

Name: _____ Period: _____ Date: _____

Environmental Science

#8-9: Infectious Disease Activity MAKE-UP

Introduction

A pneumonia of unknown cause detected in Wuhan, China was first reported to the World Health Organization on December 31st, 2019. Identified as a “novel” (new) coronavirus, it quickly spread out of China, first to Thailand, then Japan, and then the United States on January 21st. As of the beginning of March 2022, there have been over 450 million cases of COVID-19 worldwide, resulting in over 6 million deaths. The disease spreads quickly, possibly because some people have been infected but do not show symptoms, and therefore have not limited their travel or contact with others. It has been predicted that as many as 70% of all people on Earth may eventually become infected with this disease.

In this activity, you will investigate two online simulations of the spread of an infectious disease and then answer the questions below.

Simulation #1: "Measles outbreak in Akron, Ohio"

- Go to the FRED U.S. Measles Simulator here: fred.publichealth.pitt.edu/measles
- Under the “Please select a State...” dropdown menu, select **Ohio**.
- Under the “Please select a City...” dropdown menu, select **Akron, OH**.
- Watch the simulation run. The animation on the left shows a population that is 80% vaccinated, while the animation on the right shows a population that is 95% vaccinated.

Questions for Simulation #1

1. What is the definition of “herd immunity”? How is it demonstrated in the simulation?

2. How do you think the flu vaccine, which is readily available, has prevented flu outbreaks like we’re seeing with COVID-19, even though not everyone gets the flu shot?

Simulation #2: “Spread of Disease”

- Go to the Shodor "Spread of Disease" simulation here: www.shodor.org/interactivate/activities/SpreadofDisease/
- Click the "Start Simulation" button in the upper left corner of the web page and observe what happens as an infectious individual (green sad face 😞) interacts with susceptible uninfected individuals (orange meh face 😐). Allow the simulation to run for several minutes.

Questions for Simulation #2

3. How is this simulation similar to the measles simulation? How is it different?

4. What is the relationship between the number of susceptible individuals and the number of sick individuals in the graph? How is this related to different waves of the same disease, such as the flu or COVID-19?

5. What do the blue happy faces (😊) represent? What happens to them over time? Why do you think this happens?
- Close the graph and click the "Pause Simulation" button, then click the "Reset Simulation" button.
 - Click the "View/Modify Parameters" button below the grid.
 - In the popup window, change one of the percentages for "Sick Rate", "Recovery Rate", or "Susceptibility Rate". Click the "Set" button.
 - Click the "Start Simulation" button and observe the simulation again for several minutes.
6. Which parameter did you change? How much did you change it by? Why did you choose this parameter to change?
7. What happened to the simulation after you changed this parameter? Explain why you think this happened.

Overall Questions

8. Many diseases, such as the common cold, don't have visible symptoms during their most infectious stage. Why do you think this is? What would happen if they did?
9. Why does international air travel increase the risk of a rapidly spreading pandemic? How can this risk be decreased while still allowing for travel?
10. As we saw in Simulation #1, vaccination can prevent the spread of disease, but only if enough of the population (83-94%) gets immunized. However, skepticism about vaccination (aka the "anti-vax movement"), is on the rise in the United States. What are two reasons that people are opposed to vaccination? Do you think these arguments are reasonable? Why or why not?
11. Use online resources to research a disease besides COVID-19 that quickly spread across the planet and turned into a pandemic. What disease did you select, when did it first emerge, what symptoms does it cause, and how many people did it affect?