Ebola Virus Disease
What Is Ebola Virus Disease?

• Ebola is a virus that causes Ebola Virus Disease (EVD).

• Discovered in 1976 near the Ebola River in present day Democratic Republic of the Congo.

• Rare and deadly disease most commonly affecting people and nonhuman primates.

• Case fatality rate is around 50% and has varied between 25% and 90% in the past.
What Is Ebola Virus Disease?

- Ebola virus (species *Zaire ebolavirus*)
- Bundibugyo virus (species *Bundibugyo ebolavirus*)
- Sudan virus (species *Sudan ebolavirus*)
- Taï Forest virus (species *Taï Forest ebolavirus*)
- Reston virus (species *Reston ebolavirus*)
- Bombali virus (species *Bombali ebolavirus*)

Known to cause disease in humans

Known to cause disease in primates and pigs

Unknown if causes disease in animals or humans; recently identified in bats
Ebola Virus Outbreaks by Species and Size, Since 1976

https://www.cdc.gov/vhf/ebola/history/distribution-map.html
Symptoms

Symptoms may appear anywhere from 2 to 21 days following exposure but often appear between 8 and 10 days following exposure.

**Common symptoms include:**
- Fever
- Headache
- Joint and muscle pain
- Weakness
- Diarrhea
- Vomiting
- Stomach pain
- Lack of appetite

**Some patients may experience:**
- Rash
- Red eyes
- Hiccups
- Cough
- Sore throat
- Chest pain
- Difficulty breathing
- Difficulty swallowing
- Bleeding inside/outside the body
Person Under Investigation (PUI)
A person who has both consistent signs or symptoms and risk factors as follows should be considered a PUI:

- Elevated body temperature or subjective fever or symptoms, including severe headache, fatigue, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained hemorrhage;

- AND -

- An exposure within 21 days before the onset of symptoms.

Confirmed Case
Laboratory-confirmed diagnostic evidence of Ebola virus infection
Diagnostics

Tests

- Antibody-capture enzyme-linked immunosorbent assay (ELISA)
- Antigen-capture detection tests
- Serum neutralization test
- Reverse transcriptase polymerase chain reaction (RT-PCR) assay
- Electron microscopy
- Virus isolation by cell culture
Diagnostics (cont.)

Current WHO recommended tests include:

• Automated or semi-automated nucleic acid tests (NATs) for routine diagnostic management.
• Rapid antigen detection tests for use in remote settings where NATs are not readily available. These tests are recommended for screening purposes as part of surveillance activities; however, reactive tests should be confirmed with NATs.

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.
Decision Guide for Initial Evaluation of Suspect Cases of Ebola Virus Disease (EVD)

Has the individual been in a country experiencing widespread transmission of Ebola in the last 21 days?

- NO
  - This patient is not at risk for having come into contact with Ebola virus.
  - You may evaluate the patient as you would normally.

- YES

Has the individual had ANY of the following exposures in the last 21 days?

- Direct contact with body fluids, from a person sick with Ebola who is showing symptoms, through a needle stick, splashes to eyes, nose or mouth, OR getting body fluids directly on skin
- Direct contact with a person with Ebola who has symptoms, or the person's body fluids, while not wearing appropriate personal protective equipment (PPE)
- Worked in a lab processing blood or body fluids from a person sick with Ebola who has symptoms while not wearing appropriate PPE or without using standard biosafety precautions
- Providing direct care to a person showing symptoms of Ebola in a household setting
- Actively participated in a funeral or had any other contact with the remains of a known/suspect EVD patient

- NO
  - Patient is considered to be in low risk for Ebola.
  - Advise patient to monitor for symptoms and temperature closely for 21 days from date of departure from affected area.
  - Continue with your normal clinical evaluation.
  - Collect all patient information and notify SME via email.

- YES

Does the patient have ANY of the following symptoms?:

- Vomiting
- Diarrhea
- Headache
- Sore throat
- Fever
- Malaise
- Myalgias
- Abdominal pain

- NO
  - If patient is not symptomatic, they cannot transmit disease.
  - Advise patient to monitor symptoms and to take temperature twice per day for 3 weeks after their last exposure to Ebola virus.
  - Continue with normal clinical evaluation.
  - If fever or any symptoms associated with EVD develop, the patient should immediately call a healthcare provider prior to going to a healthcare facility so that proper precautions can be taken.
  - Collect all patient information and notify SME via email.

