EBOLA VIRUS DISEASE – Worldwide Implications

Course # DL-013

The information in this course is from

by

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Approved for 1.0 CE
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Level of Difficulty: Basic

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COURSE NAME  Ebola Virus Disease  COURSE # DL-013

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8. a b c d
9. a b c d
10. a b c d

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According to state regulations, this form must be completed and returned in order to receive CE hours. Your comments help us to provide you with better continuing education materials in the distance learning format. Please circle the number that agrees with your assessment with, with 5 meaning you strongly agree and 1 meaning you strongly disagree.

1. Overall, I was satisfied with the quality of this Distance Learning course.
   5 4 3 2 1

2. The objectives of this Distance Learning course were met.
   5 4 3 2 1

3. The difficulty of this Distance Learning course was consistent with the number of CE hours.
   5 4 3 2 1

4. I will use what I learned from this Distance Learning course.
   5 4 3 2 1

5. The time to complete this Distance Learning course was: _______ hours

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EBOLA VIRUS DISEASE – Worldwide Implications

DL-013
1.0 CE
Level of Difficulty: Basic

Helen Sowers, MA, CLS
Dept. of Biological Science (Retired)
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The information in this course is from http://www.cdc.gov/vhf/ebola/healthcare-us/index.html. Please refer to this reference for further information.

OBJECTIVES:
At the end of this course the participant will be able to
1. Give the host and susceptible mammals of Ebola virus disease
2. Identify the countries involved in the present epidemic
3. List the symptoms of Ebola
4. Describe how Ebola is transmitted
5. Identify the laboratory tests for diagnosis of Ebola
6. Discuss the procedures for prevention of transmission of Ebola
7. Outline the equipment and procedures for personal prevention equipment
8. Summarize the roles of the various healthcare facilities involved in identification, diagnosis, and treatment of Ebola
9. Outline the history of Ebola virus disease
10. Discuss the viral make-up and species of Ebola

INTRODUCTION:
Ebola (Ebola hemorrhagic fever) is a severe disease that is caused by a virus. Ebola is named for the river in Africa where the disease was first recognized in 1976. The exact origin and natural host of Ebola virus are unknown. There are five kinds of Ebola virus named for the places they are associated with. Four cause disease in humans. Ebola-Reston, the only kind that does not cause disease in humans, was brought to the United States in 1989. Monkeys that were brought to a Reston, Virginia research facility had the disease. They were very sick and died. None of the people who worked with the monkeys got sick.

People who get Ebola can have a high fever, body aches, rash, vomiting, and chest pain. They can also go blind, go into shock, and hemorrhage. They can die within one week of catching the virus. There is no vaccine or treatment for Ebola.

In March 2014 an epidemic of Ebola began in West Africa. This distance learning course will cover the history of the epidemic as well as the disease and procedures for caring for patients and preventing the spread of the disease.

EBOLA VIRUS
Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus strains. Ebola can cause disease in humans and nonhuman primates (monkeys, gorillas, and chimpanzees).
Ebola is caused by infection with a virus of the family Filoviridae, genus Ebolavirus. It is single-stranded RNA in filaments or branched filaments. There are five identified Ebola virus species, four of which are known to cause disease in humans: Zaire virus (Zaire ebolavirus), Sudan virus (Sudan ebolavirus), Tai Forest virus (Tai Forest ebolavirus, formerly Cote d’Ivoire ebolavirus), and Bundibugyo virus (Bundibugyo ebolavirus). The fifth, Reston virus (Reston ebolavirus), has caused disease in nonhuman primates, but not in humans.

Ebola viruses are found in several African countries. Ebola was first discovered in 1976 near the Ebola River in what is now the Democratic Republic of the Congo. Since then, outbreaks have appeared sporadically in Africa. See Table 1.

The natural reservoir host of Ebola virus remains unknown. However, on the basis of evidence and the nature of similar viruses, researchers believe that the virus is animal-borne and that bats are the most likely reservoir. Four of the five virus strains occur in an animal host native to Africa.

EBOLA OUTBREAK IN WEST AFRICA

The 2014 Ebola epidemic is the largest in history, primarily affecting the West African countries of Guinea, Liberia, and Sierra Leone. There have been a small number of cases reported in Nigeria and Mali and a single case in Senegal. Two imported cases, including one death, and two locally acquired cases in healthcare workers were reported in the United States. Several other countries reported imported cases.

