

American Society for Microbiology
Education Department
1752 N Street, NW
Washington, DC 20036





Teacher Handout

Outbreak! Investigating Epidemics

Student Prior Knowledge

None required.

Teacher Background Information

Epidemiology works to uncover and explain the factors that determine disease frequency and distribution. In the field of infectious disease, epidemiologists identify infectious agents; determine how they are spread, who gets infected, and the results of infection. This is a difficult task because not only are there different infectious agents, but there are also different environments in which they live, methods by which they spread, methods of invasion into the host, and different host abilities to fight the infectious agent. The possibilities are endless.

In order to answer these questions, scientists, physicians, public health care workers, and countless others combine their skills to accurately and methodically study the spread of a disease through a population. This is important because it helps to prevent the spread of future infectious diseases and limits the emergence of mutations of the disease.

Videopodcast

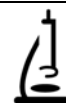
Episode 6 of ASM's *Intimate Strangers Unseen Life on Earth* videopodcast depicts scientists who seek to understand our most personal relationships with the microscopic world and follows a team from the Centers for Disease Control as they investigate an epidemic in the Four Corners area of the United States.

Viewers can access ASM's video podcast online at www.microbeworld.org or subscribe for free by entering ASM's URL feed address — <http://feeds.feedburner.com/asm> — into Apple's iTunes or another podcast receiver such as Juice or Doppler. Detailed instructions on how to subscribe to a podcast feed are available on ASM's MicrobeWorld website under the "Look & Listen" tab.

To directly download the corresponding episode of *Intimate Strangers: Unseen Life on Earth* for this exercise, enter http://libsyn.com/media/flpradio/Episode_6_-_Dangerous_Friends__Frie.mp4 into your browser's address field. For additional information about ASM's video and audio podcasts, please contact Chris Condayan, manager, public outreach, at 202-942-9302 or email condayan@asmusa.org.

Class Time

Approximately one hour class time is required; 15 minutes to watch the videopodcast, and 45 min for the exercise.





Materials and Equipment

A. Before class

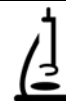
1. filter paper (a coffee filters from the grocery will work just fine)
2. scissors
3. paperclips or small envelopes
4. baking soda
5. water
6. measuring cup
7. red cabbage
8. pot
9. kitchen knife
10. jar or test tubes or paper cups

B. During class

1. *Distribution Record Sheet* and *Data Analysis Questions*
2. strips of paper
3. pen or pencil
4. indicator solution (cabbage juice)

Methods

1. Discuss the concept of epidemiology and how epidemiologists track the spread of disease.
2. Invite the students to think of questions they need to answer in order to identify the source of an unknown infectious disease.
3. Explain the purpose of the Center for Disease Control and Prevention [www.cdc.gov/]and local public health agencies and their efforts to determine how diseases spread.
4. Tell the students that they will be receiving five strips of paper that represent an unknown pathogen (germ) that can be passed from person to person through methods such as touch or the exchange of bodily fluids.
5. Distribute the *Data Analysis Questions*, the *Distribution Record Sheet*, and the strips of paper.
6. Instruct the students to write their initials or names on each of their five strips. NOTE: Because some students may be sensitive that they had, or spread "disease," rather than using their real names, you may suggest that they choose and adopt a fictitious name of a character from Star Wars, Battlestar Galactica, or other popular and contemporary movies.
7. Begin the simulation by telling students to trade one strip with another student. On their *Distribution Record Sheet*, they should write down who they traded with, the name on the strip they gave away and the name of the strip they received.
8. **On the first trade, they have to give away one of their own strips.**
9. **On the following trades, they can give away any of the strips they have (their own or that of someone who has traded with them before), but give away only ONE strip per trade.**
10. As the teacher you decide how many trades or how long you want the trading to continue. There is enough space for eight trades on the *Distribution Record Sheet*, but you can have them trade as few as five times.
11. Once all trading has stopped, ask them to use the indicator solution (red cabbage juice to see who is holding the "infected" strips. **They should dip each strip one at a time because the color**





Supplementary Materials

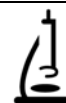
Tips / Suggestions:

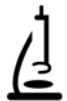
If the students have access to computers, they can play the MedMyst web adventure on cholera that employs some of the same type of epidemiological techniques. See <http://medmyst.rice.edu>.

This is a relatively simple exercise to introduce the concept of epidemics to young students. If you wish, you can make it more elaborated by selecting a particular infectious disease ahead of time. After the exchanges of strips you can discuss its transmission, symptoms, treatment, and prevention, or ask the students to investigate it on their own time and prepare a report.

