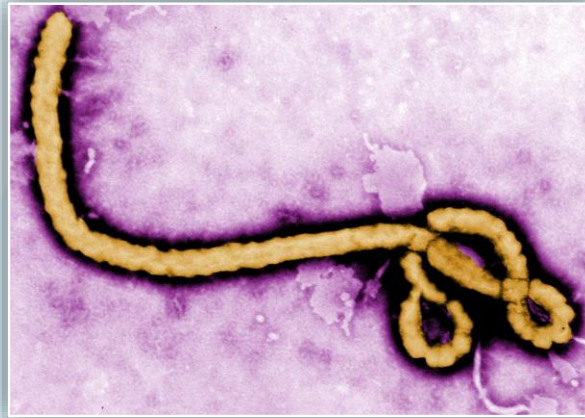


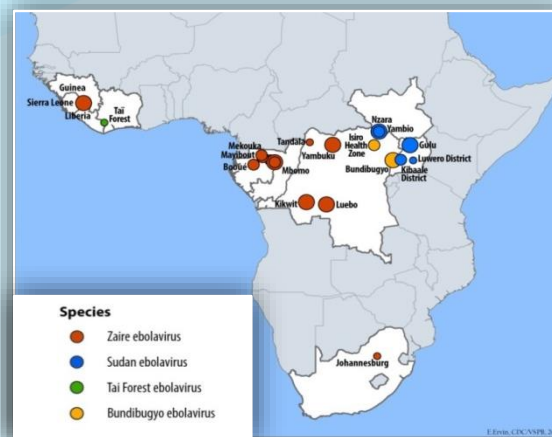
# Lessons Learned from Ebola in the United States



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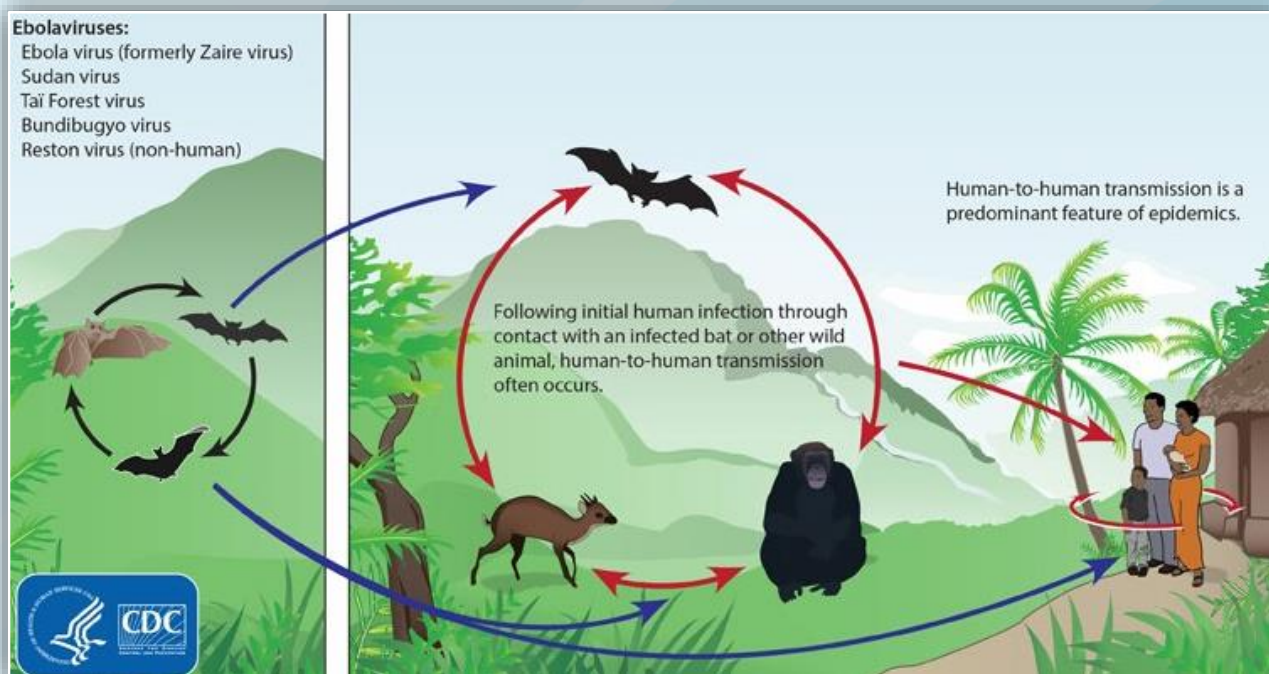
# Ebola Virus

