It's winter break, and Alex has been sick in bed for two weeks. In the middle of the second week he could not stop coughing, so his mom takes him to visit the doctor.

Dr. Ali uses a stethoscope to listen carefully to Alex's breathing. "It looks like you have pneumonia, Alex," she says. "There have been a couple cases of pneumonia in the area, and you may have caught it. We'll swab your throat to see what's going on."

Alex is confused. "What do you mean? Won't you just give me some antibiotics to get better?"

"Pneumonia is a disease that affects your lungs," Dr. Ali explains. "Most often, it's caused by a bacteria or a virus. Bacteria are alive and are made of cells, just like your red blood cells. But viruses aren't cells, and antibiotics aren't effective in treating viral diseases like the flu and some types of pneumonia. We'll have to find out exactly what it is that you have."

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In this unit, you will:

- *Explore phenomena* related to organisms as different as humans, plants, and many microbes that make people sick are all made of cells
- *Gather evidence* about the structures and functions of cells, including microbial, animal, and plant cells and how this information can be used to treat infectious diseases
- *Develop models* of cells
- *Construct explanations* about how cells in animals and plants get the matter and energy they need to survive and grow
- *Investigate* the issue of public health, preventing the spread and the treatment of infectious diseases

1 Disease Outbreak

INVESTIGATION

Different diseases are caused by different factors, such as germs, heredity, or even the environment. **Infectious** (in-FEK-shuss) **diseases** are caused by other organisms. Some of these diseases are passed directly from one person to another. Sometimes more people in an area get an infectious disease than expected. Doctors call this type of event an **outbreak**. How quickly can an infectious disease spread among a group of people? What can be done to stop more people from getting sick? In this activity, you will begin to look for a **pattern**—something that happens in a repeated and predictable way—in the spread of a disease.

GUIDING QUESTION

How do scientists figure out the source of an infectious disease outbreak?

MATERIALS

For each group of four students

- 1 50-mL graduated cylinder
- 1 set of colored pencils

For each student

- 1 9-ounce plastic cup
- paper towels
- graph paper
- 1 Student Sheet 1.1, "Tracking the Disease: Collecting Data"
- 1 Student Sheet 1.2, "Tracking the Disease: Analyzing Data"
- 1 pair of chemical splash goggles

SAFETY

Wear chemical splash goggles while working with the liquids in this activity. Do not touch the liquids or bring them into contact with your nose or mouth. Wash your hands thoroughly if any of the liquids touch your skin and after completing the activity.

PROCEDURE

Part A: Plan Your Day

1. In your group of four, discuss the ways that an infectious disease is spread around a community. Record your ideas in your science notebook.
2. In the table on Student Sheet 1.1, "Tracking the Disease: Collecting Data," fill in the "Place" column by listing the place you will go to on Day 1. Your teacher may assign your first place or let you choose.

Part B: Go Out

Your teacher will guide you through Steps 3–7.

3. Using the graduated cylinder, add 10 mL of water to a clear plastic cup. This liquid will represent the blood and fluids in your healthy body.
4. On Day 1, go to the place you recorded in the table on Student Sheet 1.1.
   a. Roll the number cube, and follow the Action Key below, which tells you which action you will take. Squeeze 2 drops from the bottle labeled for that action into your cup. This represents an action that might expose you to an infectious agent.

Action Key

NUMBER CUBE ROLLS	ACTION
1 or 4	Action 1
2 or 5	Action 2
3 or 6	Action 3

   b. Record the title of the Action in the table on Student Sheet 1.1.
   c. Repeat Steps 4a and 4b two more times.

5. On Day 2, go to your second place, and record the location in the table on Student Sheet 1.1. Repeat Steps 4a–c.
6. On Day 3, go to your third place, and record the location in the table on Student Sheet 1.1. Repeat Steps 4a–c.
7. Did you get sick?
   a. Find out by having your teacher add 2 drops of Disease Indicator to the cup that represents your body. If you have become sick, the solution will change color. If the solution does not change color, you have not become sick.
   b. Record your results.
8. Dispose of your liquid as directed by your teacher.

Part C: Analyze the Results

9. Where did the disease come from? Look for a pattern by following these steps:
   a. With your class, fill out the totals for each location in the table titled "Analyzing the Locations" on Student Sheet 1.2, "Tracking the Disease: Analyzing Data."
   b. From the data in your table, create a bar graph of the number of infected people at each place. If you need help with graphing, use the Bar Graphing Checklist in Appendix C to help you.
      - Be sure to label your bars and axes and to title your graph.
      - If you like, use different colors or shadings in your graph.
   c. On Student Sheet 1.2, record your ideas about the place where you think the infection started.
   d. With your class, fill out the totals for each activity in the tables for "Analyzing the Action" on Student Sheet 1.2.
   e. From the data in the "Analyzing the Action" tables, create a bar graph of infected people who took each action at the place you have hypothesized that the infection started.
   f. **Evidence** is factual information or data that support or refute a claim. With your group of four, discuss your ideas about the source of the disease and the evidence that supports your claim. Then discuss your explanation with the class.

ANALYSIS

1. Use your graph of the class results to answer the following questions.
   a. Where did people get the infectious disease? Describe the evidence that supports this claim.
   b. From what action did people get the infectious disease? Describe the evidence that supports this claim.
   c. How certain are you of your answers to a and b? Explain.
2. Imagine that you are the director of the health department in the town where this disease is spreading. It is your job to help prevent people from getting sick with this disease.
   a. Explain what actions you would recommend to try to end the outbreak.
   b. A **trade-off** is a desirable outcome given up to gain another desirable outcome. What are the trade-offs of your recommendations?
3. Think about the outbreak of the disease in the community compared with just one person getting sick with the disease. What information can you get from the outbreak that you could not get from one sick person?
4. How well did this activity model the spread of an infectious disease? Share your ideas with the class.
5. a. How might knowing more about the cause of a disease help stop its spread?
   b. What questions do you have about the causes of an infectious disease and how it spreads?