HOT TOPICS
Enterovirus D68
Ebola Virus Disease (EVD)

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Severe Respiratory Illness Associated with Enterovirus D68 — Missouri and Illinois, 2014

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On August 19, 2014, CDC was notified by Children’s Mercy Hospital in Kansas City, Missouri, of an increase (relative to the same period in previous years) in patients examined and hospitalized with severe respiratory illness, including some admitted to the pediatric intensive care unit. An increase also was noted in detections of rhinovirus/enterovirus by a multiplex polymerase chain reaction assay in nasopharyngeal specimens obtained during August 5-19. On August 23, CDC was notified by the University of Chicago Medicine Comer Children’s Hospital in Illinois of an increase in patients similar to those seen in Kansas City. To further characterize these two geographically distinct observations, nasopharyngeal specimens from most of the patients with recent onset of severe symptoms from both facilities were sequenced by the CDC Picornavirus Laboratory. Enterovirus D68* (EV-D68) was identified in 19 of 22 specimens from Kansas City and in 11 of 14 specimens from Chicago. Since these initial reports, admissions for severe respiratory illness have continued at both facilities at rates higher than expected for this time of year. Investigations into suspected clusters in other jurisdictions are ongoing.

Of the 19 patients from Kansas City in whom EV-D68 was confirmed, 10 (53%) were male, and ages ranged from 6 weeks to 16 years (median = 4 years). Thirteen patients (68%) had a previous history of asthma or wheezing, and six patients (32%) had no underlying respiratory illness. All patients had difficulty breathing and hypoxemia, and four (21%) also had wheezing. Notably, only five patients (26%) were febrile. All patients were admitted to the pediatric intensive care unit, and four required bilevel positive airway pressure ventilation. Chest radiographs showed perihilar infiltrates, often with atelectasis. Neither
From mid-August to October 10, 2014, a total of 691 people in 46 states and the District of Columbia have been confirmed to have respiratory illness caused by EV-D68.
How does the virus spread?
• Virus in infected person’s respiratory secretions, such as saliva, nasal mucus, or sputum
  – EV-D68 likely spreads person to person when infected person coughs, sneezes, or touches a surface that is then touched by others

What time of the year are people most likely to get infected?
• US: people more likely to get infected with enteroviruses in summer and fall

How common is EV-D68 in the United States?
• Mix of enteroviruses circulates every year
  – Different types of enteroviruses can be common in different years
  – Small numbers of EV-D68 reported regularly to CDC since 1987
  – This year the number of people reported with confirmed EV-D68 infection is much greater than that reported in previous years

Who is at risk?
• In general, infants, children, and teenagers are most likely to get infected with enteroviruses and become ill
  – Do not yet have immunity from previous exposures
  – Adults can get infected with enteroviruses; more likely to have no or mild symptoms
• Enterovirus D68 (EV-D68) is one of more than 100 non-polio enteroviruses
  – First identified in California in 1962

• EV-D68 infection
  – Mild to severe respiratory illness
    • Mild symptoms: fever, runny nose, sneezing, cough, body and muscle aches
    • Severe symptoms: wheezing and difficulty breathing
    • Most cases in children
    • Asthmatics may have higher risk for severe illness
• Consider EV-D68 as possible cause of acute, unexplained severe respiratory illness, even in absence of fever

• Non-polio enterovirus detection
  – Stool or rectal swabs and respiratory specimens (including from the throat)
  – Depending on symptoms, other specimen types (e.g., cerebrospinal fluid, blister fluid, blood) can be tested

• A positive laboratory test for non-polio enteroviruses from certain specimens (e.g., rectal or respiratory swab) does not necessarily mean the virus is cause of infection
  – Non-polio enteroviruses can be shed for extended period of time after symptoms resolved
How is it diagnosed?