In March 2014 the Ministry of Health of Guinea reported Ebola fever in four southeastern districts. There were reports of suspected cases in the neighboring countries of Liberia and Sierra Leone. Guinea reported a total of 86 suspected cases including 59 deaths. The Pasteur Institute made a preliminary report of Zaire ebolavirus as the causative agent. By the end of March there were 112 cases and 70 deaths. Over the ensuing months the number of cases in Guinea, Liberia, and Sierra Leone continued to increase, with the fatality rate over 55%.

Various outside organizations including Doctors Without Borders, WHO-led international response organizations, and CDC helped set up Ebola treatment centers, awareness campaigns, and provided equipment. Other organizations provided laboratory diagnostics.

On September 30 a man who had returned from Liberia was first diagnosed with Ebola at Texas Presbyterian Hospital. He died 9 days later. On October 10 a healthcare worker at the hospital developed Ebola and recovered. A second healthcare worker who had cared for the index case developed Ebola and subsequently recovered. On October 23 a case was reported in a medical aid worker who had returned from Guinea. The patient was treated at Bellevue Hospital in New York City and recovered. In addition to these patients, six other U.S. citizens who were diagnosed in Africa were brought to the U.S. for treatment. One died and the other five recovered.

Since November there were 8 cases reported in Mali and 20 in Nigeria. The number of cases in Guinea, Liberia, and Sierra Leone continued to increase. However, the report at the end of January 2015 showed that for the first time since the end of June 2014, there have been fewer than 100 new cases reported in a week in Guinea, Liberia, and Sierra Leone.

As of 3/20/15 the total cases (suspected, probable, and confirmed in the three countries was 24,754 with 10,236 deaths, a 41.4% fatality rate. In addition to the U.S., there were imported cases in four other countries, England, Scotland, Senegal, and Spain. A country is considered to be free of Ebola virus transmission when 42 days (double the 21-day incubation period) has lapsed since the last patient in isolation became laboratory negative for EVD.
EBOLA DISEASE

Symptoms:
Symptoms include: fever, severe headache, joint and muscle pain, weakness, fatigue, diarrhea, vomiting, abdominal (stomach) pain, and unexplained hemorrhage. Symptoms may appear anywhere from 2 to 21 days after exposure to Ebola, but the average is 8-10 days.

Treatment:
No FDA-approved vaccine or medicine (e.g., antiviral drug) is available for Ebola as of this writing. Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness. Recovery from Ebola depends on good supportive clinical care and the patient’s immune response. Symptoms of Ebola and complications are treated as they appear. The following basic interventions, when used early, can significantly improve the chances of survival:
• Providing intravenous fluids and balancing electrolytes
• Maintaining oxygen status and blood pressure
• Treating other infections if they occur
  People who recover from Ebola infection develop antibodies that last for at least 10 years, possibly longer. It is not known if people who recover are immune for life or if they can become infected with a different species of Ebola. Some people who have recovered from Ebola have developed long-term complications, such as joint and vision problems.

Diagnosis:
Diagnosing Ebola in a person who has been infected for only a few days is difficult because the early symptoms, such as fever, are nonspecific to Ebola infection and often are seen in patients with more common diseases, such as malaria and typhoid fever.
However, if a person has the early symptoms of Ebola and has had contact with the blood or body fluids of a person sick with Ebola; contact with objects that have been contaminated with the blood or body fluids of a person sick with Ebola; or contact with infected animals, they should be isolated and public health professionals notified. Samples from the patient can then be collected and tested to confirm infection.
  Ebola virus is detected in blood only after onset of symptoms, most notably fever, which accompany the rise in circulating virus within the patient’s body. It may take up to three days after symptoms start for the virus to reach detectable levels.

Laboratory Tests:

<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 immunoassay</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>

Transmission:
Because the natural reservoir host of Ebola viruses has not yet been identified, the way in which the virus first appears in a human at the start of an outbreak is unknown. However, scientists believe that the first patient becomes infected through contact with an infected animal, such as a fruit bat or primate (apes and monkeys), which is called a spillover event. Person-to-person transmission follows and can lead to large numbers of affected people. In some past Ebola outbreaks, primates were also affected and multiple spillover events occurred when people touched or ate infected primates.

