**Introduction**

In late 2013, an 18 month old boy contracted Ebola most likely from an interaction with a bat. He would pass the disease on to his family and onto other villagers in his remote village in the country of Guinea. This would be the start to one of the worst Ebola epidemics in recorded history. In this activity, you will graph prevalence, incidence and mortality rates for Guinea, Sierra Leone and Liberia, the three hardest hit countries by this epidemic. Using this data you will be able to track the infection as it is transmitted from person to person, across country borders, from the remote villages to crowded city centers.

**Background**

Ebola virus disease or Ebola is caused by one of 6 viruses in the Ebolavirus genus, four of which causes disease in humans. It is thought that one of the main ways it is transmitted initially in an infection is through the interaction of humans with an infected bat. Once an infected bats passes the virus onto humans (a spillover event), it can be transmitted from person to person through contact with blood and body fluids of individuals with Ebola or individuals who have died from Ebola.

**Procedure/Questions**

**Understanding the terminology**

Before beginning to use the data set define the following terminology:

1. Prevalence:
2. Incidence:
3. Mortality:
4. Epidemic:
5. Pandemic:

**Understanding the virus,**

Use the Center for Disease Control’s website on Ebola - <https://www.cdc.gov/vhf/ebola/symptoms/index.html>, to answer the following questions:

1. Give some characteristics of this virus. What does it look like? What type of genome does it have?
2. What are signs and symptoms of Ebola?
3. How many days after exposure do the signs and symptoms begin to appear?

**Graphing the data**

The data set from the CDC originally contained data for mortality and prevalence. Incidence data was calculated by subtracting the total number of cases from the previous date’s total number of cases.

Create graphs using the Data Set West Africa Ebola Epidemic that help you answer the following questions. This data set includes data on the number of cases in each country (prevalence), the number of new cases in each country (incidence) and the number of deaths in each country.

Comparison and Analysis of Graphs:

1. Using the data from all three countries, when was the outbreak the most severe? Does this time frame differ from country to country?
2. Compare graphs of prevalence and incidence. Do they give a different picture of the epidemic?
3. In which country did the outbreak start? How does your graphs show this?
4. In which country did it last the longest? How did you determine this?
5. Which country or countries had the last cases? Is this same country that had the longest disease outbreak?
6. Using the graphs from the individual countries, indicate the order that the countries became involved.
7. Indicate on the graphs, your hypothesis for when the virus moved into a crowded city from the rural setting. Why do you think this is the case?
8. Which country had the most deaths? What is your hypothesis for why this is the case?
9. In the following table you have the final number of cases and the final number of deaths in each country. Calculate the mortality rate in each country and in the three countries combined:

Mortality Rate = (Number of Deaths / Number of Cases) x 100

|  |  |  |  |
| --- | --- | --- | --- |
| Country | Confirmed Cases | Deaths | Mortality Rate |
| Guinea | 3814 | 2544 |  |
| Sierra Leone | 10678 | 4810 |  |
| Liberia | 14124 | 3956 |  |
| All Three Countries Combined |  |  |  |

Which country had the highest mortality rate? Using your graphs, why do you think this was the reason?

Compare the % mortality with the graph of the number of deaths in each country. Does the % mortality tell the same story as the graph of the number of deaths? Which gives you a better picture of the disease in that population?

Why does % mortality give you a better idea of how deadly a disease is than the number of deaths?

1. The outbreak spread to 7 other countries, including the United States. Here is the data from the CDC on the total numbers of cases in each of these countries.

|  |  |  |
| --- | --- | --- |
| Country | Confirmed Cases | Deaths |
| Italy | 1 | 0 |
| Mali | 7 | 6 |
| Nigeria | 19 | 8 |
| Senegal | 1 | 0 |
| Spain | 1 | 0 |
| United Kingdom | 1 | 0 |
| United States | 4 | 1 |

* 1. What is your hypothesis of why these countries did not have a widespread outbreak of Ebola?
  2. Since some of the countries do not directly border Guinea, Sierra Leone and Liberia, How do you think that it arrived in these countries? Could other disease travel around the world in the same manner?

1. Calculate the percent mortality in each of the above countries. How do they compare with Guinea, Sierra Leone and Liberia? Is this a valid comparison? Why or Why not?
2. During this time period, in the United States, there was concern the few cases of Ebola would lead to an epidemic in the United States. Why do you think that this did not occur?