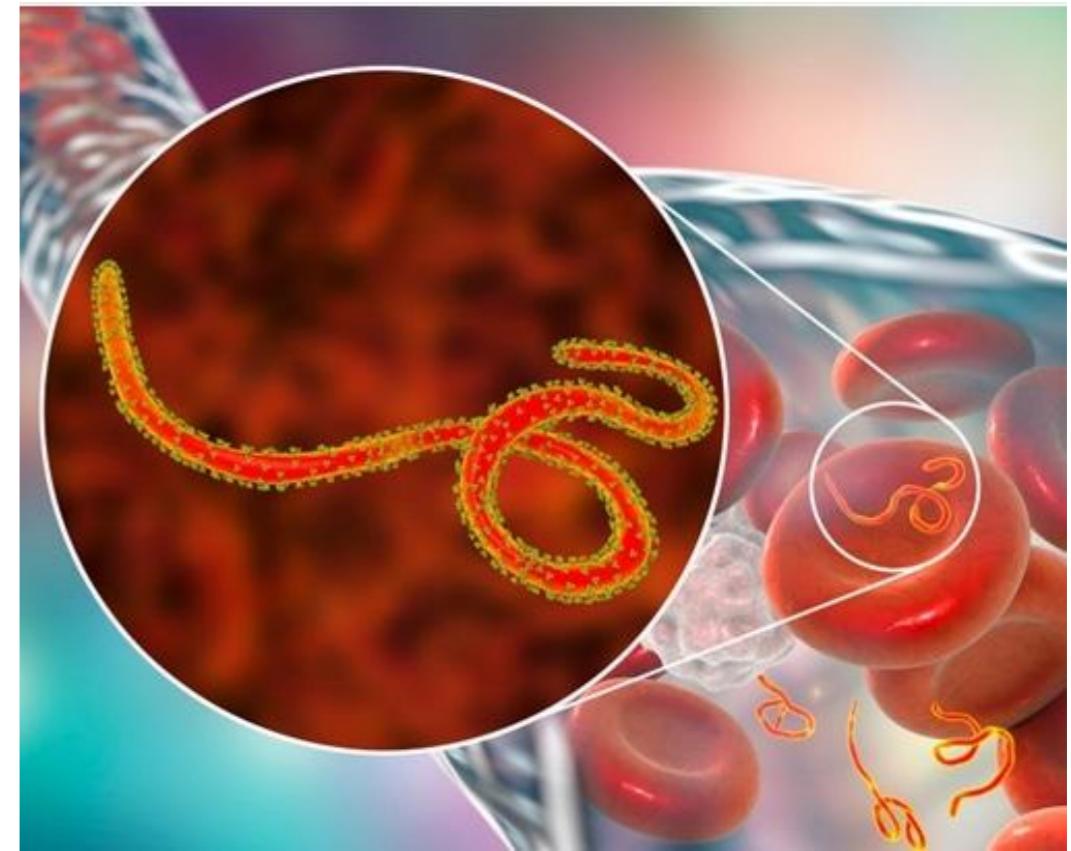
# Confirmation of Diagnosis by Lab Testing

- According to WHO:
  - Rapid antigen detection tests can be used in remote settings where PCR tests are not readily available
  - However, such rapid tests are recommended only for screening purposes as part of surveillance activities
  - **If rapid antigen test is positive, it should always be confirmed with a PCR test**



# Specimen Collection

- The preferred specimens for diagnosis include:
  - **Whole blood** collected in ethylenediaminetetraacetic acid (EDTA) from live patients exhibiting symptoms
  - **Oral fluid** specimen stored in universal transport medium collected from deceased patients or when blood collection is not possible



# Specimen Collection & Transport

- Blood and other samples from symptomatic EVD patients are highly infectious
- All biological specimens should be packaged using the **triple packaging system** when transported nationally and internationally
- Laboratory testing on non-inactivated samples should be conducted under **maximum** biological containment conditions





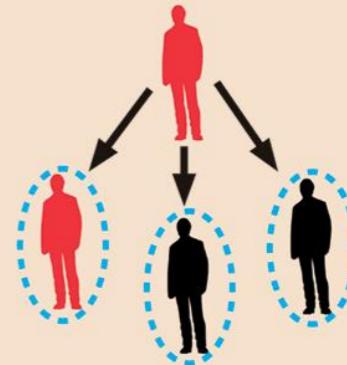
# Contact Management



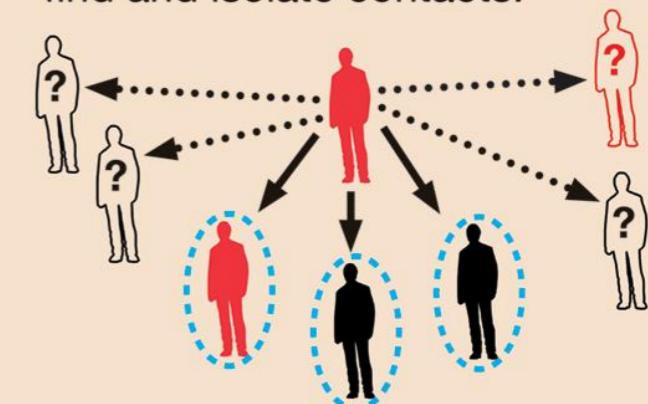
# What To Do if Someone Has Been Exposed?

- If you're exposed, **immediately** clean the area with **soap and water** or in the case of mucous membrane exposure, clean with water
- Immediately **call your medical practitioner**, UN physician or your organisation's medical services for guidance
- At this time, there is **no vaccine available** for the Sudan ebolavirus (SUDV)
  - However, vaccines may be **trialed** for SUDV in the near future

## Contact tracing



Sick individuals asked to identify contacts. Authorities attempt to find and isolate contacts.

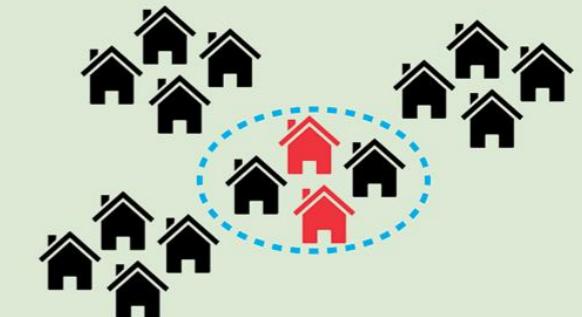


Hard in urban environments with unknown contacts.

# What To Do if Someone Has Been Exposed?

- Assess for any other **blood borne virus (BBV)** exposure (HIV, Hep B, Hep C) and receive prophylaxis and counseling as appropriate.
- Monitor contacts daily for Ebola symptoms for **21 days** counting from the last day of exposure
- **Educate contacts** on signs and symptoms of Ebola, next steps if s/s present, and preventing transmission to family members
- Contacts **should not travel** until cleared by health officials
- **Local** guidelines should be followed

## Community monitoring



Communities with infected individuals monitored daily. Travel between communities limited.



Effective due to early identification of infected.