- EV-D68 can only be diagnosed by doing specific lab tests on specimens from a person’s nose and throat.
- Many hospitals, some doctor’s offices can test ill patients to see if they have enterovirus infection.
  - Most cannot do specific testing to determine the type of enterovirus, like EV-D68.
- CDC recommends clinicians only consider EV-D68 testing for patients with severe respiratory illness and when cause is unclear.
• Prioritizing testing of specimens from children with severe respiratory illness
  – Likely many children affected with milder forms of illness
  – Of the specimens tested by CDC, about half have tested positive for EV-D68
    • 1/3 tested positive for an enterovirus or rhinovirus other than EV-D68
  – Almost all the confirmed cases this year of EV-D68 infection have been among children
    • Many of the children had asthma or a history of wheezing
• EV-D68 detected in specimens from five patients who died and had samples submitted for testing
  – Died of, died with, EV-D68?
• CDC has one complete genomic sequence and 6 nearly complete genomic sequences from viruses representing the 3 known strains of EV-D68 causing infection at this time
  – Comparison to previous years shows genetically related strains of EV-D68 detected in previous years in the United States, Europe, and Asia
Infection Prevention Recommendations

• Vigilance about preventing the spread of EV-D68
  – Precautions include Standard, Contact, and Droplet Precautions for the current outbreak of EV-D68
  – Non-enveloped viruses such as EV-D68 may be less susceptible to alcohol than enveloped viruses or vegetative bacteria
    • Alcohol-based hand rub offers benefits in skin tolerance, compliance, and when combined with glove use, overall effectiveness for a wide variety of healthcare pathogens
    • Upon removal and prior to donning gloves, perform hand hygiene using either ABHR or soap and water
  – EV-D68 is a non-enveloped virus, environmental disinfection of surfaces in healthcare settings should be performed using hospital-grade disinfectant with EPA label claim for any of several non-enveloped viruses (e.g., norovirus, poliovirus, rhinovirus)
General protection and prevention:

• Wash hands often with soap and water for 20 seconds
• Avoid touching eyes, nose and mouth with unwashed hands
• Avoid close contact
  • Kissing, hugging, and sharing cups or eating utensils with people who are sick
• Cover coughs and sneezes with a tissue or shirt sleeve, not hands
• Clean and disinfect frequently touched surfaces, such as toys and doorknobs, especially if someone is sick
• Stay home when sick
• There are no vaccines for preventing EV-D68 infections
• Reporting:
  – Providers should report suspected clusters of severe respiratory illness to local and state health departments
  – EV-D68 is not nationally notifiable, but state and local health departments may have additional guidance on reporting
  – Health departments may contact CDC for epidemiologic support
Summary

The Centers for Disease Control and Prevention (CDC) is working closely with the Colorado Department of Public Health and Environment (CDPHE) and Children’s Hospital Colorado to investigate a cluster of nine pediatric patients hospitalized with acute neurologic illness of undetermined etiology. The illness is characterized by focal limb weakness and abnormalities of the spinal cord gray matter on MRI. These illnesses have occurred since August 1, 2014 coincident with an increase of respiratory illnesses among children in Colorado. The purpose of this HAN Advisory is to provide awareness of this neurologic syndrome under investigation with the aim of determining if children with similar clinical and radiographic findings are being cared for in other geographic areas. Guidance about reporting cases to state and local health departments and CDC is provided. Please disseminate this information to infectious disease specialists, intensive care physicians, pediatricians, neurologists, radiologists/neuroradiologists, infection preventionists, and primary care providers, as well as to emergency departments and microbiology laboratories.
GENEVA — The Ebola outbreak in West Africa is “unquestionably the most severe acute public health emergency in modern times,” Dr. Margaret Chan, the director general of the World Health Organization, said Monday. (10/13/14, NYT)
Ebola Virus Disease

• First appeared in 1976
  • Two simultaneous outbreaks (Nzara, Sudan, Yambuku, Democratic Republic of Congo)