When an infection occurs in humans, the virus can be spread to others through direct contact (through broken skin or mucous membranes in, for example, the eyes, nose, or mouth) with

- Body or body fluids (including but not limited to urine, saliva, sweat, feces, vomit, breast milk, and semen) of a person who is sick with Ebola
- Objects (like needles and syringes) that have been contaminated with the virus
- Infected fruit bats or primates (apes and monkeys)

Ebola is not spread through the air, by water, or in general, by food. However, in Africa, Ebola may be spread as a result of handling bushmeat (wild animals hunted for food) and contact with infected bats. There is no evidence that mosquitoes or other insects can transmit Ebola virus. Only a few species of mammals (e.g., humans, bats, monkeys, and apes) have shown the ability to become infected with and spread Ebola virus.

Healthcare providers caring for Ebola patients and family and friends in close contact with Ebola patients are at the highest risk of getting sick because they may come in contact with infected blood or body fluids, which may be through contact with objects like bedding, clothes, needles, syringes, sharps, or medical equipment. During outbreaks of Ebola, the disease can spread quickly within healthcare settings (such as a clinic or hospital). Exposure to Ebola can occur in healthcare settings where hospital staff is not wearing appropriate personal protective equipment.

Dedicated medical equipment (preferably disposable, when possible) should be used by healthcare personnel who provide patient care. Proper cleaning and disposal of instruments, such as needles and syringes, also are important. If instruments are not disposable, they must be sterilized before being used again. Without adequate sterilization of instruments, virus transmission can continue and amplify an outbreak.

Scientists know that the Ebola virus can stay in semen and in vaginal fluids even after recovery. Scientists continue to study whether and for how long Ebola can be spread through sex. Until more is known, Ebola survivors should not have sex (oral, vaginal, or anal) for at least three months after recovery. If abstinence is not possible, a condom should be used every time.

PREPARATION AND PREVENTION:
Acute care facilities

During the epidemic the CDC developed protocols for hospitals in the United States that might have to treat a patient with Ebola. All U.S. acute care facilities have an important role in preparing to identify, isolate, and evaluate patients under investigation (PUI) for Ebola and promptly inform public health authorities. However, the roles and the preparations required will differ by facility. Acute healthcare facilities can serve one of three roles:

1. Frontline healthcare facility
2. Ebola assessment hospital
3. Ebola treatment center
The capabilities of each are as follows:
Frontline healthcare facility:
- Identify patients with relevant exposure history and Ebola-compatible symptoms
- Isolate patients
- Inform health department
- Initiate testing if low-risk; high risk should be transferred for evaluation and testing
- Staff trained on specimen transport, waste management, Standard Precautions; proficient in donning and doffing personal protection equipment (PPE)

Ebola assessment hospitals
- Evaluate and care for patient for up to 96 hours or until discharged or transferred
- Initiate Ebola testing and transport patient to Ebola treatment center if lab-confirmed Ebola Virus Disease
- Staff trained and proficient in donning/doffing PPE, proper waste management, infection control practices, and specimen transport

Ebola treatment centers
- Care for and manage patient throughout disease process

Personal Protective Equipment (PPE) needs for each facility level:

Since in healthcare settings Ebola virus is spread through direct contact (through broken skin or through mucous membranes of the eyes, nose, or mouth) with blood or body fluids of a person who is sick with Ebola or with objects (needles, syringes, bedding, clothes) that have been contaminated with the virus, all healthcare workers caring for patients with Ebola, PPE with full body coverage including respiratory protection and double gloving is recommended to reduce the risk of contamination. The PPE procedure most likely to result in contamination of the healthcare worker is doffing (taking off) of PPE. There are different personal protection equipment needs for each of these care facilities, as follows:

Frontline healthcare facility
- The use of PPE should be based on the patient’s clinical status
- PPE for clinically stable patients should be sufficient for most patients
- Maintain access to Ebola PPE sufficient for 12-24 hours of patient care, to be used if needed

Ebola assessment hospitals
- The use of PPE should be based on the patient’s clinical status
- Maintain Ebola PPE sufficient for 4-5 days of patient care

Ebola treatment centers
- Maintain Ebola PPE sufficient for at least 7 days of patient care

Outpatient facilities
Most patients with fever and other symptoms coming to an ambulatory care facility don’t have Ebola, but it is important that staff members know how to identify and manage patients who might have Ebola. Staff members should be ready to take three steps: Identify, Isolate, and Inform by doing the following:
- Ask every patient if, in the last 21 days, they traveled to a country with widespread transmission or uncertain control measures (Guinea, Liberia, or Sierra Leone) or had contact with someone with confirmed Ebola.
• If a patient appears to be at risk for Ebola, isolate the patient immediately, avoid unnecessary direct contact, determine personal protective equipment needed, and notify the health department to arrange a transfer to a facility that can further assess the patient.
• Do not transfer the patient without first notifying the health department; these patients should only be transferred to a facility approved by public health authorities.