# Clinical Management

# Clinical Management

- **Predominantly supportive care**
- **Aggressively replace volume loss** from diarrhea, vomiting .etc
- **Oral hydration with ORS** (even if patient does not have diarrhea or vomiting)
- **IV resuscitation** with Ringer's lactate (contains some potassium)
- **Replace potassium and magnesium loss**, likely significant for patients with diarrhea
- There are **no approved therapies** specific for EVD Sudan virus



# Managing the Treatable Manifestations & Complications of EVD



## Fever and pain

- Paracetamol (acetaminophen)
- Do NOT use NSAIDs (concern for thrombocytopenia, bleeding)
- Opioids (caution in hypotensive patients; may reduce gut transit in diarrhea)

## Nausea and vomiting

- Promethazine, metoclopramide, ondansetron

## Diarrhea

- Aggressive oral rehydration
- IV hydration when possible for those unable to take orally
- Role of anti-motility agents uncertain

## Dyspepsia

- Cimetidine or omeprazole

## Agitation

- Diazepam or haloperidol

## Malaria (empiric therapy for all, or treat rapid diagnostic test positives)

## Bacterial co-infections or gut translocation

- Empiric antibiotic therapy aimed at gut pathogens (e.g., cefepime)

# WHO's Guidelines on EVD Clinical Management



1. Systematic assessment and re-assessment of all Ebola patients
2. Fluid resuscitation
3. Electrolyte monitoring and correction
4. Glucose monitoring and management
5. Treatment of potential co-infections
6. Nutrition
7. Symptomatic care and prevention of complications
8. Management of complications



*The main priority is to transfer patients to a location where they can receive supportive care.*

# Systematic assessment and Re-assessment of all EVD Patients

- Staffing ratio of **1** or more clinicians for **4** patients
- Assessments (evaluation of each patient) performed at least **3** times per **24 hours**
- **Close monitoring** of patients to allow recognition of and reaction to acute changes in condition



# Systematic Assessment and Re-assessment of all EVD Patients

- Identification of patients at **high risk** for complications, including:
  - Low systolic blood pressure (SBP) in either adults or children or delayed capillary refill and cold extremities in a child
  - Altered mentation, delirium or seizure
  - Tachypnea (fast respiratory rate)
  - Weak or rapid pulse
  - Oliguria (urine output < 0.5 ml/kg/hour in adults; < 1.0 ml/kg/hour in children) or
  - Anuria
  - Haemorrhagic manifestations
  - Severe hypoglycaemia (glucose < 54 mg/dl or < 3 mmol/l)
  - SpO<sub>2</sub> < 92%
- **Resuscitation** should be initiated
  - Severe electrolyte, metabolic, acid-base abnormalities
  - Severe vomiting and/or diarrhoea
  - Severe weakness with inability to ambulate or eat/drink
- Patients should be placed in the area of the treatment unit designated for the care of the **critically ill**

# WHO's Daily Assessment Checklist

Daily assessment checklist	
Assessment	Plan
<b>1. Is the patient at high risk of complications?</b> <ul style="list-style-type: none"> <li>a. Airway obstruction or respiratory distress?</li> <li>b. Tachypnea (RR &gt; 22 or fast for age) or SpO<sub>2</sub> &lt; 92%?</li> <li>c. Shock? Hypotension, weak or rapid pulse, cold extremities or delayed capillary refill?</li> <li>d. Signs of severe dehydration?</li> <li>e. Altered mentation or seizure?</li> <li>f. Oliguria or anuria, urine output &lt; 0.5 (adult)/1.0 ml (child)/kg/hour?</li> <li>g. Haemorrhagic manifestations?</li> <li>h. Severe hypoglycaemia (glucose &lt; 54 mg/dl or &lt; 3 mmol/l)?</li> <li>i. Severe electrolyte abnormalities?</li> <li>j. Severe weakness with inability to ambulate or eat/drink?</li> </ul>	<input type="checkbox"/> NOT at high risk Regular assessments – three times a day <input type="checkbox"/> HIGH risk Increased interval of assessments: _____ <input type="checkbox"/> Plan: _____
<b>2. Fluid status assessment</b> <ul style="list-style-type: none"> <li>a. Able to drink normally?</li> <li>b. Able to drink some but not enough to correct dehydration or meet daily fluid requirements?</li> <li>c. Signs of sepsis or shock (HR &gt; 90, SBP &lt; 100, RR &gt; 22). And for child: cold extremities, weak fast pulse, delayed capillary refill &gt; 3 sec?</li> </ul>	<input type="checkbox"/> Continue with oral fluids <input type="checkbox"/> Add maintenance fluids <input type="checkbox"/> Bolus IV fluids: _____ ml
<b>3. Laboratory assessment</b> <ul style="list-style-type: none"> <li>a. Does potassium or magnesium need to be replaced?</li> <li>b. Is renal failure present?           <ul style="list-style-type: none"> <li>i. If yes, has the patient been adequately fluid resuscitated?</li> <li>ii. Is a urinary catheter needed to monitor urine output?</li> </ul> </li> </ul>	<input type="checkbox"/> Replace potassium <input type="checkbox"/> Replace magnesium <input type="checkbox"/> Place a urinary catheter <input type="checkbox"/> Use ultrasounds to assess fluid status
<b>4. Severe hypoglycaemia</b> <ul style="list-style-type: none"> <li>a. Evidence of hypoglycaemia (glucose &lt; 54 mg/dl or &lt; 3 mmol/l)?           <ul style="list-style-type: none"> <li>i. If yes, are they symptomatic and require D50 or D10?</li> <li>ii. If no, are they able to eat and drink or do they require continuous infusion of D5 or D10?</li> </ul> </li> </ul>	<input type="checkbox"/> Euglycaemic <input type="checkbox"/> D50 (adult) or D10 (child) for symptomatic hypoglycaemia <input type="checkbox"/> D5 or D10 for asymptomatic hypoglycaemia
<b>5. Treatment of potential bacterial co-infections</b> <ul style="list-style-type: none"> <li>a. Is the patient at high risk of co-infections?           <ul style="list-style-type: none"> <li>i. If yes, is the patient being treated with ceftriaxone?</li> <li>ii. If no, is the patient being treated with cefixime?</li> </ul> </li> <li>b. Does the patient still need to be treated with antibiotics?</li> </ul>	<input type="checkbox"/> Ceftriaxone <input type="checkbox"/> Cefixime <input type="checkbox"/> Antibiotics discontinued
<b>6. Treatment of potential malaria</b> <ul style="list-style-type: none"> <li>a. Does the patient have signs of severe malaria?           <ul style="list-style-type: none"> <li>i. If yes, is the patient being treated with artesunate?</li> <li>ii. If no, is the patient being treated with an antimalarial medication?</li> </ul> </li> <li>b. Can the antimalarials be stopped due to a negative malaria test?</li> </ul>	<input type="checkbox"/> Artesunate <input type="checkbox"/> Artesunate-amodiaquine (ASAQ) <input type="checkbox"/> Malaria negative <input type="checkbox"/> Malaria treatment completed
<b>7. Nutrition</b> <ul style="list-style-type: none"> <li>a. Is the patient able to eat and drink?           <ul style="list-style-type: none"> <li>i. If yes, can maintenance fluids be stopped?</li> </ul> </li> </ul>	<input type="checkbox"/> Able to eat and drink <input type="checkbox"/> NOT able to eat and drink and requires maintenance fluids
<b>8. Prevention</b> <ul style="list-style-type: none"> <li>a. Can the IV line be removed?</li> <li>b. Can the urinary catheter be removed?</li> <li>c. Does the patient require assistance walking or can they walk on their own?</li> </ul>	Remove IV line <input type="checkbox"/> Yes <input type="checkbox"/> No Remove urinary catheter <input type="checkbox"/> Yes <input type="checkbox"/> No Patient requires assistance walking <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>9. Is the patient a pregnant woman?</b> <ul style="list-style-type: none"> <li>a. Is she having an abortion? Premature birth? Has she had an incomplete abortion? If no, is the fetus viable?</li> </ul>	Date of last menstrual period: Echo: _____ Plan: _____

Notes: D dextrose; HR heart rate; RR respiratory rate; SBP systolic blood pressure; SpO<sub>2</sub>, oxygen saturation.

# Fluid Resuscitation

- Patients with Ebola often present with or develop **one or more** of the following:
  - Volume depletion (dehydration), sepsis, haemorrhage and/or shock
- Management:
  - **Oral** rehydration in patients who can drink
  - **Intravenous** administration in those who are unable to drink or who have severe dehydration or shock



# Electrolyte Monitoring and Correction

- Complete **daily labs** during acute phase of illness and haematology on admission and as needed
- Ensure appropriate and timely correction of **electrolyte abnormalities**, including:
  - Hypokalaemia, hyperkalaemia, hypomagnesemia, hypocalcaemia, hyponatraemia, hypernatraemia

## 5. ELECTROLYTE MANAGEMENT

The following topics are covered in this section: hypokalaemia, hyperkalaemia, hypomagnesemia, hypocalcaemia, hyponatraemia, hypernatraemia.<sup>(6)</sup>

### 5.1 Hypokalaemia

Hypokalaemia is a dangerous complication that is associated with arrhythmias and/or death, but repletion must also be done carefully.