• Member of Filoviridae family
  • 5 distinct species
    • Bundibugyo ebolavirus (BDBV)*
    • Zaire ebolavirus (EBOV)*
    • Reston ebolavirus (RESTV)
    • Sudan ebolavirus (SUDV)*
    • Tai Forest ebolavirus (TAFV)

*associated with large EVD outbreaks in Africa
Ebola Virus Disease

• EVD outbreaks occur primarily in remote villages in Central and West Africa, near tropical rainforests
  – Case fatality rate up to 90%; hemorrhage during 2\textsuperscript{nd} week of symptoms
• Fruit bats (\textit{Pteropodidae} family) likely natural host
  – Non-human primates source of infection for humans, not thought to be reservoir but accidental hosts
• Virus transmitted to people from wild animals, then human-to-human transmission
  – Direct contact with the blood or secretions of an infected person
  – Exposure to items contaminated with infected secretions
  – Greatest during later stages of illness, viral load highest
  – \textit{Can spread quickly within health care settings}
    • HCP not wearing appropriate protective equipment (masks, gowns, gloves, googles/face protection)
    • Improper cleaning and disposal of instruments, needles and syringes
Ebola virus Ecology

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

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

Epizootic Cycle
Epizootics caused by ebolaviruses appear sporadically, producing high mortality among non-human primates and duikers and may precede human outbreaks. Epidemics caused by ebolaviruses produce acute disease among humans, with the exception of Reston virus which does not produce detectable disease in humans. Little is known about how the virus first passes to humans, triggering waves of human-to-human transmission, and an epidemic.

Human-to-human transmission is a predominant feature of epidemics.

Following initial human infection through contact with an infected bat or other wild animal, human-to-human transmission often occurs.
Ebola

- **Incubation period**
  - 2-21 days, 8-10 days most common

- **Symptoms**
  - Common
  - Fever (T>101.5°F)
  - Headache
  - Joint and muscle aches
  - Diarrhea, vomiting, abdominal pain
  - Weakness, anorexia
  - Rash*
  - Hemorrhage < 50%*
  - Respiratory distress*

*later stages of illness
<table>
<thead>
<tr>
<th>Timeline of Infection</th>
<th>Diagnostic tests available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within a few days after symptoms begin</td>
<td>• Antigen-capture enzyme-linked immunosorbent assay (ELISA) testing</td>
</tr>
<tr>
<td></td>
<td>• IgM ELISA</td>
</tr>
<tr>
<td></td>
<td>• Polymerase chain reaction (PCR)</td>
</tr>
<tr>
<td></td>
<td>• Virus isolation</td>
</tr>
<tr>
<td>Later in disease course or after recovery</td>
<td>• IgM and IgG antibodies</td>
</tr>
<tr>
<td>Retrospectively in deceased patients</td>
<td>• Immunohistochemistry testing</td>
</tr>
<tr>
<td></td>
<td>• PCR</td>
</tr>
<tr>
<td></td>
<td>• Virus isolation</td>
</tr>
</tbody>
</table>
Prevention

• Avoid contact with the blood or secretions of an infected patient
  • Personal protective equipment: masks, gloves, gowns, goggles
  • Infection prevention measures including complete equipment sterilization and routine disinfection
  • Isolation of patients from contact with unprotected persons
  • Prevent direct contact with bodies of deceased patients
West Africa Ebola 2014 Outbreak

• Severe outbreak in West Africa
  – April 23, 2014:
    • 218 cases/141 deaths in Guinea (26 HCP/16 deaths)
    • 35 cases (6 confirmed) in Liberia
    • 3 cases VHF being investigated in Sierra Leone
  – Difficult to contain
    • Widespread dispersion of cases; moving from rural regions to cities
    • Highly lethal -> fear, anxiety interfere with transmission prevention efforts
  – New strain of Ebola virus, not imported from Central Africa
    • Ebola endemic to Democratic Republic of Congo, Uganda, South Sudan and Gabon (Zaire strain)
    • Guinea cases: 97% similarity with Zaire strain
Countries with Widespread Transmission