Clinical Laboratory Testing of Clinical Specimens when Ebola is a concern
Note: for more information see http://www.cdc.gov/vhf/ebola/healthcare-us/laboratories/safe-specimen-management.html

If a patient meets the criteria for persons under investigation for Ebola (has the early symptoms including fever, severe headache, vomiting, diarrhea, abdominal pain or unexplained hemorrhage and has an epidemiological risk factor, had contact with the blood or body fluids of a person sick with Ebola, contact with objects that have been contaminated with the blood or body fluids of a person sick with Ebola, or contact with infected animals), they should be isolated and local and/or state public health authorities notified. A blood specimen is drawn and sent to the indicated Laboratory Response Network laboratory. If it is determined that testing for Ebola virus is indicated, at least 4 mL whole blood collected in a plastic tube and preserved with EDTA is the preferred sample. Specimens should be shipped with refrigerant to maintain 2°-8°C.

CDC considers the risk of acquiring Ebola virus disease or other hemorrhagic diseases through laboratory testing to be low, but not zero risk. Recommended measures to minimize the risk of laboratory transmission include: limiting the number of staff engaged in testing, evaluating, and segregating equipment used for testing and performing testing in a dedicated space. The decision to perform testing in a hospital care laboratory using existing instrumentation, or alternatively, acquiring dedicated point of care instrumentation should be carefully evaluated because of the consequence of testing contaminated blood might lead to core laboratory instruments being removed from service. The planning should include how to mitigate such potential outcomes.

Although laboratory testing for patients for which there is a clinical suspicion of Ebola, or a patient with confirmed Ebola will likely vary, assessment and treatment facilities should consider how they might safely perform the following laboratory tests, if indicated, or, if unable to safely perform specific tests, identify alternative approaches to patient management (e.g., empiric treatments, alternative diagnostic strategies):
• A complete blood count including differential, and platelet count
• Sodium, potassium, chloride, bicarbonate, calcium, blood urea nitrogen, creatinine, and glucose
• Aspartate aminotransferase (AST), alanine aminotransferase (ALT) and total bilirubin
• Coagulation testing, specifically prothrombin (PT) expressed as INR
• Blood culture for bacterial pathogens
• Malarial testing (smear or rapid tests)
• Influenza virus testing
• Respiratory syncytial virus and other respiratory virus testing
• Rapid group A strep testing on throat swabs
• Urinalysis

Ebola treatment hospitals should be able to provide the above tests, as well as additional testing required to manage a patient with Ebola.
SUMMARY:

Ebola virus disease was first described in 1976 at the Ebola River in Africa. It is a very severe disease that is spread by contact with body fluids from an infected person. The Ebola epidemic, which started in the West African countries of Guinea, Sierra Leone, and Liberia in March 2014, presented challenges of control, prevention, and treatment. Several cases were imported to the United States, which led to two secondary cases. The CDC developed procedures for healthcare facilities to prepare for possible cases. These include how to diagnose, treat, and prevent the spread of the disease and who to notify. Laboratories need to be prepared to test patients and to be aware of the consequences of infected blood in their core instruments.