- When tolerated (not vomiting) oral potassium should be used.
- Never give potassium IV as bolus.
- Adults: the maximum rate of IV potassium through a peripheral IV line is 10 mmol/hour. The maximal concentration is 10 mmol per 100 ml.
  - » If a central venous catheter is in place, it can give up to 20–40 mmol/hour, administered as 20–40 mmol in 1 litre NS while on a cardiac monitor.
- Children: the maximum IV infusion rate is 0.5 mmol/kg/hour through a peripheral IV or central line.
  - » The maximum concentration of IV potassium through a peripheral line in children is 10 mmol/l.
- It is preferable to infuse potassium using an electric syringe pump to ensure rate.
- Every 0.1 mmol reduction in serum requires approximately 10 mmol KCl repletion in adult patients.
- Every 1 g of potassium in a 10 ml ampoule is equivalent to 13.4 mmol or 13.4 mEq of potassium.

Potassium level	Adult dosing
3.3–3.5	40 mmol oral dose. Re-check serum K level and repeat dose if needed.
2.5–3.2	60–80 mmol oral dose. Re-check serum K level and treat if necessary.
< 2.4 (severe)	10 mmol per hour IV for 4 hours. Re-check serum K level. Give additional dose at 2–4 hours, if still needed. Always re-check serum K level between dosing.
Paediatric dosing	
K 2.5–2.9 mmol/l	0.5–1.0 mmol/kg oral dose. Re-check serum K level. Can repeat every 6–12 hours. Can repeat to a total of 2–4 mmol/kg/day in 2–4 divided doses.
K < 2.5 mmol/l	0.5 mmol/kg/hour IV for 2 hours + 2 mmol/kg oral dose. Re-check serum K level. Can repeat every 12 hours.

Detailed guidance on electrolyte management can be found in WHO Optimized Supportive Care for Ebola Virus Disease found [here](#).

# Glucose Monitoring and Management

- **Hypoglycaemia** is frequently seen in patients with Ebola (especially infants and children) and should be managed to avoid complications
- Recommendations:
  - Serum glucose checked at least **3 times a day** with vital signs
  - **Intravenous (IV) glucose management** as needed

## HYPOGLYCEMIA SYMPTOMS



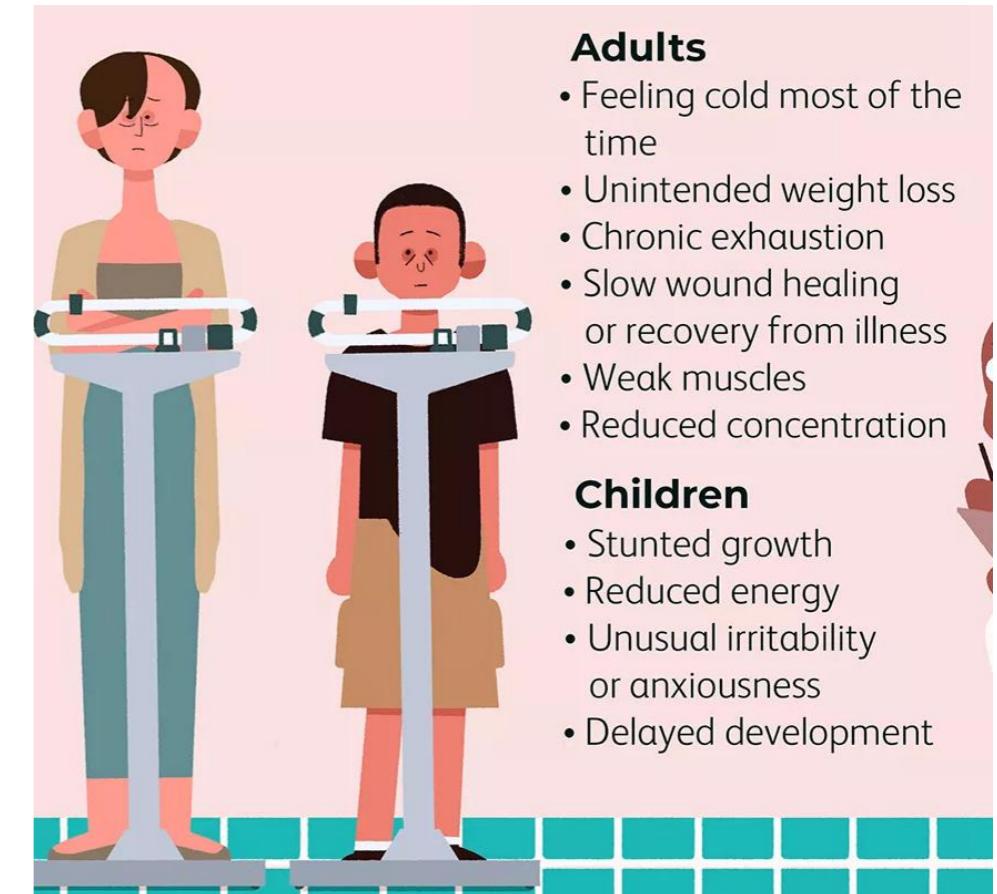
# Treatment of Potential Co-infections

- Bacterial co-infection
  - **Empiric treatment** with antibiotics is recommended for patients with Ebola
- Co-infection with malaria
  - **Empiric antimalarial therapy** should be administered to all febrile patients with suspect and confirmed Ebola
  - **Stop treatment** once malaria testing is negative or the treatment course is finished.



# Nutrition

- On admission, assess the **nutritional status** of all patients with Ebola, including:
  - Body weight, height, and in children, mid-upper arm circumference
  - Signs of malnutrition
  - Current appetite status
- **Enteral nutrition** should be provided and advanced as tolerated
- **IV dextrose** provided for patients that cannot take oral food and with evidence of hypoglycaemia



# Prevention of Complications

- Feeding
  - Encourage **early enteral nutrition**
- Stress ulcer prophylaxis
  - Use of a **proton pump inhibitor** or **H2 receptor blocker** in critically ill patients at high risk of bleeding



# Prevention of Complications

- **Early Mobility**

- Assess patient **daily** for early mobility
- Once patient is improving, then **encourage early mobility** and ambulation to prevent pressure ulcers and thrombotic events
- **Provide assistance** for patient to sit up, dangle on side of bed, then to stand and walk
- If unable to mobilize, turn patient in bed every **2–4 hours** to prevent pressure ulcers



# Management of complications

- The complications of Ebola include:

<b>Seizure</b>	<b>Bleeding at the site of IV</b>
<b>Altered mental state and encephalopathy</b>	<b>Intracerebral haemorrhage</b>
<b>Haemorrhage</b>	<b>Acute renal failure/kidney injury</b>
<b>Haematemesis</b>	<b>Metabolic acidosis</b>
<b>Haematochezia</b>	<b>Hypoxic respiratory failure</b>
<b>Vaginal bleeding</b>	<b>Sepsis and septic shock</b>
<b>Gingival bleeding</b>	

