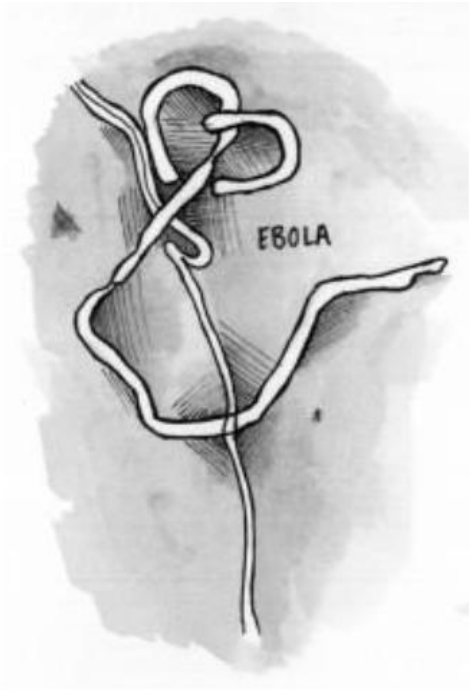
Name: _____

Ebola Epidemic: Student Worksheet

Ebola Virus Disease (EVD), also known as Ebola hemorrhagic fever, is a rare and deadly disease. The 2014 Ebola epidemic is the largest in history, affecting multiple countries in West Africa. Two imported cases, including one death, and two locally acquired cases in healthcare workers have been reported in the United States. Today's activity will help us learn more about Ebola as a disease, as well as the specifics of Ebola epidemic in West Africa.



Part 1: Ebola Jigsaw

A. Each group will go onto the CDC website on EVD, available at the following website: http://www.cdc.gov/vhf/ebola/index.html. If you don't have internet access, your instructor will provide you with paper handouts of the same information. Your group will gather information on your topic, as listed below, to share with students in the other groups. You will have ~15 minutes to gather information on your topic from the CDC site, and other reputable sites (please list your sources). From the information that you gather on your topic, you will have about 1 minute to share with other students, so you will need to decide with your group members what is the most relevant information, writing out key details in the space provided.

Group	Topic
A	General Information
B	Illness and Symptoms
C	Sources of infection and risk factors
D	Diagnosis and detection
E	Treatment
F	Prevention and Control

_____

_____

_____

_____

_____

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B. In groups A-F, count off within your group, 1-4. Form new groups by number (1-4). Each new group should have at least 1 person from each of the topic groups (A-F). Each person should take about 1 minute to share about their topic. Use this information to answer the questions on the next page. Answer each question to the best of your ability based on the information you collected.

1. Is Ebola a bacteria or a virus?

_____

2. How many species of Ebola are there? Do all of the species cause disease in humans?

_____

3. What is the natural host of Ebola virus?

_____

_____

4. List five symptoms of Ebola.

_____

5. How long after exposure to the virus do symptoms appear?

_____

6. Can the virus be spread by someone who is not showing any signs or symptoms?

_____

7. What tools are used to diagnose Ebola?

_____

_____

8. How is the disease transmitted?

_____

_____

9. Is the Ebola virus airborne?

_____

_____

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10. How can Ebola be prevented?

_____

_____

11. Which strain of Ebola is responsible for the current outbreak in West Africa?

_____

12. What countries in West Africa have been affected by the 2014 outbreak?

_____

_____

13. How many total cases of Ebola have been reported in the 2014 outbreak? How many deaths?

_____

_____

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Part 2: Modeling an Epidemic

In this activity, you are going to model how diseases can spread. You will be given a container full of a liquid. One person in the class will have a liquid that is already "infected." You will combine your fluid with three of your classmates and then will use a biotechnology technique called an assay to determine if your sample has been infected. The assay involves the use of a dipstick which changes color based on whether the sample is positive or negative.

1. Examine the liquid in your container. Briefly explain what it looks like by describing the color and clarity. Then indicate the volume (for example, is your container half full, three-quarters full, etc.).