REFERENCES:
<table>
<thead>
<tr>
<th>Year(s)</th>
<th>Country</th>
<th>Ebola subtype</th>
<th>Reported number of human cases</th>
<th>Reported number (%) of deaths among cases</th>
<th>Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>August – November 2014</td>
<td>Democratic Republic of the Congo</td>
<td>Ebola virus</td>
<td>66</td>
<td>49 (74%)</td>
<td>Outbreak occurred in multiple villages in the Democratic Republic of the Congo. The outbreak was unrelated to the outbreak of Ebola in West Africa.</td>
</tr>
<tr>
<td>March 2014 – Present</td>
<td>Multiple countries</td>
<td>Ebola virus</td>
<td>24281</td>
<td>9976</td>
<td>Ongoing outbreak across multiple countries in West Africa. Number of patients is constantly evolving due to the ongoing investigation.</td>
</tr>
<tr>
<td>November 2012 – January 2013</td>
<td>Uganda</td>
<td>Sudan virus</td>
<td>6*</td>
<td>3* (50%)</td>
<td>Outbreak occurred in the Luwero District. CDC assisted the Ministry of Health in the epidemiologic and diagnostic aspects of the outbreak. Testing of samples by CDC’s Viral Special Pathogens Branch occurred at UVRI in Entebbe.</td>
</tr>
<tr>
<td>June – November 2012</td>
<td>Democratic Republic of the Congo</td>
<td>Bundibugyo virus</td>
<td>36*</td>
<td>13* (36.1%)</td>
<td>Outbreak occurred in DRC’s Province Orientale. Laboratory support was provided through CDC/UVRI lab in Uganda. The outbreak in DRC had no epidemiologic link to the near contemporaneous Ebola outbreak in the Kibaale district of Uganda.</td>
</tr>
<tr>
<td>June – October 2012</td>
<td>Uganda</td>
<td>Sudan virus</td>
<td>11*</td>
<td>4* (36.4%)</td>
<td>Outbreak occurred in the Kibaale District of Uganda. Laboratory tests of blood samples were conducted by the UVRI and the CDC.</td>
</tr>
<tr>
<td>May 2011</td>
<td>Uganda</td>
<td>Sudan virus</td>
<td>1</td>
<td>1 (100%)</td>
<td>The Uganda Ministry of Health informed the public a patient with suspected Ebola Hemorrhagic fever died on May 6, 2011 in the Luwero district, Uganda. The quick diagnosis from a blood sample of Ebola virus was provided by new CDC Viral Hemorrhagic Fever laboratory installed at the Uganda Viral Research Institute.</td>
</tr>
<tr>
<td>November 2008</td>
<td>Philippines</td>
<td>Reston virus</td>
<td>6 (asymptomatic)</td>
<td>0</td>
<td>First known occurrence of Ebola-Reston in pigs. Strain closely similar to earlier strains. Six workers from the pig farm and slaughterhouse developed antibodies but did not become sick.</td>
</tr>
<tr>
<td>December</td>
<td>Uganda</td>
<td>Bundibugyo</td>
<td>149</td>
<td>37 (25%)</td>
<td>Outbreak occurred in Bundibugyo</td>
</tr>
<tr>
<td>Year</td>
<td>Location</td>
<td>Virus</td>
<td>Cases</td>
<td>Deaths</td>
<td>Notes</td>
</tr>
<tr>
<td>------------</td>
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</tr>
<tr>
<td>2007</td>
<td>Democratic Republic of the Congo</td>
<td>Zaire virus</td>
<td>264</td>
<td>187 (71%)</td>
<td>Outbreak occurred in Kasai Occidental Province. The outbreak was declared over November 20. Last confirmed case on October 4 and last death on October 10.</td>
</tr>
<tr>
<td>2004</td>
<td>Russia</td>
<td>Zaire virus</td>
<td>1</td>
<td>1 (100%)</td>
<td>Laboratory contamination.</td>
</tr>
<tr>
<td>2004</td>
<td>Sudan (South Sudan)</td>
<td>Sudan virus</td>
<td>17</td>
<td>7 (41%)</td>
<td>Outbreak occurred in Yambio county of southern Sudan. This outbreak was concurrent with an outbreak of measles in the same area, and several suspected EHF cases were later reclassified as measles cases.</td>
</tr>
<tr>
<td>November – December 2003</td>
<td>Republic of the Congo</td>
<td>Zaire virus</td>
<td>35</td>
<td>29 (83%)</td>
<td>Outbreak occurred in Mbomo and Mbandza villages located in Mbomo district, Cuvette Quest Département.</td>
</tr>
<tr>
<td>December 2002 – April 2003</td>
<td>Republic of the Congo</td>
<td>Zaire virus</td>
<td>143</td>
<td>128 (89%)</td>
<td>Outbreak occurred in the districts of Mbomo and Kélé in Cuvette Quest Département.</td>
</tr>
<tr>
<td>October 2001 – March 2002</td>
<td>Republic of the Congo</td>
<td>Zaire virus</td>
<td>57</td>
<td>43 (75%)</td>
<td>Outbreak occurred over the border of Gabon and the Republic of the Congo. This was the first time that Ebola hemorrhagic fever was reported in the Republic of the Congo.</td>
</tr>
<tr>
<td>October 2001 – March 2002</td>
<td>Gabon</td>
<td>Zaire virus</td>
<td>65</td>
<td>53 (82%)</td>
<td>Outbreak occurred over the border of Gabon and the Republic of the Congo.</td>
</tr>
<tr>
<td>2000 – 2001</td>
<td>Uganda</td>
<td>Sudan virus</td>
<td>425</td>
<td>224 (53%)</td>
<td>Occurred in Gulu, Masindi, and Mbarara districts of Uganda. The three most important risks associated with Ebola virus infection were attending funerals of Ebola hemorrhagic fever case-patients, having contact with case-patients in one’s family, and providing medical care to Ebola case-patients without using adequate personal protective measures.</td>