# UN, WHO and CDC's EVD Resources

<b>DHMOSH Ebola Resource Page</b>	<a href="https://hr.un.org/page/ebola">https://hr.un.org/page/ebola</a>
<b>UNMD Ebola Risk Mitigation Plan (July 2019)</b>	<a href="https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist_DHMOS_HPH_2019-05_FINAL_Eng_2.pdf">https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist_DHMOS_HPH_2019-05_FINAL_Eng_2.pdf</a>
<b>Ebola Preparedness And Response: A Checklist for UN Health Facilities (May 2019)</b>	<a href="https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist_DHMOS_HPH_2019-05_FINAL_Eng_2.pdf">https://hr.un.org/sites/hr.un.org/files/Ebola%20Checklist_DHMOS_HPH_2019-05_FINAL_Eng_2.pdf</a>
<b>PPE Calculator</b>	<a href="https://www.cdc.gov/vhf/ebola/healthcare-us/ppe/calculator.html">https://www.cdc.gov/vhf/ebola/healthcare-us/ppe/calculator.html</a>
<b>Ebola Virus Disease: Standard Precautions and How to Use EVD PPE Calculator [Video]</b>	<a href="https://www.youtube.com/watch?v=EyJqhhLwgX4">https://www.youtube.com/watch?v=EyJqhhLwgX4</a>
<b>Personal protective equipment for use in a filovirus disease outbreak (November 2016)</b>	<a href="https://www.who.int/publications/i/item/9789241549721">https://www.who.int/publications/i/item/9789241549721</a>
<b>Optimized supportive care for Ebola virus disease: clinical management standard operating procedures (2019)</b>	<a href="https://apps.who.int/iris/handle/10665/325000">https://apps.who.int/iris/handle/10665/325000</a>
<b>Implementation and management of contact tracing for Ebola virus disease (July 2015)</b>	<a href="https://www.who.int/publications/i/item/WHO-EVD-Guidance-Contact-15.1">https://www.who.int/publications/i/item/WHO-EVD-Guidance-Contact-15.1</a>
<b>Manual for the care and management of patients in Ebola Care Units/Community Care Centres (Jan 2015)</b>	<a href="https://apps.who.int/iris/bitstream/handle/10665/149781/WHO_EVD_Manual_ECU_15.1_eng.pdf">https://apps.who.int/iris/bitstream/handle/10665/149781/WHO_EVD_Manual_ECU_15.1_eng.pdf</a>

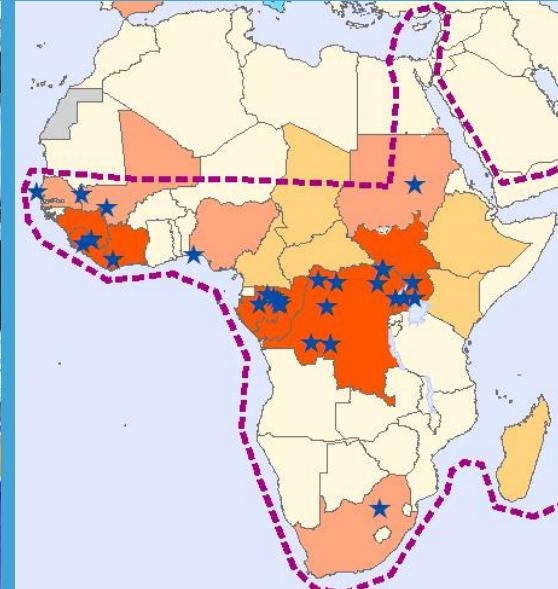


Questions?

[dos-dhmosh-public-health@un.org](mailto:dos-dhmosh-public-health@un.org)

# Introduction to Ebola disease

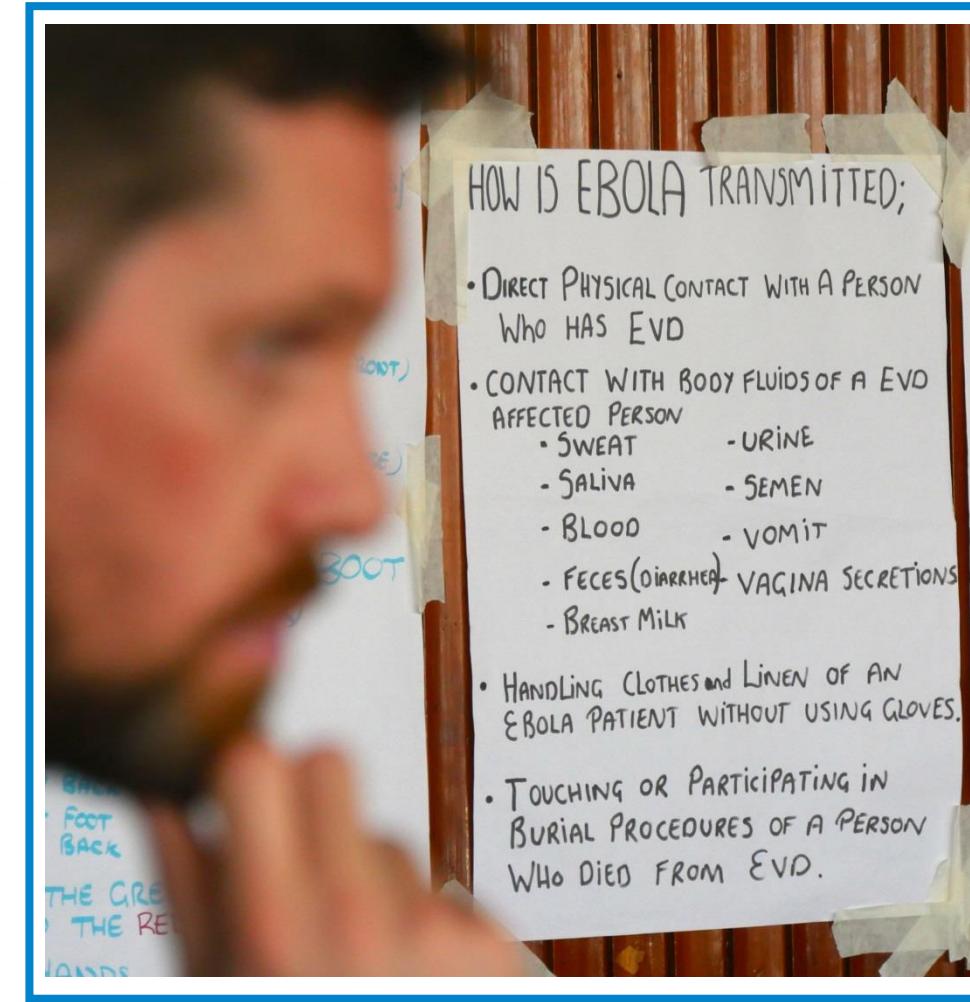
Managing  
infectious hazards





# Learning objectives

- **Describe signs, symptoms, and transmission of Ebola disease**
- **List preventive and control measures**
- **Describe main public health concern during an Ebola disease outbreak**