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Cases</th>
<th>Laboratory-Confirmed Cases</th>
<th>Total Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea</td>
<td>1350</td>
<td>1097</td>
<td>778</td>
</tr>
<tr>
<td>Liberia</td>
<td>4076</td>
<td>943</td>
<td>2316</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>2950</td>
<td>2593</td>
<td>930</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8376</strong></td>
<td><strong>4633</strong></td>
<td><strong>4024</strong></td>
</tr>
</tbody>
</table>

Countries with Travel-associated Cases

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Cases</th>
<th>Laboratory-Confirmed Cases</th>
<th>Total Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senegal</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Spain</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>United States</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3</strong></td>
<td><strong>3</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

Countries with Localized Transmission

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Cases</th>
<th>Laboratory-Confirmed Cases</th>
<th>Total Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>20</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>19</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>

Case Counts*

*Case counts updated in conjunction with the World Health Organization updates and are based on information reported by the Ministries of Health.

As of October 8, 2014
(Updated October 10, 2014)
Total Cases: 8399
Laboratory-Confirmed Cases: 4655
Total Deaths: 4033

Detailed Case Counts ➜
Detailed Hospital Checklist for Ebola Preparedness

The U.S. Department of Health and Human Services (DHHS), Centers for Disease Control and Prevention (CDC), and Office of the Assistant Secretary for Preparedness and Response (ASPR), in addition to other federal, state, and local partners, aim to increase understanding of Ebola virus disease (EVD) and encourage U.S. hospitals to prepare for managing patients with EVD and other infectious diseases. Every hospital should ensure that it can detect a patient with Ebola, protect healthcare workers so they can safely care for the patient, and respond in a coordinated fashion. Many of the signs and symptoms of EVD are non-specific and similar to those of many common infectious diseases, as well as other infectious diseases with high mortality rates. Transmission can be prevented with appropriate infection control measures.

In order to enhance our collective preparedness and response efforts, this checklist highlights key areas for hospital staff -- especially hospital emergency management officers, infection control practitioners, and clinical practitioners -- to review in preparation for a person with EVD arriving at a hospital for medical care. The checklist provides practical and specific suggestions to ensure your hospital is able to detect possible EVD cases, protect your employees, and respond appropriately.

While we are not aware of any domestic EVD cases (other than two American citizens who were medically evacuated to the United States), now is the time to prepare, as it is possible that individuals with EVD in West Africa may travel to the United States, exhibit signs and symptoms of EVD, and present to facilities.

Hospitals should review infection control policies and procedures and incorporate plans for administrative, environmental, and communication measures, as well as personal protective equipment (PPE) and training and education. Hospitals should also define the individual work practices that will be required to detect the introduction of a patient with EVD or other emerging infectious diseases, prevent spread, and manage the impact on patients, the hospital, and staff.

The checklist format is not intended to set forth mandatory requirements or establish national standards. In this checklist, healthcare personnel refers to all persons, paid and unpaid, working in healthcare settings who have the potential for exposure to patients and/or to infectious materials, including body substances, contaminated medical supplies and equipment, or contaminated environmental surfaces.¹

This detailed checklist for hospitals is part of a suite of HHS checklists currently in development. CDC is available 24/7 for consultation by calling the CDC Emergency Operations Center.
Detailed Hospital Checklist for Ebola Preparedness