- ❑ Prototype Viral Hemorrhagic Fever Pathogen
  - Filovirus: enveloped, non-segmented, negative-stranded RNA virus
  - Severe disease with high case fatality
  - Absence of specific treatment or vaccine
- ❑ >20 previous Ebola and Marburg virus outbreaks
- ❑ 2014 West Africa Ebola outbreak caused by *Zaire ebolavirus* species (five known Ebola virus species)

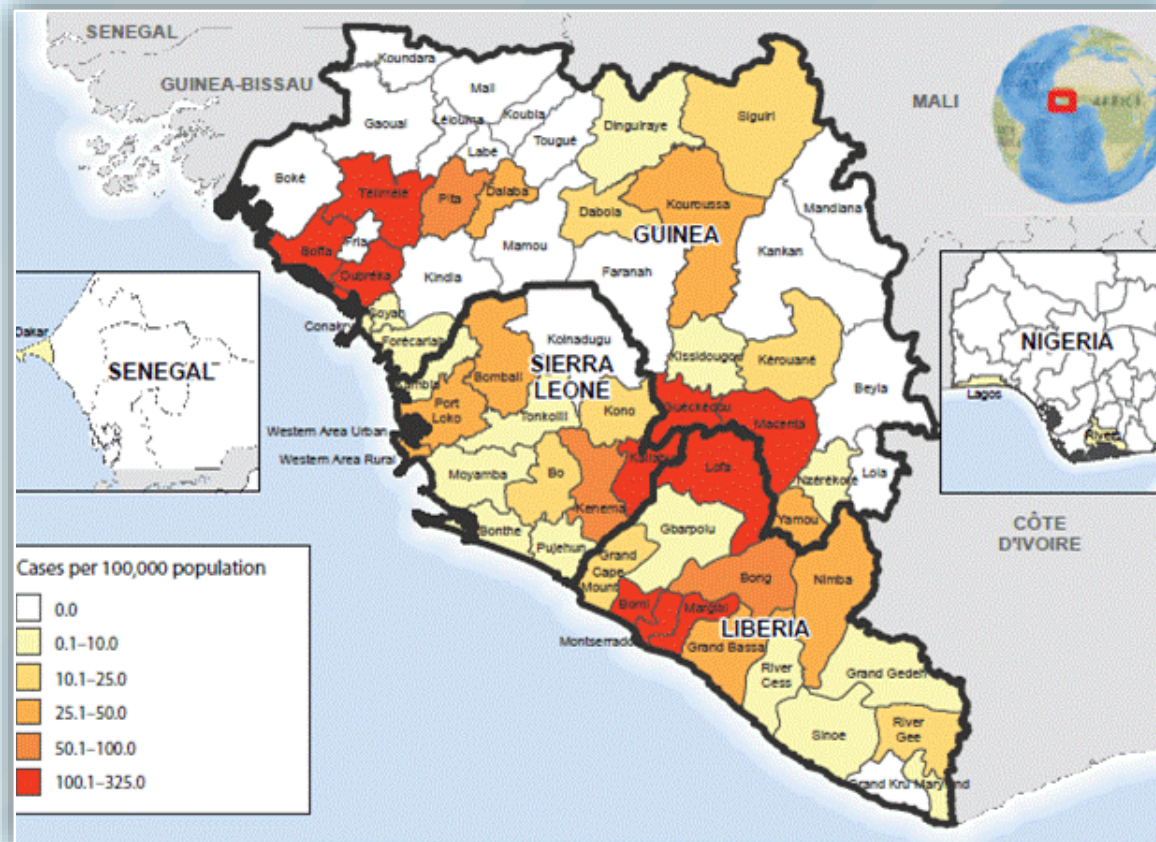


# Ebola Virus

- ❑ Zoonotic virus – bats the most likely reservoir, although species unknown
- ❑ Spillover event from infected wild animals (e.g., fruit bats, monkey, duiker) to humans, followed by human-human transmission