# Ebola disease

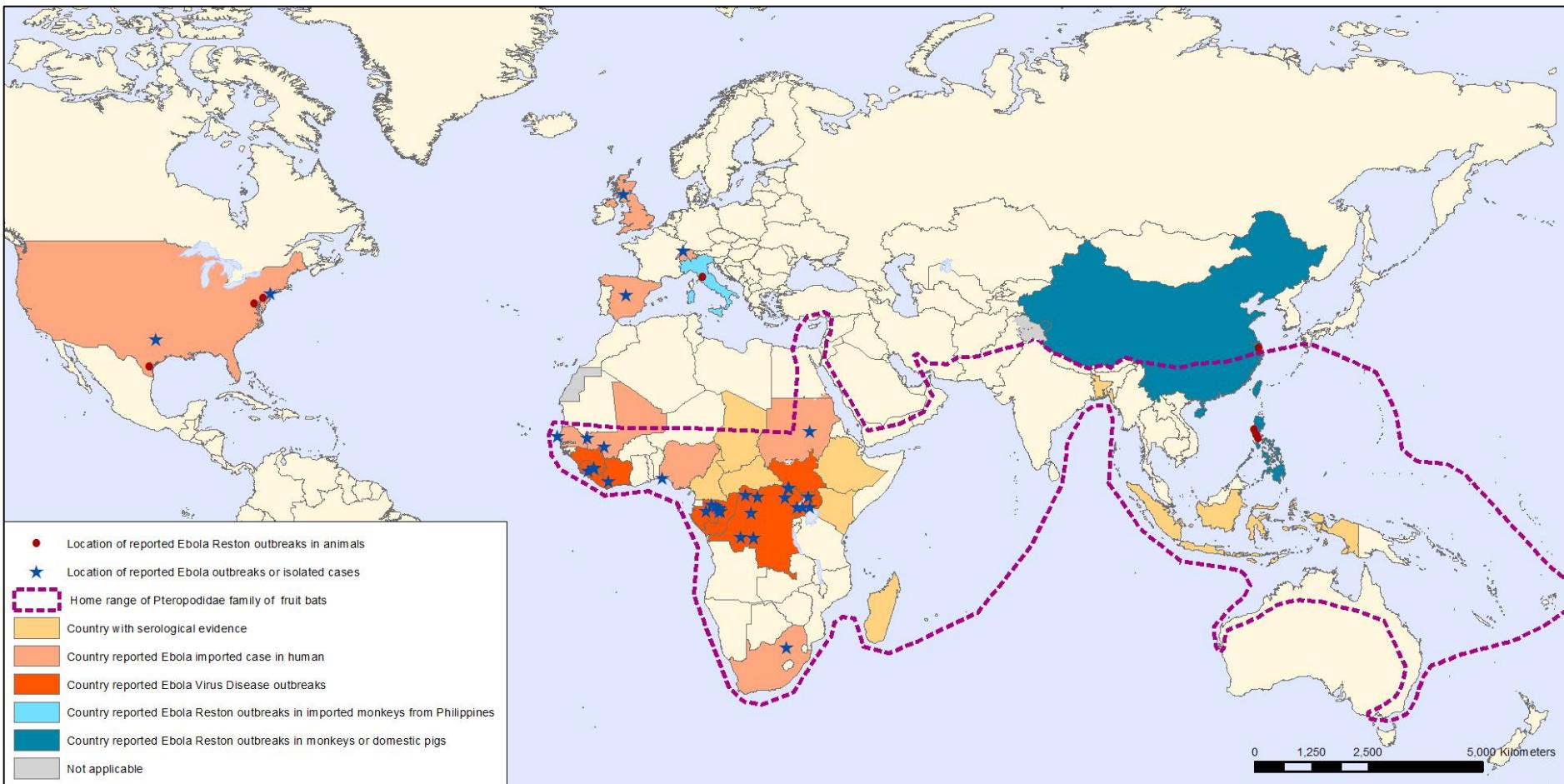
- Ebola disease is a severe, often fatal illness in humans.
- The virus is transmitted to people from wild animals and then spreads in the human population through human-to-human transmission.
- The average Ebola case fatality rate is around 50%. Early supportive care with rehydration, symptomatic treatment improves survival.
- Five species of Ebola virus have been identified. Among them, Bundibugyo ebolavirus, Zaïre ebolavirus, and Sudan ebolavirus have been associated with large outbreaks in Africa.



@drawingchange



# Geographic distribution of Ebola

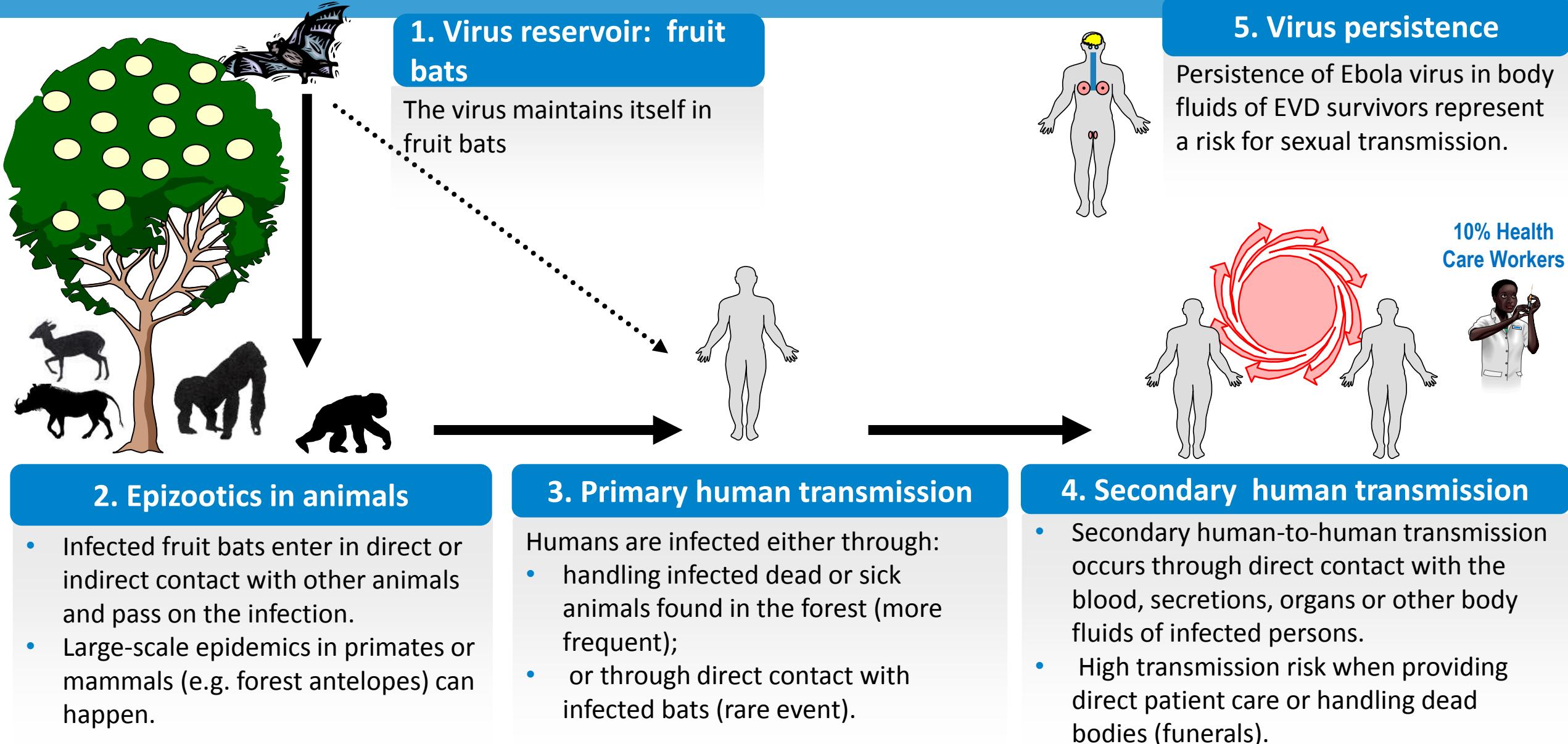


- Ebola disease was identified in 2 simultaneous outbreaks in 1976, one in South Sudan and one in the Democratic Republic of the Congo.
- Since 1976, 25 Ebola outbreaks occurred mostly in central Africa.
- The 2014–2016 Ebola outbreak in West Africa was the largest and most complex.

Map available at: [http://www.who.int/csr/disease/ebola/global\\_ebolaoutbreakrisk\\_20150316.png?ua=1](http://www.who.int/csr/disease/ebola/global_ebolaoutbreakrisk_20150316.png?ua=1)



# Ebola virus transmission



## 2. Epizootics in animals

- Infected fruit bats enter in direct or indirect contact with other animals and pass on the infection.
- Large-scale epidemics in primates or mammals (e.g. forest antelopes) can happen.

## 3. Primary human transmission

- Humans are infected either through:
- handling infected dead or sick animals found in the forest (more frequent);
  - or through direct contact with infected bats (rare event).

## 4. Secondary human transmission

- Secondary human-to-human transmission occurs through direct contact with the blood, secretions, organs or other body fluids of infected persons.
- High transmission risk when providing direct patient care or handling dead bodies (funerals).



# Clinical features of Ebola disease

- The incubation period is 2 - 21 days.
- Humans are not infectious until they develop symptoms.
- Initial symptoms are sudden onset of fever and fatigue, muscle pain, headache and sore throat.
- Usually followed by: vomiting, diarrhoea, rash, impaired kidney and liver function, spontaneous bleeding internally and externally (in some cases).