- YES

- Immediately place patient in isolation.
- Immediately notify SME.
When a Traveler Shows Symptoms

- LHD should not have direct contact.
- LHD contacts ISDH immediately to confirm symptoms.
- We will contact everyone to arrange for transport of the patient to the nearest assessment hospital:
  - Chief Medical Officer
  - State Epidemiologist
  - Deputy State Epidemiologist
  - DEP, Division Director
  - DEP, Director of Operations
- Once at an assessment hospital, blood tests are performed to confirm diagnosis.
- Patient is transported to the nearest treatment hospital.
Transmission

• People are contagious as long as they are symptomatic.
• Many common illnesses can have these same symptoms, including influenza (flu) or malaria.
• Ebola virus spreads through direct contact with:
  – Blood or bodily fluids of a person who is sick with or has died from EVD
  – Objects (such as needles and syringes) contaminated with bodily fluids from a person sick with EVD or the body of a person who died from EVD
  – Infected fruit bats or nonhuman primates
  – Semen from a man who recovered from EVD (through oral, vaginal, or anal sex)
Immunologically Privileged Sites

- Areas of the body where viruses and pathogens can remain undetected even after the immune system has cleared the virus from other sites of the body
Reasons for Continued Spread

• Refusing vaccination
• Improper burial practices
• Healthcare-associated infections:
  – Lack of separation of patients
  – Short on supplies
  – Use of traditional medicines
  – Lack of PPE use
Treatment and Prevention

• There is no proven treatment for Ebola.
• Hand hygiene is the #1 way to prevent transmission.
• Vaccinations are currently being investigated.

https://www.who.int/health-topics/ebola/#tab=tab_1
<table>
<thead>
<tr>
<th>Product / Company</th>
<th>Phase</th>
<th>Trial Location</th>
<th>Dates</th>
<th>Product</th>
<th>Phase</th>
<th>Company/ Organizer</th>
<th>Dates</th>
<th>Notes</th>
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<tbody>
<tr>
<td>ChAd3-ZEBOV GlaxoSmithKline and PHAC</td>
<td>Phase I</td>
<td>By VRC at NIH, USA</td>
<td>September 2014</td>
<td>VSV-EBOV</td>
<td>Phase III</td>
<td>By Médecins Sans Frontières (MSF), WHO and Government of Guinea in Conakry, Guinea</td>
<td>March 2015 – A vaccine trial for front line workers only. As of 19 June, more than 800 volunteers have been vaccinated. The target number is 1 200.</td>
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<td>rVSV-ZEBOV NewLink Genetics and Merck Vaccines USA</td>
<td>Phase I</td>
<td>By WRAIR in the US</td>
<td>October 2014</td>
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<td></td>
<td>By US NIH and MOH Liberia in Monrovia, Liberia</td>
<td>March 2015 – Randomized control trial design As of April, Phase II enrollment of 1 500 volunteers in Liberia was completed.</td>
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<td>By NIAID in the US</td>
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<td>By CTC North GmbH in Hamburg, Germany</td>
<td>November 2014</td>
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<td>At Albert Schweitzer Hospital in Lambarene, Gabon</td>
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<td>At the University of Geneva, Geneva, Switzerland</td>
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<td>At the IWK Health Center, Halifax, Canada</td>
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<td>By KEMRI Wellcome Trust in Kilifi, Kenya</td>
<td>December 2014</td>
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<td>Ad26-EBOV and MVA-EBOV Johnson &amp; Johnson and Bavarian Nordic</td>
<td>Phase I</td>
<td>By University of Oxford in the UK and NIAID, USA</td>
<td>January 2015</td>
<td>VSV-EBOV</td>
<td>Phase III</td>
<td>By US CDC and MOH Sierra Leone in Freetown, Sierra Leone</td>
<td>April 2015 – Cluster based, non-blinded, individually randomized trial design. As of 18 June, approximately 6 000 frontline workers had been enrolled with half of them vaccinated.</td>
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<td></td>
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<td>TBD, Kenya</td>
<td>Second half of 2015</td>
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<td></td>
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<td>Recombinant protein Ebola vaccine candidate Novavax</td>
<td>Phase I</td>
<td>Australia</td>
<td>February 2015</td>
<td>VSV-EBOV</td>
<td>Phase III</td>
<td>By US CDC and MOH Sierra Leone in Freetown, Sierra Leone</td>
<td>April 2015 – Cluster based, non-blinded, individually randomized trial design. As of 18 June, approximately 6 000 frontline workers had been enrolled with half of them vaccinated.</td>
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<tr>
<td>ChAd3-ZEBOV GlaxoSmithKline and PHAC</td>
<td>Phase II</td>
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<td>TBD, Nigeria</td>
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<tr>
<td>VSV-EBOV NewLink Genetics and Merck Vaccines USA</td>
<td>Phase III</td>
<td>By WHO, Médecins Sans Frontières (MSF) and Government of Guinea in Conakry, Guinea</td>
<td>April 2015 – Ring vaccination trial design. As of 17 July, 103 rings comprising approximately 4 000 volunteers have been vaccinated.</td>
<td>VSV-EBOV</td>
<td>Phase III</td>
<td>By US CDC and MOH Sierra Leone in Freetown, Sierra Leone</td>
<td>April 2015 – Cluster based, non-blinded, individually randomized trial design. As of 18 June, approximately 6 000 frontline workers had been enrolled with half of them vaccinated.</td>
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rVSV-ZEBOV

• In a major trial in Guinea in 2015, the vaccination rVSV-ZEBOV proved to be highly protective.
• It is not yet licensed but is being used under expanded access or “compassionate use.”
• It is protective against the Zaire strain of the Ebola virus.
rVSV-ZEBOV