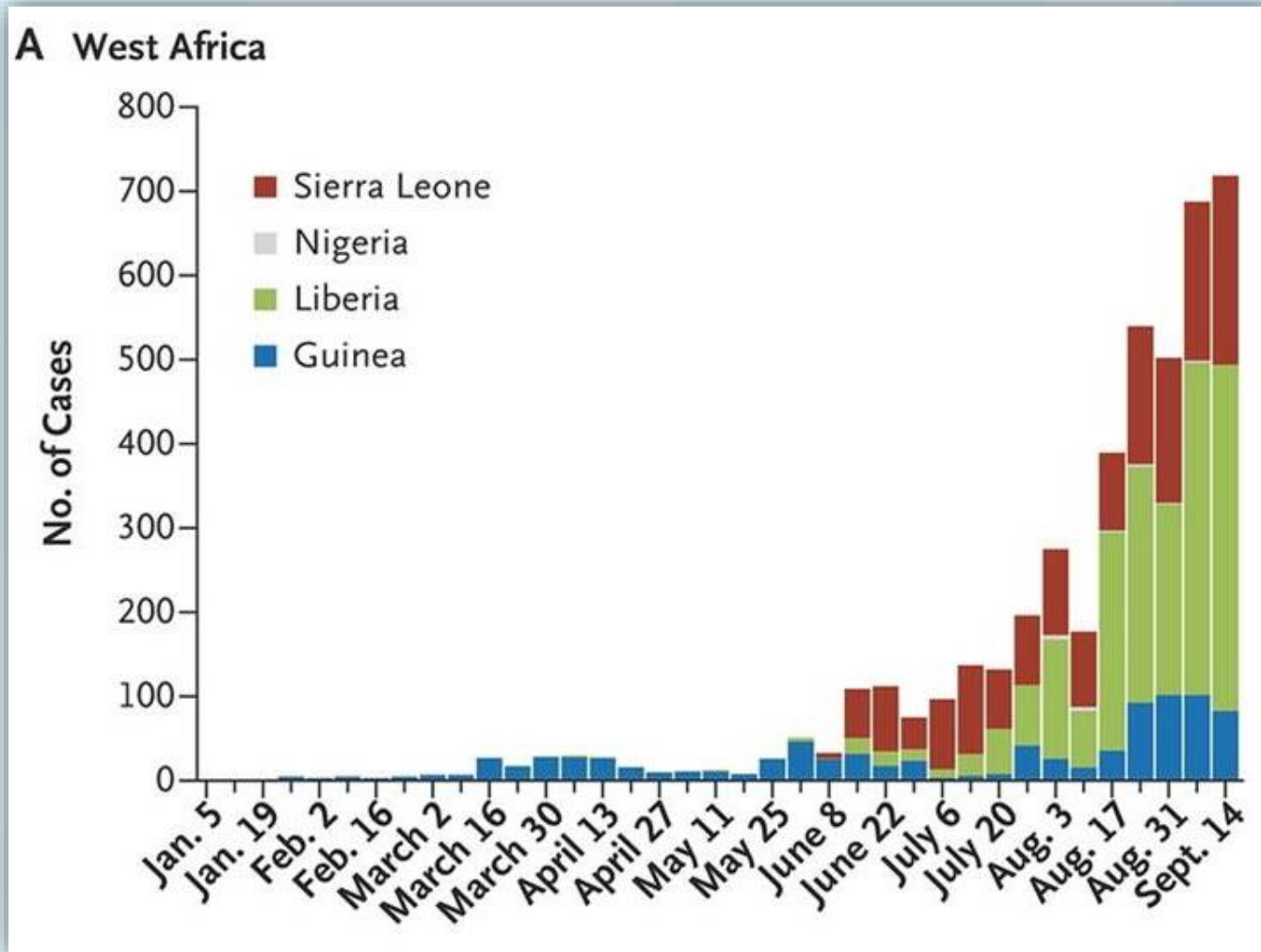
**Figure.** Ebola virus disease (EVD) cumulative incidence\* — West Africa, September 20, 2014



\* Cumulative number of reported EVD cases per 100,000 persons since December 22, 2013.  
MMWR 2014;63(Early Release):1-2



# 2014 Ebola Outbreak, West Africa



WHO Ebola Response Team. *N Engl J Med* 2014. DOI: 10.1056/NEJMoa1411100  
<http://www.nejm.org/doi/full/10.1056/NEJMoa1411100?query=featuredEbola#t=articleResults>

# EVD Cases and Deaths\*

	Total Cases	Confirmed Cases	Total Deaths
Guinea	1,919	1,647	1166
Liberia	6,878	2,562	2,812
Sierra Leone	5,586	4,683	1,187
Nigeria**	20	19	8
Spain	1	1	0
Senegal**	1	1	0
United States	4	4	1
Mali	4	3	3
<b>TOTAL</b>	<b>14,413</b>	<b>8,920</b>	<b>5,177</b>

Updated case counts available at <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html>.

\*Reported by WHO using data from Ministries of Health

\*\*The outbreaks of EVD in Senegal and Nigeria were declared over on October 17 and 19, respectively. A national Outbreak is considered over when 42 days has elapsed since the last patient in isolation became lab negative for EVD.