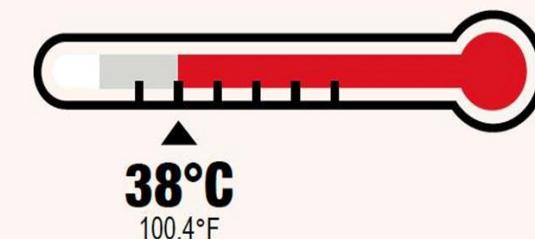
## FACTS TO KNOW ABOUT EBOLA



### SYMPTOMS

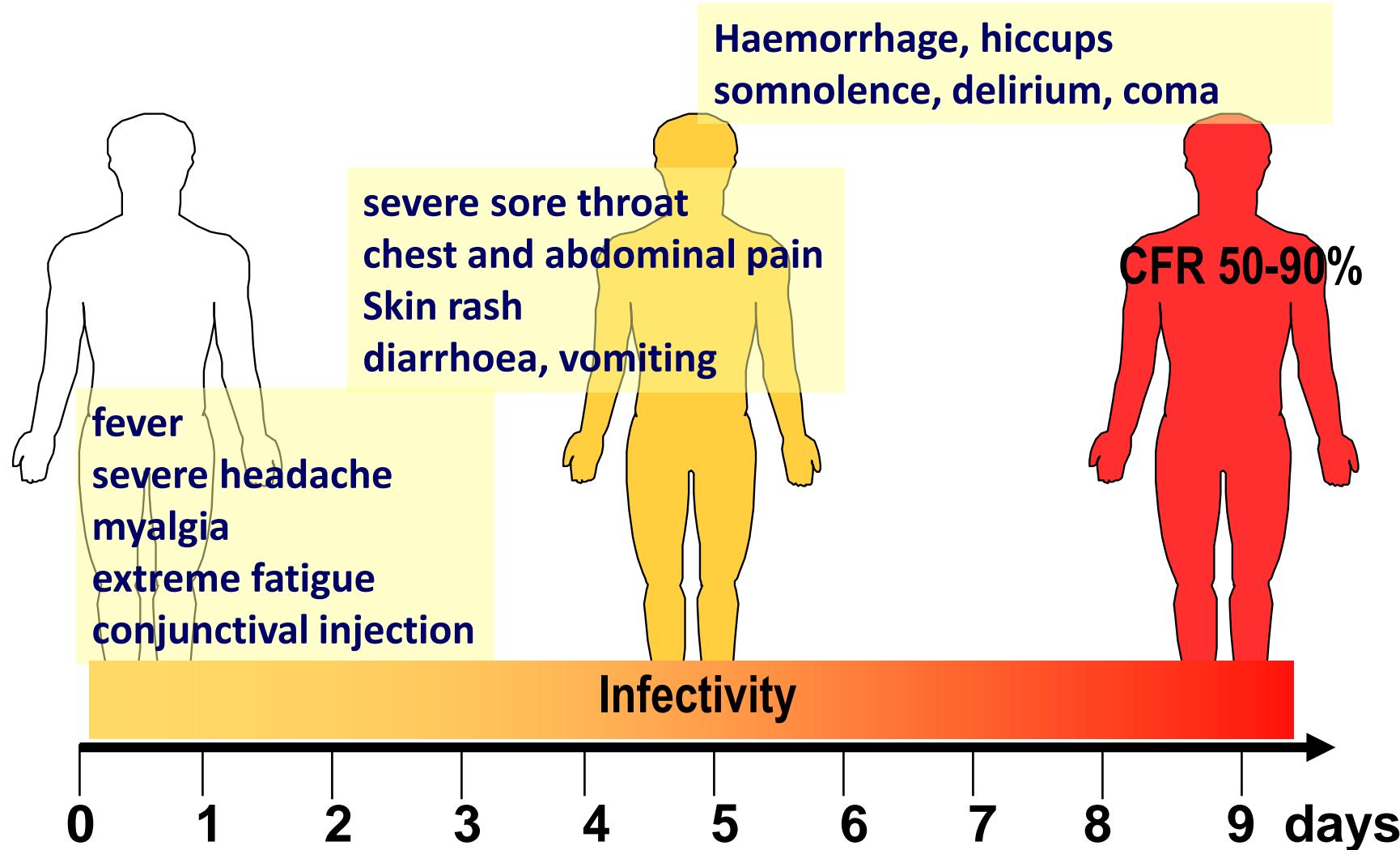


Fever, weakness, muscle pain, headache and sore throat, followed by vomiting, diarrhoea, and bleeding





# EVD: clinical symptoms





# Ebola disease diagnosis

- Symptoms are non-specific; clinical diagnosis may be difficult.
- Differential diagnosis includes other viral haemorrhagic fevers, yellow fever, malaria, typhoid fever, shigellosis, and other viral and bacterial diseases.
- Patient history is essential and should include:
  - Contact with a dead or sick animal;
  - Contact with a suspected, probable or confirmed Ebola patient



# Ebola disease laboratory diagnosis

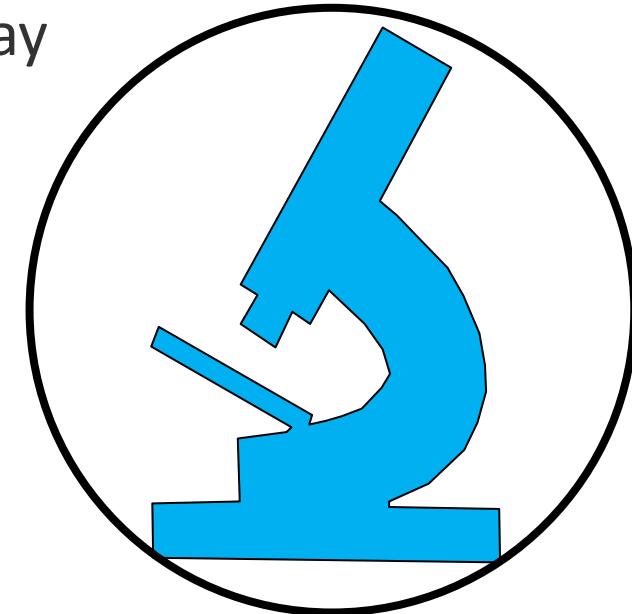
## Definitive diagnosis requires testing:

- reverse transcriptase polymerase chain reaction (RT-PCR) assay
- IgG and IgM antibodies with enzyme-linked immunosorbent assay (ELISA)
- antigen detection tests
- virus isolation by cell culture

The list of diagnostics approved for Emergency Use Assessment and Listing procedure (EUAL) by WHO is available here:

[http://www.who.int/medicines/ebola-treatment/emp\\_ebola\\_diagnostics/en/](http://www.who.int/medicines/ebola-treatment/emp_ebola_diagnostics/en/)

Handling and processing specimen requires **suitably equipped laboratories under maximum biological containment conditions** and staff collecting samples should be trained





# Ebola disease treatment



- Early, aggressive, intensive care support: Monitor fluid and electrolyte balance and renal function, blood pressure, oxygenation, careful rehydration.
- Supportive drug therapy including : painkillers, antiemetic for vomiting, anxiolytic for agitation, +/-antibiotics and/or antimalarial drugs
- Psycho-social support and services