• Prepare to detect
• Prepare to protect
• Prepare to respond
EVD

• Role of the environment in transmission has not been established
  – Limited laboratory studies under favorable conditions
    • Virus can remain viable on solid surfaces; concentrations fall slowly over several days
  – Only one study assessed contamination of the patient care environment during an outbreak (Bausch, et al. J Infect Dis. 2007 196(S2): S142-S147)
    • Virus not detected in any of 33 samples collected from sites not visibly bloody
    • Virus detected on a blood-stained glove and bloody intravenous insertion site
  – No epidemiologic evidence of transmission via environment or fomites that could become contaminated during patient care
  – *Given the apparent low infectious dose, potential of high virus titers in the blood of ill patients, and disease severity, higher levels of precaution are warranted to reduce the potential risk posed by contaminated surfaces in the patient care environment*
• Use a US Environmental Protection Agency (EPA)-registered hospital disinfectant with a label claim for a non-enveloped virus (e.g., norovirus, rotavirus, adenovirus, poliovirus) to disinfect environmental surfaces in rooms of patients with suspected or confirmed Ebola virus infection
  – No products with specific label claims against Ebola virus
    • Enveloped viruses such as Ebola are susceptible to broad range of hospital disinfectants used to disinfect hard, non-porous surfaces
    • Non-enveloped viruses are more resistant to disinfectants
    • As a precaution, selection of a disinfectant product with a higher potency than what is normally required for an enveloped virus is being recommended at this time
      – EPA-registered hospital disinfectants with label claims against non-enveloped viruses (e.g., norovirus, rotavirus, adenovirus, poliovirus) are broadly antiviral and capable of inactivating both enveloped and non-enveloped viruses
How long does the Ebola virus persist in indoor environments?

• Based upon what is known regarding the environmental infection prevention of other enveloped RNA viruses, expectation is with consistent daily cleaning and disinfection practices in US hospitals that persistence of Ebola virus in the patient care environment would be short
  – 24 hours considered a cautious upper limit
Are wastes generated during delivery of care to Ebola virus-infected patients subject to any special transportation requirements?

- Yes, wastes contaminated or suspected to be contaminated with Ebola virus must be packaged and transported in accordance with U.S. DOT Hazardous Materials Regulations (HMR, 49 C.F.R., Parts 171-180)

- Once a patient with suspected Ebola Virus Disease (e.g., patients under investigation) is no longer suspected to have EVD or has ruled out for EVD, their waste materials no longer need to be managed as if contaminated with Ebola virus.
Are used health care products that may be contaminated regulated?

- Yes, transport of medical equipment, sharps, linens, and used health care products contaminated or suspected of being contaminated with a Category A infectious substance must comply with the packaging requirements for infectious substances in § 173.196.

What is the correct packaging for a Category A infectious substance?

- Specific requirements for authorized packaging and materials for transporting a Category A infectious substance are listed in § 173.196. Each packaging must meet specific test standards in accordance with § 178.609.
- In general, Category A infectious substances must be triple packed:
  1. primary watertight receptacle,
  2. watertight secondary packaging, and
  3. rigid outer packaging.
PHMSA Provides Guidance for Transporting Ebola Contaminated Items

Department of Transportation Guidance for Transporting
Ebola Contaminated Items, a Category A Infectious Substance

An infectious substance is regulated as a hazardous material under the U.S. Department of Transportation’s (DOT’s) Hazardous Materials Regulations (HMR; 49 C.F.R., Parts 171-180). The HMR apply to any material DOT determines is capable of posing an unreasonable risk to health, safety, and property when transported in commerce. An infectious substance must conform to all applicable HMR requirements when offered for transportation or transported by air, highway, rail, or water. Refer to the Center for Disease Control (CDC) for guidance on handling these agents before transporting them (see http://www.cdc.gov/vhf/ebola/hcp/index.html).

This document provides guidance on DOT regulations regarding the transportation of a Category A infectious substance only and highlights some of the requirements of the HMR, which can affect transportation safety. This document is intended to provide general guidance and does not address many of the specific provisions and exceptions contained in the HMR. It should not be used as a substitute for the HMR to determine compliance.

What is a Category A infectious Substance?

- A Category A infectious substance is a material known or reasonably expected to contain a pathogen, such as Ebola, that is in a form capable of causing permanent disability or life threatening or fatal disease in otherwise healthy humans or animals when exposed to it.