   _____

   _____

2. Pick a classmate and combine the liquid from your two containers into one. This action will cause the liquid to mix. If the infection is present in one liquid, it will spread to the other liquid. After mixing the two liquids, pour half back into the other container. You should each end up with the same volume of liquid as when you started. Record the name of the person you exchanged fluids with below, as well as the color of your liquid after the exchange.

   Person you exchanged fluids with: _____
   Color of your liquid after exchange:_____

3. Repeat the fluid exchange with a different classmate, and record the information below.

   Person you exchanged fluids with: _____
   Color of your liquid after exchange:_____

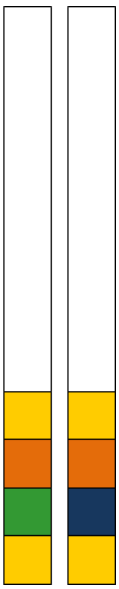
4. Repeat the fluid exchange for a third and final time. Make sure to pick someone you have not already exchanged fluids with. Record the information below.

   Person you exchanged fluids with: _____
   Color of your liquid after exchange:_____

5. You are now ready to conduct an assay to determine if your sample is infected. First, you will want to test the assay to ensure that it works by using a positive and negative control. Your teacher has set up a single positive and negative control for the class. Record the results of the controls below, and write a brief description below each entry of what the results mean.

Instructions for Testing Samples

1. Hold the dipstick by the white plastic and dip the orange end into the sample for 2 seconds.
2. Remove the dipstick and read the results immediately.
3. If the results show a green square at the end of the dipstick, this is a negative result – sample is not infected.
4. If the results show a dark blue square at the end of the dipstick, this is a positive result – the sample is infected.



Name: _____

Positive Control (circle one): Green Square Dark Blue Square

What does this result indicate?

_____
_____

Negative Control (circle one): Green Square Dark Blue Square

What does this result indicate?

_____
_____

6. Now, it is time to test your sample. Follow the instructions shown here, and record the results here:

   Experimental Sample (circle one): Green Square Dark Blue Square

   What does this result indicate?

   _____
   _____

7. Your teacher will ask how many students are infected. Write the total here: _____.

8. How do you think this number might vary if you increased or decreased the number of exchanges? Explain:
   _____
   _____

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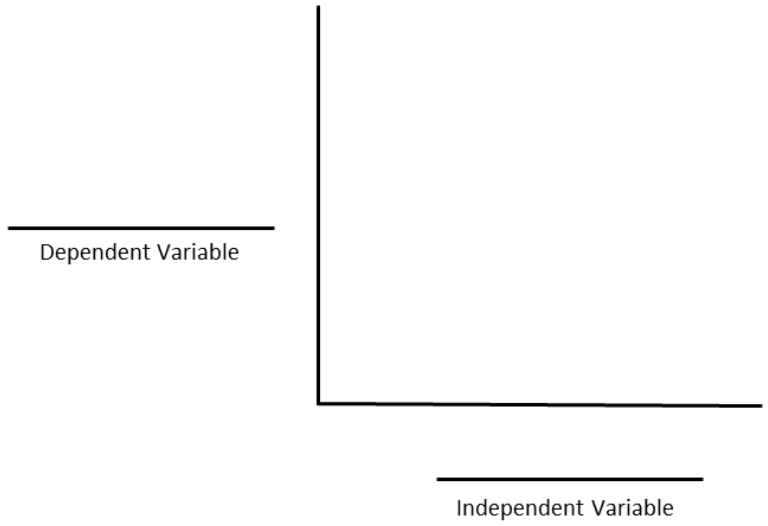
9. The following information was obtained from a class of 25 students who conducted the same experiment but varied the number of exchanges. Graph the data, making sure to label the axes.

Number of Exchanges	Number of Infections
1	2
2	4
3	8
4	14
5	23
6	25
7	24
8	23
9	25
10	25



10. Describe the shape of the curve that you drew.

_____

_____

11. Why does it never exceed 25 infections?

_____

_____

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Part 3: Tracking an Epidemic

Epidemiology is the study of the distribution and determinants of health problems in specified populations and the application of that information to control health problems. In other words, epidemiology is the study of health problems—specifically who they affect, what factors play a role in getting a disease and how to contain it. It is the scientific method of problem-solving used by "disease detectives," which includes epidemiologists, laboratory scientists, statisticians, physicians and other health care providers, and public health professionals. These professionals work to get to the root of health problems in a community, solving issues that range from a measles outbreak on a small college campus to a global influenza pandemic, an increase in homicide in a single community to a national surge in violence, or a localized to widespread rise in cancer.