• Ring vaccination is defined and performed using the following criteria once a patient is confirmed through lab testing:
  – Those who lived in the same household as the patient in the past 21 days or had close contact.
  – Contacts of these previously mentioned contacts, including neighbors and family.
  – Health care workers and frontline workers who are in contact with Ebola patients.
Second Vaccine

• Beginning in mid-October
• 2-dose course, 56 days apart
• Will complement the rVSV-ZEBOV vaccine
• Ring vaccination
Contact tracing finds new cases quickly so they can be isolated to stop further spread.
Ebola Monitoring

- **Step 1:** ISDH is notified by the CDC that a traveler from an Ebola-affected area is entering the state.
- **Step 2:** ISDH notifies LHD, and they take over monitoring.
- **Step 3:** Traveler is monitored for 21 days.
- **Step 4:** Traveler takes follow-up survey.
Ebola Monitoring

- The CDC and the Department of Homeland Security’s Custom and Border Protection (CBP) performs entry screening at U.S. airports that receive travelers from affected areas.
Ebola Monitoring

• Exit screening in countries with Ebola outbreaks:
  1. All travelers have their temperature taken, answer questions about their health and exposure history, and are visually assessed for signs of potential illness.
  2. Travelers with symptoms or possible exposures are separated and assessed further.
  3. Assessment determines whether they are allowed to travel or not allowed to travel on a commercial flight and referred to public health authorities.
• Astute IPs call with suspect cases.
Recent Outbreaks

2014 – 2016
Guinea
Liberia
Sierra Leone

2018 – 2019
Democratic Republic of the Congo
### Recent Outbreaks

#### Ebola Numbers

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
<th>Deaths</th>
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<tr>
<td>2014-2016</td>
<td>28,616</td>
<td>11,310</td>
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<td>2018-2019</td>
<td>3,287</td>
<td>2,192</td>
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</tbody>
</table>

*Numbers current as of November 14, 2019*
Identify, Isolate, Inform: Emergency Department Evaluation and Management of Patients Under Investigation for Ebola Virus Disease

1. Identify exposure history:
   Has patient lived in or traveled to a country with widespread Ebola transmission or had contact with an individual with confirmed Ebola Virus Disease within the previous 21 days?
   - NO: Continue with usual triage and assessment
   - YES

2. Identify signs and symptoms:
   Fever (subjective or ≥100.4°F or 38.0°C) or Ebola-compatible symptoms: headache, weakness, muscle pain, vomiting, diarrhea, abdominal pain, or hemorrhage
   - NO
   - YES
   - A. Continue with usual triage and assessment
   - B. Notify relevant health department
   - C. Monitor for fever and symptoms for 21 days after last exposure in consultation with the relevant health department

3. Isolate and determine personal protective equipment (PPE) needed
   Place patient in private room or separate enclosed area with private bathroom or covered, bedside commode. Only essential personnel with designated roles should evaluate patient and provide care to minimize transmission risk. The use of PPE should be determined based on the patient's clinical status:
   - Is the patient exhibiting obvious bleeding, vomiting, copious diarrhea or a clinical condition that warrants invasive or aerosol-generating procedures (e.g., intubation, suctioning, active resuscitation)?
   - NO: Continue with usual triage and assessment
   - YES:
     - A. Use PPE designated for the care of hospitalized patients
       [Link to CDC guidance]
     - B. If the patient requires active resuscitation, this should be done in a pre-designated area using pre-designated equipment.

4. Inform
   - YES
   - A. IMMEDIATELY notify the hospital infection control program and other appropriate staff
   - B. IMMEDIATELY report to the health department

5. Further evaluation and management
   - A. Complete history and physical examination; decision to test for Ebola should be made in consultation with relevant health department
   - B. Perform routine interventions (e.g., placement of peripheral IV, phlebotomy for diagnosis) as indicated by clinical status
   - C. Evaluate patient with dedicated equipment (e.g., stethoscope)

Developed in collaboration with American College of Emergency Physicians and Emergency Nursing Association

• Indiana used direct active monitoring with individuals traveling to Indiana from Ebola-affected areas.
• All travelers were monitored for 21 days upon arrival in Indiana.
• Travelers were required to FaceTime LHD or ISDH staff two times every day while taking their own temperature and reporting symptoms.
Ebola Outbreak 2018 – 2019

• Outbreak was declared on August 1, 2018.
• This time, travelers do not have to FaceTime LHD or ISDH staff, but they are required to enter their temperature and symptoms into REDCap twice every day for 21 days.
• Exception to the rule: health care workers who have direct contact with Ebola patients must still check in with FaceTime.
Ebola Outbreak 2018 – 2019

- 217,000+ people have been vaccinated against Ebola in the Democratic Republic of the Congo (DRC).
- 91 million travelers have been screened at health checkpoints in the outbreak area, airports, and land borders in the DRC for signs of illness.

Contact

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Thank You!