# Key components for Ebola disease control

Cases investigation

Care for sick people

National  
leadership

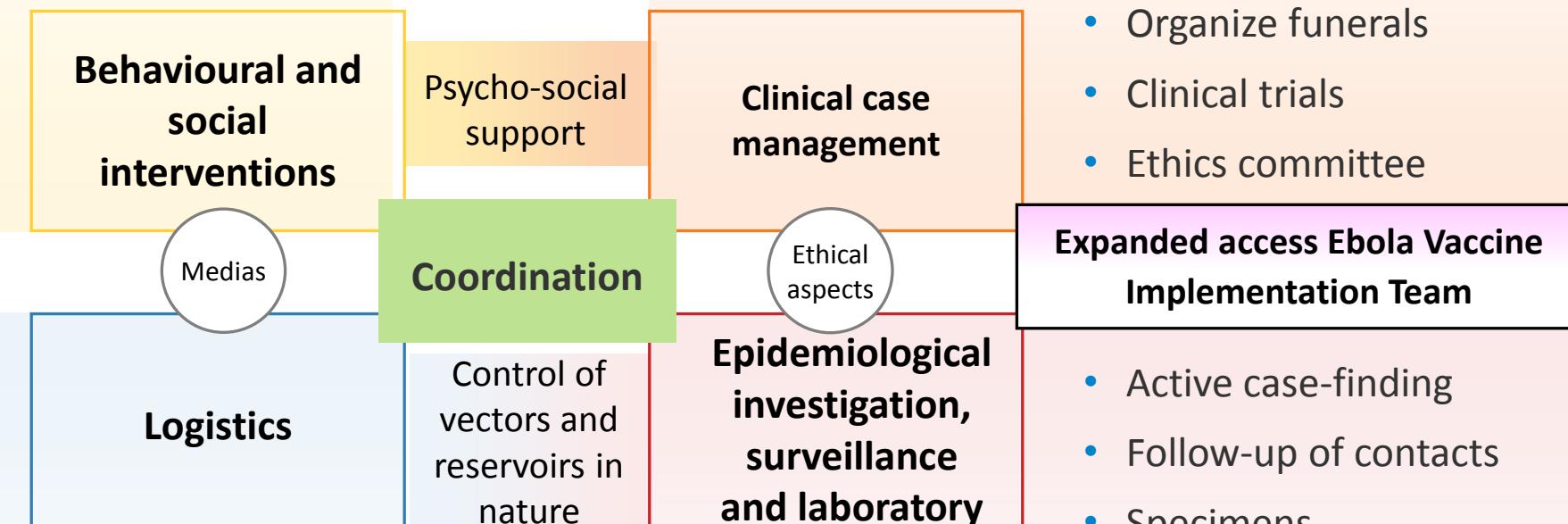
Preventive measures in communities  
and health care settings



# General strategy to control EVD outbreaks

- Conduct social and cultural assessments
- Engage with key influencers: women and /or youth associations, traditional healers, local authorities, religious & opinion leaders
- Formal and informal communication
- Address community concerns

- Security, police
- Lodging, food
- Social and epidemiological mobile teams
- Finances, salaries
- Transport vehicles



- Triage in/out
- Barrier nursing
- Infection control
- Organize funerals
- Clinical trials
- Ethics committee

## Expanded access Ebola Vaccine Implementation Team

- Active case-finding
- Follow-up of contacts
- Specimens
- Laboratory testing
- Database analysis
- Search for the source



# Community engagement and awareness

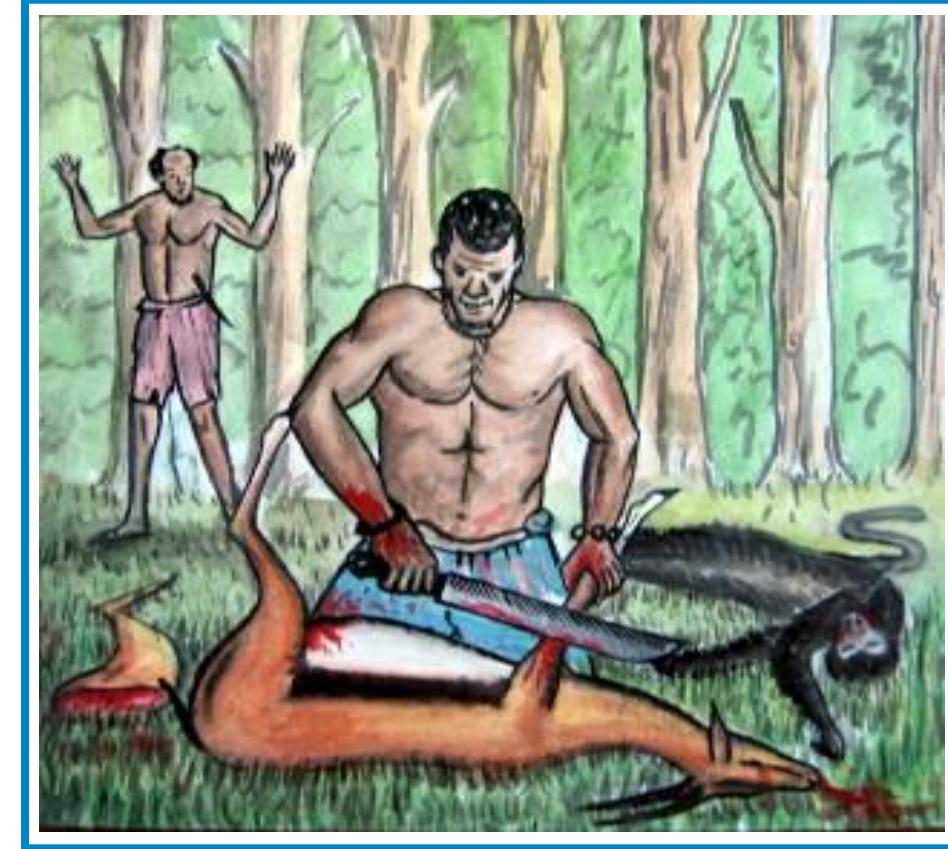
- Engage with communities to promote desired health practices and behaviours, particularly on caring for sick and/or deceased persons.
- Provide accurate and timely health advice and information on the disease.





# Reducing wildlife-to-human transmission

- Reducing the risk of wildlife-to-human transmission from contact with infected fruit bats or monkeys/apes and the consumption of their raw meat.
  - Animals should be handled with gloves and other appropriate protective clothing.
  - Animal products (blood and meat) should be thoroughly cooked before consumption.





# Reducing human-to-human transmission

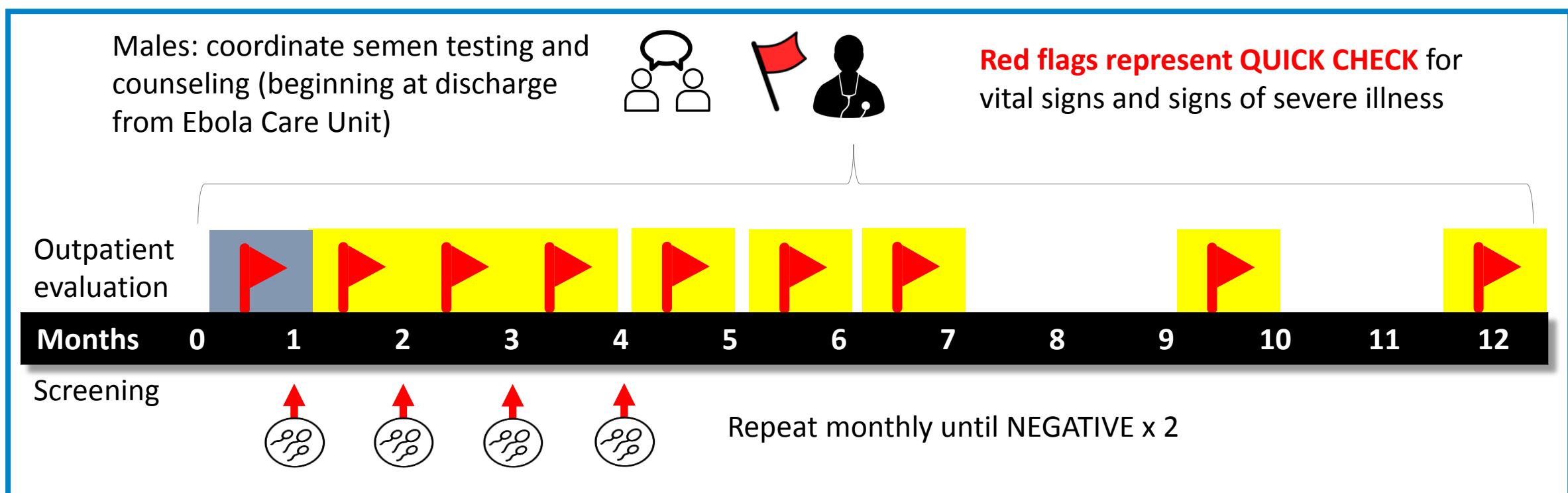
- **Reducing the risk of human-to-human transmission** from direct or close contact with people with Ebola symptoms, particularly with their bodily fluids.
  - Gloves and appropriate personal protective equipment should be worn when taking care of ill patients at home.
  - Regular hand washing is required after visiting patients in hospital, as well as after taking care of patients at home.
  - Organize safe and dignified burials for people who may have died of Ebola Virus Disease





# Reducing possible sexual transmission

- Reducing the risk of possible sexual transmission, WHO recommends that male survivors of Ebola virus disease practice safer sex and hygiene for 12 months from onset of symptoms or until their semen tests negative twice for Ebola virus.