</tr>
<tr>
<td>1996</td>
<td>Russia</td>
<td>Zaire virus</td>
<td>1</td>
<td>1 (100%)</td>
<td>Laboratory contamination.</td>
</tr>
<tr>
<td>1996</td>
<td>Philippines</td>
<td>Reston virus</td>
<td>0</td>
<td>0</td>
<td>Ebola-Reston virus was identified in a monkey export facility in the Philippines. No human infections were identified.</td>
</tr>
<tr>
<td>1996</td>
<td>USA</td>
<td>Reston virus</td>
<td>0</td>
<td>0</td>
<td>Ebola-Reston virus was introduced into a quarantine facility in Texas by monkeys imported from the Philippines. No human infections were identified.</td>
</tr>
<tr>
<td>1996</td>
<td>South Africa</td>
<td>Zaire virus</td>
<td>2</td>
<td>1 (50%)</td>
<td>A medical professional traveled from Gabon to Johannesburg, South Africa, after having treated Ebola-infected patients and having been exposed to the virus. He was hospitalized, and a nurse who took</td>
</tr>
<tr>
<td>Year</td>
<td>Location</td>
<td>Virus</td>
<td>Cases</td>
<td>Deaths</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1996-1997 (July – January)</td>
<td>Gabon</td>
<td>Zaire virus</td>
<td>60</td>
<td>45 (74%)</td>
<td>Occurred in Booué area with transport of patients to Libreville. Index case-patient was a hunter who lived in a forest camp. Disease was spread by close contact with infected persons. A dead chimpanzee found in the forest at the time was determined to be infected.</td>
</tr>
<tr>
<td>1996 (January – April)</td>
<td>Gabon</td>
<td>Zaire virus</td>
<td>37</td>
<td>21 (57%)</td>
<td>Occurred in Mayibout area. A chimpanzee found dead in the forest was eaten by people hunting for food. Nineteen people who were involved in the butchery of the animal became ill; other cases occurred in family members.</td>
</tr>
<tr>
<td>1995</td>
<td>Democratic Republic of the Congo (formerly Zaire)</td>
<td>Zaire virus</td>
<td>315</td>
<td>250 (81%)</td>
<td>Occurred in Kikwit and surrounding area. Traced to index case-patient who worked in the forest adjoining the city. The epidemic spread through families and hospitals.</td>
</tr>
<tr>
<td>1995</td>
<td>Côte d’Ivoire (Ivory Coast)</td>
<td>Tai Forest virus</td>
<td>1</td>
<td>0</td>
<td>Scientist became ill after conducting an autopsy on a wild chimpanzee in the Tai Forest. The patient was treated in Switzerland.</td>
</tr>
<tr>
<td>1994</td>
<td>Gabon</td>
<td>Zaire virus</td>
<td>52</td>
<td>31 (60%)</td>
<td>Occurred in Mékouka and other gold-mining camps deep in the rain forest. Initially thought to be yellow fever; identified as Ebola hemorrhagic fever in 1995.</td>
</tr>
<tr>
<td>1992</td>
<td>Italy</td>
<td>Reston virus</td>
<td>0</td>
<td>0</td>
<td>Ebola-Reston virus was introduced into quarantine facilities in Sienna by moneys imported from the same export facility in the Philippines that was involved in the episodes in the United States. No humans were infected.</td>
</tr>
<tr>
<td>1989-1990</td>
<td>Philippines</td>
<td>Reston virus</td>
<td>3 (asymptomatic)</td>
<td>0</td>
<td>High mortality among cynomolgus macaques in a primate facility responsible for exporting animals in the United States. Three workers in the animal facility developed antibodies but did not get sick.</td>
</tr>
<tr>
<td>1990</td>
<td>USA</td>
<td>Reston virus</td>
<td>4 (asymptomatic)</td>
<td>0</td>
<td>Ebola-Reston virus was introduced once again into quarantine facilities in Virginia and Texas by monkeys imported from the Philippines. Four people developed antibodies but did not get sick.</td>
</tr>
<tr>
<td>1989</td>
<td>USA</td>
<td>Reston virus</td>
<td>0</td>
<td>0</td>
<td>Ebola-Reston virus was introduced into quarantine facilities in Virginia and Pennsylvania by monkeys imported from the Philippines.</td>
</tr>
<tr>
<td>1979</td>
<td>Sudan (South)</td>
<td>Sudan virus</td>
<td>34</td>
<td>22 (65%)</td>
<td>Occurred in Nzara, Maridi. Recurrent</td>
</tr>
<tr>
<td>Year</td>
<td>Location</td>
<td>Virus</td>
<td>Cases</td>
<td>% of Cases</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>1977</td>
<td>Zaire</td>
<td>Zaire virus</td>
<td>1</td>
<td>1 (100%)</td>
<td>Noted retrospectively in the village of Tandala.</td>
</tr>
<tr>
<td>1976</td>
<td>England</td>
<td>Sudan virus</td>
<td>1</td>
<td>0</td>
<td>Laboratory infection by accidental stick of contaminated needle.</td>
</tr>
<tr>
<td>1976</td>
<td>Sudan (South Sudan)</td>
<td>Sudan virus</td>
<td>284</td>
<td>151 (53%)</td>
<td>Occurred in Nzara, Maridi, and the surrounding area. Disease was spread mainly through close personal contact within hospitals. Many medical care personnel were infected.</td>
</tr>
<tr>
<td>1976</td>
<td>Zaire (Democratic Republic of the Congo – DRC)</td>
<td>Zaire virus</td>
<td>318</td>
<td>280 (88%)</td>
<td>Occurred in Yambuku and surrounding area. Disease was spread by close personal contact and by use of contaminated needles and syringes in hospitals/clinics. This outbreak was the first recognition of the disease.</td>
</tr>
</tbody>
</table>