Like investigators at the scene of a crime, disease detectives begin by looking for clues. They systematically gather information about what happened, asking questions like: who is sick? What are their symptoms? When did they get sick? Where could they have been exposed to the illness? Using statistical analysis, investigators study the answers to these questions to find out how a particular health problem entered a community. The Epidemiological Triangle is a model that scientists have developed to understand infectious diseases and how they spread is the Epidemiological Triangle. The triangle has three corners (vertices):

- **Agent**, or microbe that caused the disease (the "what" of the triangle)
- **Host**, or organism harboring the disease (the "who" of the triangle)
- **Environment**, or external factors contributing to disease transmission (the "where" of the triangle)

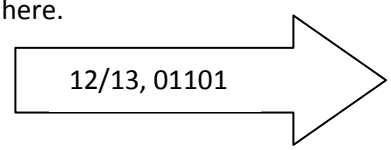
The mission of an epidemiologist is to break at least one side of the triangle, disrupting the connection between the agent, the host, and the environment, and stopping the continuation of the disease.

Instructions

In the previous section of this lesson, you modeled an outbreak of infectious disease. In this portion, you will act as a disease detective, using patient epidemiological reports provided by healthcare workers active on-scene, to track the current outbreak of Ebola Zaire in Guinea to its origin.

Each group will be given 2-3 patient records. Based on the information provided, each group will:

1. Determine the chronology of the outbreak in Guinea. Using the chart below, indicate the date and patient case number on the flag as shown on the sample here.



Date of Onset or Date of Patient Sample	Flag color to use on Ebola Timeline
December 2013	Red
January 2014	Yellow
February 2014	Green
March 2014	Blue

2. Once you have a flag for each patient, place the flags in the correct location on the large wall map of Guinea. For patients that are deceased, label the map with the flags at the location of death

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Based upon discussion of the results with your teacher and fellow classmates, you should be able to answer the following questions.

1. Based on the placement and color of the flags, when and where did the outbreak begin?

_____

_____

_____

2. Can we determine Patient Zero of the outbreak?

_____

_____

_____

3. Using the investigation details provided on the epidemiological report, identify which patients are likely to have aided in the spread of the outbreak from city to city.

_____

_____

_____

4. Briefly outline the spread of the outbreak through Guinea (and beyond).

_____

_____

_____

_____

_____

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5. Briefly outline the spread of the outbreak through Guinea (and beyond).

_____

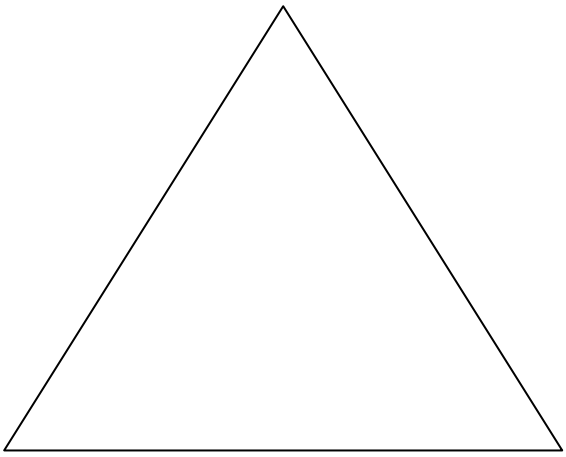
_____

_____

_____

_____

6. Fill in the epidemiological triangle for the Ebola outbreak based on all the information you've been given.



7. As an epidemiologist trying to curb the outbreak, which side of the triangle would you target? Suggest potential strategies to prevent the spread of EVD based on the vertex of the triangle you selected.

_____

_____

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