- An infectious substance classification is based on the patient or animal’s known medical history or symptoms, endemic local conditions, or professional judgment concerning the individual circumstances of the source human or animal.
The Ebola Epidemic
A Global Health Emergency

On August 8, the World Health Organization (WHO) Director-General Margaret Chan declared the West Africa Ebola crisis a "public health emergency of international concern," triggering powers under the 2005 International Health Regulations (IHR). The IHR requires countries to develop national preparedness capacities, including the duty to report internationally significant events, conduct surveillance, and exercise public health the epidemic and treat those infected.

Global Governance
The West African Ebola crisis is unique given the virulence, intensive community and health facility transmission patterns, and weak health systems. The WHO director-general's declaration of a public health emergency of international concern underscores the urgency of a coordinated international response and the imperative of raising the capacity of low-income states. The WHO declaration

Fueling disquiet about global justice, 2 US aid workers infected in Liberia were treated with an experimental anti-Ebola antibody prior to being transported to Atlanta. This serum had been previously used only in nonhuman primates. Even though the serum's safety and efficacy remain unknown, it sparked an international controversy. Should US workers receive a drug in extremely scarce supply when Africans are affected in far greater numbers?

Years of civil unrest and weak development have left West Africa with fragile health systems as it faces a crisis. Although the director-general urged international solidarity, global governance once again was weakened from a lack of capacity in developing countries. A sustainable solution to EVD, and other emerging threats, requires binding commitments for funding and technical assistance to build national preparedness capabilities, including surveillance, laboratories, health systems, and rapid response.

a reported case fatality rate of 55%. Infection can cause fever, vomiting, diarrhea, and generalized bleeding as well as death.

Fruit bats likely carry Ebola virus, with humans infected by close contact with infected body fluids and "bushmeat" of primates, forest antelope, wild pigs, and bats. Human-to-human transmission occurs only by close contact with infected body fluids. Importantly, no airborne transmission between humans has been demonstrated. Early EVD symptoms are similar to those of malaria and typhoid fever—as well as endemic hemorrhagic fevers such as Lassa—

Moreover, who should decide whether experimental treatment should be administered? Liberian officials apparently did not approve the use of an investigational drug administered in their territory. National leaders also would need to be part of future decision-making processes for allocating scarce vaccines and medications.

Public Health Countermeasures
Sierra Leone's president captured the state of crisis: "The very essence of our nation is at stake." Without effective vaccines or treatments, West African governments
**WIN**

*Watch:* Ask the appropriate epidemiologic questions

*Isolate immediately*

*Notify:* Communicate immediately as required
Overview

The 2014 Ebola epidemic is the largest in history, affecting multiple countries in West Africa. There were a small number of cases reported in Nigeria and a single case reported in Senegal; however, these cases are considered to be contained, with no further spread in these countries.

On September 30, 2014, CDC confirmed, the first travel-associated case of Ebola to be diagnosed in the United States. CDC and partners are taking precautions to prevent the spread of Ebola within the United States. CDC is working with other U.S. government agencies, the World Health Organization (WHO), and other domestic and international partners and has activated its Emergency Operations Center to help coordinate technical assistance and control activities with partners. CDC has also deployed teams of public health experts to West Africa and will continue to send experts to the affected countries.

October 8, 2014

Outbreak Update

- CDC is implementing enhanced entry screening at five U.S. airports that receive over 94% of travelers from Guinea, Liberia, and Sierra Leone.
- A confirmed case of Ebola has been reported in Spain.
- On September 30, 2014, CDC confirmed the first travel-associated case of Ebola to be diagnosed in the United States. The patient passed away on October 8, 2014.
- New cases continue to be reported from Guinea, Liberia, and Sierra Leone.
- Nigeria and Senegal have not reported any new cases since September 5, 2014, and August 29, 2014, respectively. All contacts in both countries have now completed their 21-day follow up, with no further cases of Ebola reported.

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