# Priority Objectives

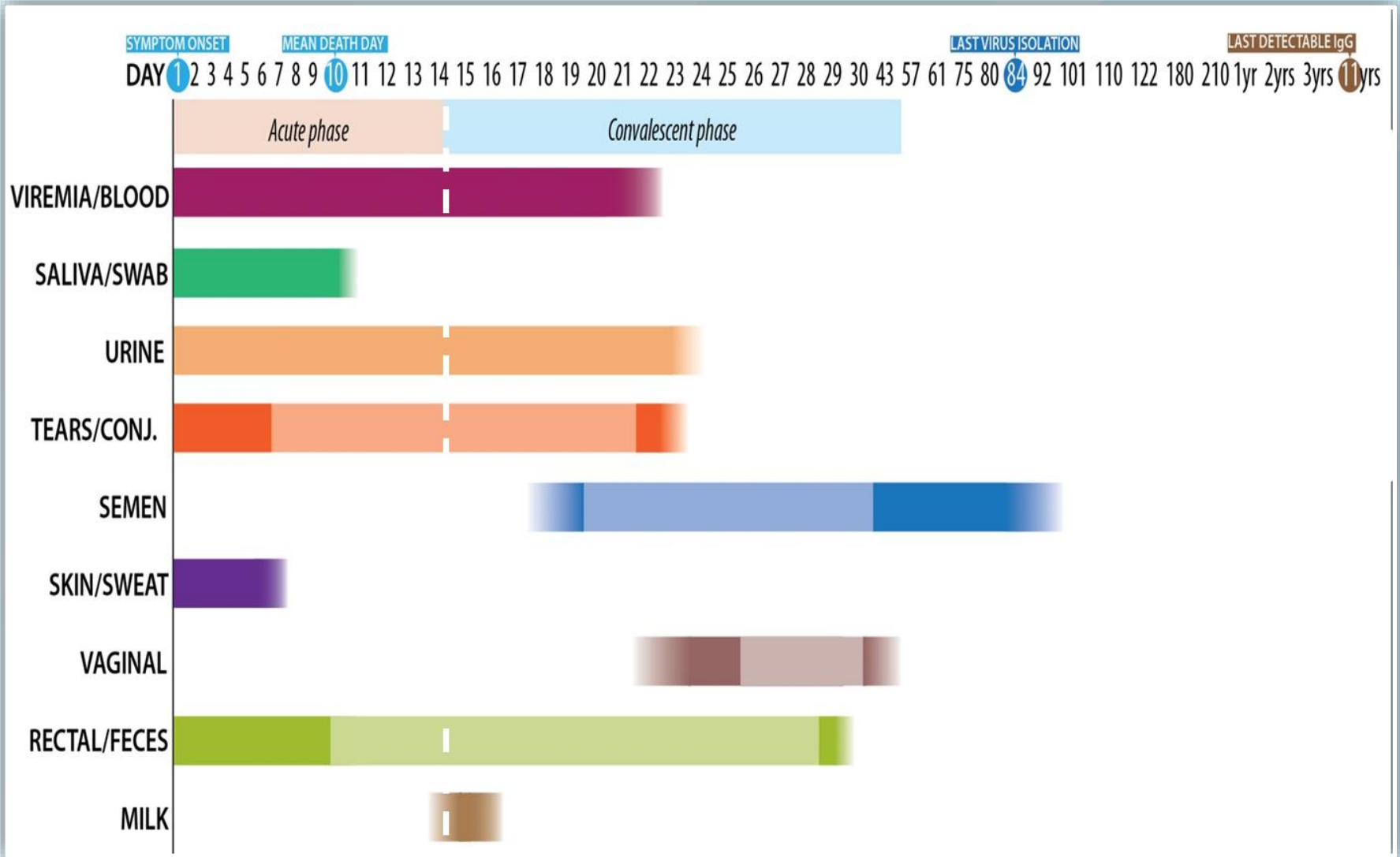
- **Interrupt Ebola transmission in affected countries**
  - Case identification (laboratory), isolation and care
  - Contact identification and monitoring
  - Transmission risk factor identification and mitigation
    - HCW protection and infection control
    - Funeral and burial safe practices
- **Prevent Ebola transmission in other countries**
  - Prevention of cases entering unaffected countries
  - Rapidly detect, control and eliminate Ebola if introduced into a previously unaffected country

# 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



# Human-to-Human Transmission

- ❑ Infected persons are not contagious until onset of symptoms
- ❑ Infectiousness of body fluids (e.g., viral load) increases as patient becomes more ill
  - Remains from deceased infected persons are highly infectious
- ❑ Human-to-human transmission of Ebola virus via inhalation (aerosols) has not been demonstrated

# Data on Airborne Transmission

- Has not been demonstrated in humans
- No evidence of airborne transmission in hospitals or home settings in past Ebola outbreaks
  - People have shared air space with patients and not become infected
  - In Kikwit study, presence of cough in case patients did not predict spread
- Some conflicting animal data

# Transmission to Healthcare Personnel

- The risk is high
- Late stage illness with high viral loads and severe gastrointestinal symptoms increase the risk
- Limited experience with some invasive procedures (blood draws) can increase
- No data on risks during aerosol generating procedures

# Transmission to Healthcare Personnel

- 1995 Kikwit outbreak- 80 cases of HCP contracting Ebola before implementation of proper precautions.
- Only 1 case after implementation of precautions (nurse who reported inadvertently rubbing her eyes with soiled gloves).
- 2007-2008 outbreak in Bundibugyo district, Uganda- 14 HCP infected before implementing precautions, none after.