*Numbers reflect laboratory confirmed cases only.

References available from: [http://www.cdc.gov/vhf/ebola/outbeaks/history/chronology.html](http://www.cdc.gov/vhf/ebola/outbeaks/history/chronology.html)
REVIEW QUESTIONS:
COURSE # DL-013
Choose the one best answer

1. The species of Ebola virus that causes the present epidemic in West Africa is
   a. Reston ebolavirus
   b. Sudan ebolavirus
   c. Taï Forest ebolavirus
   d. Zaire ebolavirus

2. The present epidemic is primarily in which three countries?
   a. Guinea, Liberia, and Sierra Leone
   b. Guinea, Mali, and Liberia
   c. Liberia, Sierra Leone, and Nigeria
   d. Sierra Leone, Senegal, and Nigeria

3. Which of the following is not a symptom of Ebola?
   a. fever
   b. stomach pain
   c. jaundice
   d. hemorrhage

4. Which of the following is thought to be the most likely reservoir of Ebola virus?
   a. monkeys
   b. chimpanzees
   c. humans
   d. bats

5. Transmission of Ebola virus disease is by all the following except
   a. blood
   b. mosquitoes
   c. contaminated bedding
   d. vomitus

6. Which of the following is correct in the use of personal protective equipment (PPE)?
   a. Doffing equipment presents more hazard than donning
   b. PPE is used primarily in treatment hospitals
   c. PPE consists of full body coverage including a face-mask
   d. Frontline healthcare facilities need to have PPE sufficient for 4-5 days of patient care

7. In the history of Ebola virus disease in Africa, what year had the worst epidemic before
   the present epidemic?
   a. The Congo in 1995
   b. Sudan in 1976
   c. Uganda in 2000-2001
8. Laboratory tests for the identification of Ebola virus shortly after symptoms begin are all of the following except
   a. IgM ELISA
   b. PCR
   c. IgG antibodies
   d. Antigen-capture enzyme linked immunoassay

9. Which of the following is not in the province of Ebola Assessment Hospitals?
   a. Initiate Ebola testing of possible infected patient
   b. Evaluate and care for patient during entire disease process
   c. Train staff in use of PPE
   d. Transport of specimen

10. The preferred sample for Ebola virus testing is
    a. sputum collected in a sterile tube
    b. 4 ml EDTA whole blood
    c. first voided urine in the morning
    d. serum from clotted blood specimen