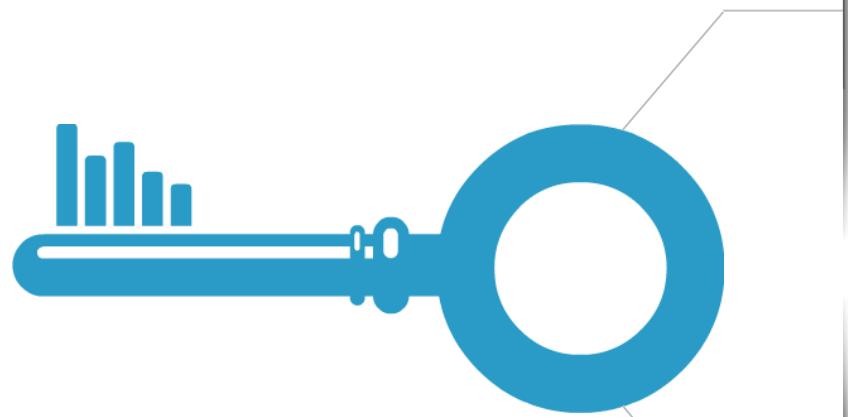


# Controlling infection in health-care settings

- Implement Standard Precautions with all patients – regardless of their diagnosis – in all work practices at all times including safe injection practices. <http://www.who.int/csr/resources/publications/standardprecautions/en/index.html>
- Health care workers treating patient with Ebola Virus Disease should apply extra infection control measures to prevent contact with the patient's blood and body fluids and contaminated surfaces or materials such as clothing and bedding.  
[http://www.who.int/csr/resources/publications/ebola/filovirus\\_infection\\_control/en/?ua=1](http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/?ua=1)
- Laboratory workers are also at risk. Samples taken from suspected Ebola Virus Disease cases for diagnosis should be handled by trained staff and processed in suitably equipped laboratories.



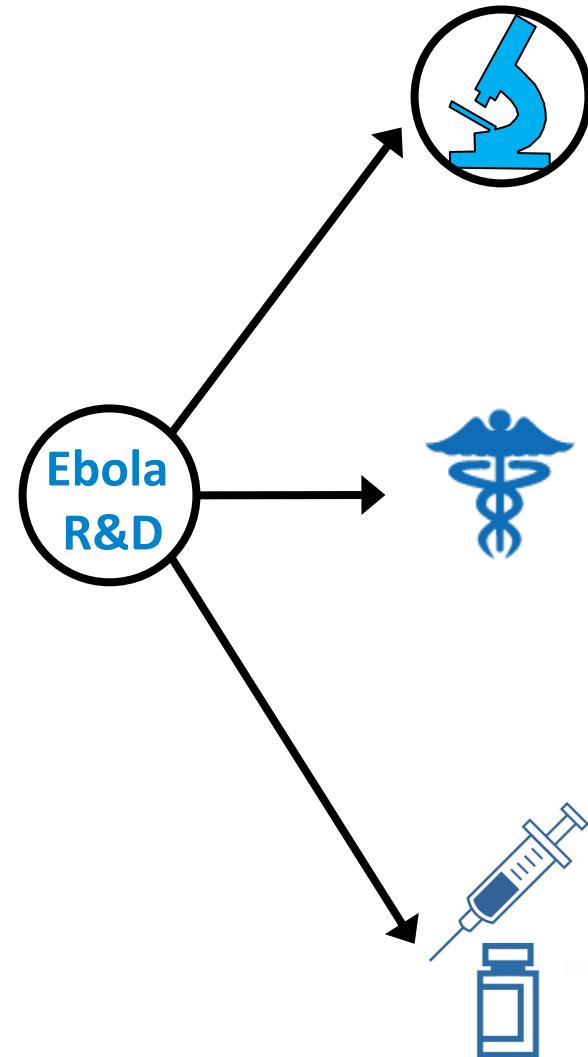
# Key Challenges for Ebola Virus Disease



- Difficult to diagnose patients based on clinical presentation
- Stopping all chains of transmission
- Engaging timely with communities



# Ebola Research and Development



## Rapid Antigen Test (3) Nucleic Acid Test (6)

US-FDA and WHO approved for Emergency Use

## Therapeutics trials medicines and blood products

**ZMapp** Randomized Control Trial, estimated effect of appeared to be beneficial

**Favipiravir** decreases CFR in patients with a low to moderate viral load (200 patients)

**GS-5734** Gilead, phase I, used for 3 compassionate treatments

## Vaccines trials implemented in Guinea, Liberia and Sierra Leone

Expanded access proposed during Likati outbreak, DRC 2017

# WHO information on Ebola Virus Disease

中文 English Français Русский Español عربی

<http://www.who.int/ebola/en/>

- Technical information
- Fact Sheet
- Disease outbreak news
- Infographics
- Maps
- Related links

## Ebola virus disease

### Sierra Leone one year on

9 June 2017 -- Today, Sierra Leone marks the one year anniversary of the end of the Ebola outbreak. The country is working to build back stronger, more resilient health systems, after the worst Ebola outbreak in history. This photo story shows how WHO-supported mothers' groups are playing an important role in bringing women and their families back to health services and clinics.

[Read the photo story](#)



UNO/Adand



#### Fact sheet

General information on Ebola virus disease, controlling the infection, WHO response



[Frequently asked questions](#)  
Answers to questions on the disease, transmission of the virus, treatment



[Ebola outbreak 2014-2015](#)  
Information and documents posted during the 2014-2015 epidemic

## Health systems

### Health systems recovery

Recovering from an outbreak requires getting essential health services back up and running, and addressing the weaknesses of the health system. WHO's is working with affected countries in rebuilding their health systems.

## Survivors

### Ebola survivors programme

Ebola survivors need comprehensive support for the medical and psychosocial challenges they face and also to minimize the risk of continued Ebola virus transmission.

## Situation reports: DRC

Review of the situation and an assessment of the response measured against the core indicators. The reports include tables, maps, and data on total number of Ebola cases in the Democratic Republic of Congo.

[All situation reports](#)

## Technical guidance

### Key technical documents on Ebola

Clinical care for survivors of Ebola virus disease

Surveillance strategy during Phase 3 of the Ebola response

Recovery toolkit: Supporting countries to achieve health service resilience

Ebola response phase 3: Framework for achieving and sustaining a resilient zero

Infection prevention and control guidance for care of patients in health-care settings, with focus on Ebola

[All publications, technical guidance documents](#)  
[Journal articles on Ebola](#)

## Preparedness, R&D

### Preparedness for emergencies

WHO is working with countries in implementing plans to prevent and respond to a possible epidemic of Ebola virus disease.

### R&D Blueprint

Ebola clinical trials are bringing the world close to having its first safe and effective Ebola vaccine, while researchers are learning more every day about the long-term effects of Ebola on survivors.

## News, features

### Past outbreaks of Ebola in DRC

19 May 2017

[Press briefing on Ebola virus disease in the Democratic Republic of the Congo](#)  
18 May 2017, audio recording

WHO Regional Director for Africa, Dr Matshidiso Moeti travels to Kinshasa to discuss Ebola outbreak response  
14 May 2017

[Ebola vaccines for Guinea and the world: photos](#)  
5 May 2017



# Key contact



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- 

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