# Early Clinical Presentation

- ❑ Acute onset; typically 8–10 days after exposure (range 2–21 days)
- ❑ Signs and symptoms
  - Initial: Fever, chills, myalgias, malaise, anorexia
  - After 5 days: GI symptoms, such as nausea, vomiting, watery diarrhea, abdominal pain
  - Other: Headache, conjunctivitis, hiccups, rash, chest pain, shortness of breath, confusion, seizures
  - Hemorrhagic symptoms in 18% of cases
- ❑ Other possible infectious causes of symptoms
  - Malaria, typhoid fever, meningococemia, Lassa fever and other bacterial infections (e.g., pneumonia) – all very common in Africa

# **Ebola Infection Control Guidance for Hospitals Treating Patients with Ebola**

# Early Identification is Essential

- Both for infection control and for patient care
- Need to screen for Exposure risk:
  - Contact in the past 21 days with either confirmed or suspect Ebola patients
  - Residence in—or travel to—an area where Ebola transmission is currently active including Liberia, Sierra Leone and Guinea
- AND symptoms:
  - Fever or any Ebola-compatible symptoms: fatigue, headache, weakness, muscle pain, vomiting, diarrhea, abdominal pain, or hemorrhage



# **Hospital Management of Patients with Ebola in the U.S.**

- Experience in the U.S. indicates that care of patients with confirmed Ebola virus disease is best done in hospitals that are well prepared, equipped and supplied to do this
- This is not every US hospital, but a select group of hospitals
- Federal partners are currently collaborating with state and local public health officials to determine where Ebola care can be most effectively and safely delivered
- Will focus training and support

# **Ebola Hospital Management Plan**

## **Key Considerations**

- Facility manager who develops the plan and oversees implementation and readiness.
- Plan for patient placement- identifying a room that allows for separate space to put on and remove PPE.
- Plan for very limited staff who will provide care.
- Plan for training of healthcare personnel to put on and take off PPE.
- Plan for necessary supplies, especially PPE.
- Plan for lab testing
- Plan for environmental cleaning
- Plan for waste management



# Personal Protective Equipment for Care of Patients Hospitalized with Ebola

## PPE for Management of Hospitalized Ebola Patients:

- 1 Single use, disposable face shield, surgical hood extending to shoulders, and N95 Respirator OR PAPR with a full face shield, helmet, or headpiece (not shown)
- 2 Single use, disposable, fluid-resistant or impermeable gown that extends to at least mid-calf OR coverall without integrated hood (not shown)
- 3 Two pairs of single use, disposable gloves w/ extended cuffs
- 4 Single use, disposable, fluid-resistant or impermeable apron that covers the torso to the level of the mid-calf (optional)
- 5 Single use, disposable, fluid-resistant or impermeable boot covers that extend to at least mid-calf



# Why A Respirator?

- Ebola is NOT transmitted via an airborne route
- However, experience in caring for patients with Ebola in the US indicates that patients might require aerosol generating procedures (e.g. intubation) and the need for these procedures could develop unexpectedly
- Because Ebola PPE is time-consuming and challenging to put on and remove, the guidance recommends that people entering the room wear PPE that would protect them even if an aerosol generating procedure had to be done

# Respiratory Protection

- Two options:
  - Fit-tested, NIOSH certified N95 respirator
  - Powered air purifying respirator (PAPR)
- Both have been used to safely care for Ebola patients in the US.
- Both have been used for decades to safely care for patients with true airborne diseases (e.g. tuberculosis).
  - Including during aerosol generating procedures

# Personal Protective Equipment (PPE)

- Most staff are not accustomed to using these PPE
- Putting on PPE properly is challenging
- Taking it off without contaminating yourself is very challenging
- Staff will need training and practice, practice, practice
- CDC recommends that putting and taking off PPE always be supervised by an observer who is experienced in PPE and well trained on the facility's PPE

# Personal Protective Equipment

- Guidance and videos for putting on and taking off PPE are available to help with training
- No substitute for hands-on practice
- Videos are guides. You might have differences in your procedures based on your experience and practice





# Some Key Lessons Learned About PPE for Ebola

- Critical to have a trained observer monitor all steps of putting on and removing PPE
  - Can also be helpful to have an assistant to help with removal, especially with the PAPR
- Important to inspect and decontaminate PPE before removal
- Frequent hand hygiene during removal reduces risks of contamination
- More PPE is not always better
  - Adding extra layers or taping PPE can actually increase the risk of contamination during removal



# Disinfection of the Patient Care Area

- Daily cleaning of high-touch surfaces (e.g. bed rails) should be done by the clinical care team to minimize the number of people who must enter the room
- Terminal cleaning should be done by staff with training and experience in environmental services and trained to wear the same PPE that patient care staff wear
- Disinfectants - Ebola is an enveloped virus and many products are highly effective against it
  - Alcohol based hand rubs.
  - Any EPA registered disinfectant or wipe with a label claim against “non-enveloped viruses” (e.g. norovirus)

# Key Points: Healthcare Facility Safety

- Facility leadership provides resources and support for effective prevention precautions
- Designated on-site Ebola site manager oversees precautions
- Make sure there are clear, standardized procedures
- Practice, practice, practice with the personal protective equipment (PPE) you will use
- Make sure there is oversight of practices and putting on and taking off of Personal Protective Equipment

# Ebola Infection Control Setting-Specific Guidance

# Practical Considerations for Evaluating Patients for EVD in the United States

- ❑ CDC encourages all U.S. healthcare providers to
  - Ask patients with symptoms about a history of travel to West Africa in the 21 days before illness onset
  - Know the signs and symptoms of EVD
  - Know the initial steps to take if a diagnosis of EVD is suspected
- ❑ CDC has developed documents to facilitate these evaluations
  - The EVD algorithm for the evaluation of a returned traveler
    - Available at <http://www.cdc.gov/vhf/ebola/pdf/ebola-algorithm.pdf>
  - The checklist for evaluation of a patient being evaluated for EVD
    - Available at <http://www.cdc.gov/vhf/ebola/pdf/checklist-patients-evaluated-us-evd.pdf>



- ❑ **Algorithm - Evaluating Returned Travelers for Ebola, US**
- ❑ **Checklist for Patients Being Evaluated for Ebola in the U.S.**
- ❑ **Emergency Department Evaluation and Management for Patients**
- ❑ **Ambulatory Care Evaluation**

**Identify, Isolate, Inform: Emergency Department Evaluation and Management of Patients with Possible Ebola Virus Disease**

**1 Identify exposure history:**  
No patient tested or is unable to comply with widespread Ebola transmission risk reduction with confirmed Ebola Virus Disease within the previous 21 days?

**NO** Continue with usual triage and assessment

**YES**

**2 Identify signs and symptoms:**  
Few subjective signs or symptoms (e.g., fever, headache, muscle pain, vomiting, diarrhea, abdominal pain, or rash/eruption)

**NO** Continue with usual triage and assessment

**YES**

**Isolate and determine personal protective equipment (PPE) needed:**  
No previous exposure to persons with Ebola virus disease, health care workers, health care personnel, or persons with symptoms of Ebola virus disease (e.g., fever, headache, muscle pain, vomiting, diarrhea, abdominal pain, or rash/eruption)

**NO** Isolate and determine personal protective equipment (PPE) needed

**YES**

**Inform:**  
Is the PPE required for the care of hospitalized patient?  
<http://www.cdc.gov/ebola/symptoms/signs/index.html>


**NO** Is the PPE required for the care of hospitalized patient?

**YES** Is the PPE required for the care of hospitalized patient?

**Further evaluation and management:**  
Complete history and physical examination, decide to test for Ebola based on risk reduction measures with minimal health equipment  
Perform further laboratory testing (e.g., polymerase chain reaction, antibody detection, or nucleic acid detection)  
Isolate patient with tested equipment (e.g., antiseptic)

**U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention**

PHS-2014-008-00001



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Health and Human Services  
Centers for Disease Control and Prevention

# Checklist for Patients & Ebola Virus Disease (EVD)

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### Upon arrival at setting/bridge

- Ask the patient for their first name and date of birth (DOB) / SSN/C
- Determine if the patient has symptoms compatible EVD (fever, muscle aches, weakness, joint aches, vomiting, diarrhea, abnormal pain or hemorrhage)
- Determine if the patient has a potential exposure from traveling to country with widespread ELD
- Assess the patient's current status and determine if the patient is in the 21 days before illness onset

**Ispect their skin for any red compatible rashes**

**Review the patient and ask questions to determine the next steps in the checklist and the Algorithm for Initial Assessment of the Suspected Patient at the Clinic**

[www.cdc.gov/eid/content/patients\\_and\\_visitors/algorithm\\_for\\_initial\\_assessment\\_of\\_the\\_suspected\\_patient\\_at\\_the\\_clinic.pdf](http://www.cdc.gov/eid/content/patients_and_visitors/algorithm_for_initial_assessment_of_the_suspected_patient_at_the_clinic.pdf)

### Low-risk exposures

- Household members of an EVD patient or others who had brief direct contact (e.g., hugging) while with an EVD patient without appropriate PPE
- Health care workers in facilities with EVD patients who have been in care with EVD patients without appropriate PPE

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### Upon initial assessment

- Isolate the patient in single room with a private bathroom and with the door to hallway closed
- Implement standard contact, & droplet precautions
- Notify the facility's Infection Control Program at

• Report to the health department at

### Refer to appropriate personnel

**Refer to a clinician for Patient Protection Measures To Be Used by Healthcare Workers During Movement of Patients from the Clinic to the U.S. Hospital, Including Procedures for Putting On (Donning) and Removing (Doffing) Personal Protective Equipment (PPE)**

[www.cdc.gov/eid/content/patients\\_and\\_visitors/algorithm\\_for\\_initial\\_assessment\\_of\\_the\\_suspected\\_patient\\_at\\_the\\_clinic.pdf](http://www.cdc.gov/eid/content/patients_and_visitors/algorithm_for_initial_assessment_of_the_suspected_patient_at_the_clinic.pdf)

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### Conduct a risk assessment:

#### High-risk exposures

- Percutaneous (e.g., needle sticks) or mucous membrane exposure to blood or body fluids from an EVD patient
- Direct skin contact with skin, blood, or body fluids from an EVD patient
- Percussing blood or body fluids from an EVD patient without appropriate PPE
- Direct contact with a body fluid in a EVD-infected area without appropriate PPE

#### During on-going assessment procedures

- Limit number of personnel present
- Conduct in an airborne infection isolation room
- EVD also classified in the Guidelines for Respiratory Protection: PPE to be used by Healthcare Workers During Management of Patients with Ebola Virus Disease in U.S. Hospitals, including Procedures for Putting On (Donning) and Removing (Doffing) PPE
- [www.cdc.gov/eid/content/patients\\_and\\_visitors/algorithm\\_for\\_initial\\_assessment\\_of\\_the\\_suspected\\_patient\\_at\\_the\\_clinic.pdf](http://www.cdc.gov/eid/content/patients_and_visitors/algorithm_for_initial_assessment_of_the_suspected_patient_at_the_clinic.pdf)

[illegible]

# Emergency Departments

- Important to remember that of roughly 400+ patients in the U.S. who have been evaluated for Ebola, only 1 case has been confirmed in an ED
- Most patients will be found not to have Ebola
- If Ebola is ruled out, all aspects of care, including lab testing, environmental cleaning, and waste management can proceed per normal protocols

# Ebola Emergency Department Management Plan Key Considerations

- Facility manager who develops the plan and oversees implementation and readiness
- Plan for patient placement
- Plan for very limited staff who will provide care
- Plan for training of healthcare personnel to put on and take off PPE
- Plan for necessary supplies, especially PPE
  - Limited supply needed for training and evaluation
  - Likely only will be used for very small number of patients
- Plan for lab testing, environmental cleaning, waste management- special considerations for confirmed cases

# Identify, Isolate and Inform:

## Ebola Guidance for Emergency Department Settings

- Point of entry screening for exposure risks and symptoms is an essential key to safety
  - Signs on entry points asking patients/family to self-identify
  - Triage questions at first interaction

**IDENTIFY**  
**ISOLATE**  
**INFORM**

# Identify, Isolate and Inform:

## Ebola Guidance for Ambulatory, Non-Emergency Department Settings

- Patients should generally not be evaluated for possible Ebola infection in these settings
- Telephone screening can help ensure that symptomatic patients with exposure risks do not unexpectedly come to these settings
- Chances that a patient with Ebola risks will unexpectedly present to one of these clinics is even lower with daily monitoring by health department



U.S. Centers for Disease Control and Prevention

Revised 1/2015 15-203027

<http://www.cdc.gov/vhf/ebola/pdf/ambulatory-care-evaluation-of-patients-with-possible-ebola.pdf>

# Identify, Isolate and Inform:

## **Ebola Guidance for Ambulatory, Non-Emergency Department Settings**

- Avoid direct patient contact, especially if the patient is bleeding, vomiting, or has diarrhea
  - Call Health department, EMS
- If contact is required, staff should wear:
  - Eye protection- e.g. face shield
  - Mouth protection- surgical mask
  - Clothing protection- gown
  - Hand protection- 2 pairs of gloves

# Guidance for EMS

- EMS call centers have incorporated screening questions into 911 calls.
- When there is a potential patient with Ebola, EMS crews are deployed with personal protective equipment (PPE).
  - Following PPE guidance for care of hospitalized patients.

# CDC's Rapid Ebola Preparedness (REP) Teams

- ❑ Provide on-site assessment and support hospitals identified as part of regional planning efforts to help assure they can safely care for Ebola patients.
- ❑ Multi-disciplinary teams visiting hospitals at the request of local and state health
  - Assess ebola-specific infection control plans; focus areas include infection control, worker safety, laboratory safety, environmental safety and waste management
  - Teams offer technical assistance, including facilitating and recommending follow-up training and technical support
- ❑ Facility assessments are ongoing



# Education and Training

- Collaborating across the federal government to enhance healthcare worker training, education, outreach (ASPR, OSHA, NIH, CMS, DoD, HRSA)
- Partnering with numerous professional organizations, public-private partnerships for dissemination
  - Numerous webinars, partner calls daily (>75,000 healthcare workers reached in last 2 weeks alone)
  - The Joint Commission Webinar: Oct 30
  - Live event in NYC on Oct 21<sup>st</sup>, LA on Nov 7<sup>th</sup> with frontline healthcare workers
  - Creating training videos for multiple topics (PPE series being released this week)
  - Developing plain language messaging and materials from CDC guidance



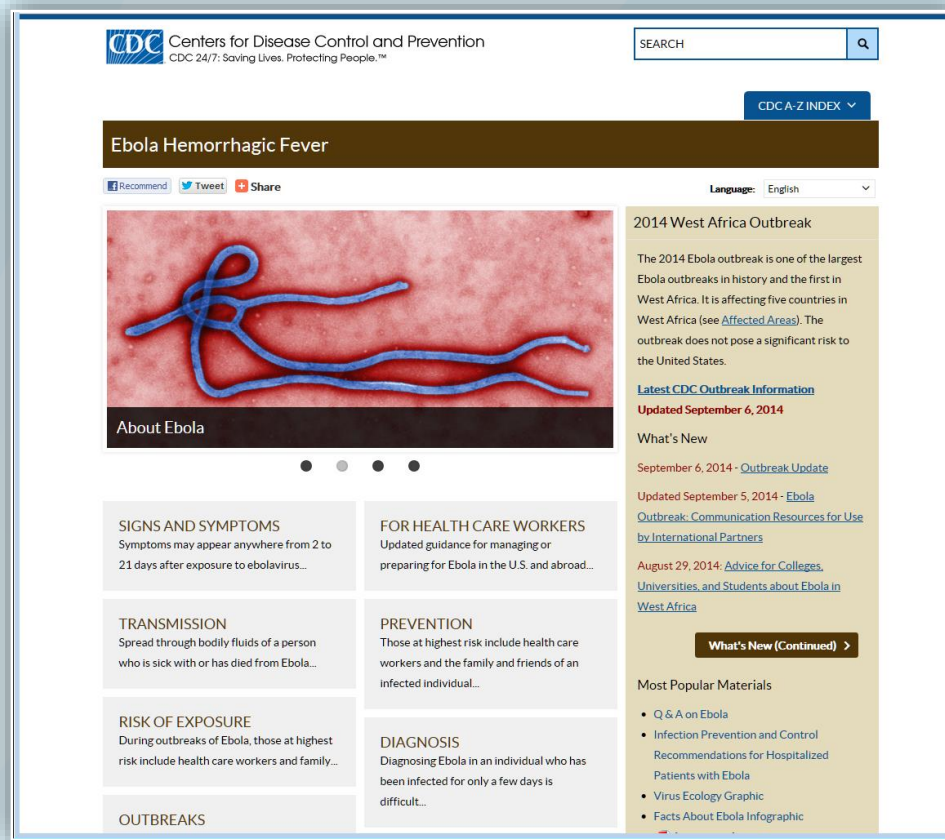
NYC Live Ebola Training Event: 5,400 in-person, 53 news outlets, and 15k-20k in 10 countries on live stream



# Lessons Learned About Ebola and the U.S. Healthcare System

- The care of patients with Ebola virus disease (EVD) in U.S. hospitals is complex and challenging
- It can be done safely and effectively
- It takes really strong quality and safety systems





**For more information, please contact Centers for Disease Control and Prevention**

1600 Clifton Road NE, Atlanta, GA 30333

Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

Visit: [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov) | Contact CDC at: 1-800-CDC-INFO or [www.cdc.gov/info](http://www.cdc.gov/info)

*The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.*



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