Answers to Data Analysis (Student Handout)

1. Who was the original source of the epidemic? **This is determined at the end of the exercise**
2. Did you get the infectious disease? **This is determined at the end of the exercise.**
3. Were some people exposed to the infectious disease (microbe) but not infected? **The answer will be affirmative if blank filter paper strips are given along with a few "contaminated" ones in the same envelope. Here you can discuss the concept of asymptomatic infections, and the role of immunity (natural or through vaccines).**
4. How many people in the class were exposed to the microbe? **It varies from group to group.**
5. What factors might have increased the chance of exposure to the microbe?
Here you can discuss proximity (higher probability), time of exposure, infective dose.
6. It was possible to trade with the infected person but not get the disease. How do you think this relates to real life? **See answer to question 3**
7. What do you think would ha9641 0 TD.4 TD.0008 Tc-.0032 Tw[(Se)3.8(e a)6.1(nr5(ed p))Tjruig7H-0 TD.001o8(e a





Instructional Delivery: Process

Teacher Processes:

Learning will be facilitated using a podcast from the American Society for Microbiology, inexpensive hand-on activities, group discussions and individual use of the internet.

Activities:

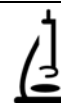
- Discussion
- Thinking skills
 - Analyzing
 - Synthesizing
 - Evaluating
 - Cause-effect
 - Hypothesizing
 - Decision Making
- Performance (written)
- Graphic Organizers
 -

Student Process/Procedures:

Before class, students will play with an internet-based program (MedMyst), or review basic information about the different types of microorganisms on a website from ASM. The MedMyst game consists of a futuristic setting designed for students to learn about pathogenic microbes. During class, students will exchange pieces of paper with one another to simulate the epidemiology of tracking an infectious agent. After this activity, the students should have a better understanding of how infectious agents spread from person to person and ways to prevent outbreaks.

Guided Practice (Check for understanding):

Using their *Distribution Record Sheet* as a "clues map," students should be able to determine who was the first person infected and the path of transmission of the mysterious microbe.





Appendix

1. Extension Activities

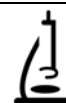
- *Health*: Determine what characteristics can increase the likelihood of contracting an infectious disease.
- *Health*: Discuss what environmental factors can affect the spread of an infectious disease.
- *Language Arts*: Interview a scientist or physician working in the field of epidemiology. Ask them questions about the diseases they study, what they do at work, and what infectious diseases concern them.
- *Mathematics*: Calculate the mortality rate of the epidemic in the class by dividing the number of cases of the disease (assuming it was fatal) by the total number of students in the classroom (population at risk).

2. Useful Books

- Hoff, B.H. and Smith, C., III (2000) Mapping Epidemics: A Historical Atlas of Disease. New York: Franklin Watts.
- Stephen, B.H., et al. (2001) Designing Clinical Research: An Epidemiologic Approach. New York: Lippincott Williams & Wilkins Publishers.
- National Research Council (1996) National Science Education Standards. Washington, DC: National Academy Press.

3. Useful Web sites

- Epidemiology Lessons for Middle and High School Students
<http://www.montclair.edu/detectives/index.shtml>
- Critical Thinking
<http://www.criticalthinking.com/>
- Historical Infectious Diseases
<http://www.rlc.dccd.edu/MATHSCI/reynolds/history/history.htm/>
- History of Epidemics and Plagues
<http://uhavax.hartford.edu/BUGL/histepi.htm/>
- CDC-Epidemiology Teaching Material
<http://www.cdc.gov/excite/index.htm>



Student Handout

Outbreak! Investigating Epidemics

Introduction

The study of how an infectious disease spreads through a population can ultimately lead to the prevention of the disease. An outbreak is about to occur in your classroom. See if you can help in this search for the source of contamination.

Terms and Definitions

Epidemiology - It is the scientific method of problem solving used by "disease detectives" to get to the root of a health problem in the community.

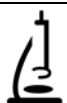
Epidemic - An epidemic occurs when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time.

Outbreak - Many epidemiologists use the term outbreak interchangeably with epidemic. Some restrict the use of epidemic when a large geographic area is affected.

Vaccination - The process of giving a vaccine to humans or animals.

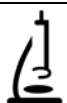
Vaccine - Any preparation of attenuated or killed microorganisms (usually bacteria and some viruses) used to stimulate the immune system to produce antibodies and prevent infectious diseases.

Quarantine - To restrict the activities or movement of people who may be exposed to a disease.



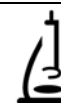
Procedure

1. Pick up the *Distribution Record Sheet* and *Data Analysis Questions* and a group of 5 paper strips.
2. Write your name (real or adopted) or initials on each strip.
3. When the teacher says trading begins, trade one of your strips with another student. Write down whom you traded with, the name on the strip you gave away, and the name on the strip you received on the *Distribution Record Sheet*.
4. **On the first trade, you have to give away one of YOUR strips (one strip per trade).**
5. **On the following trades, you can give away any of the strips that you have (a strip with your name or someone else's who has traded with you).**
6. Your teacher will tell you when the trading period will begin and end.
7. At the conclusion of trading, you will have to place each strip ONE at a TIME in the indicator solution.
8. If one of your strips turns GREEN, it indicates that you have now contracted an infectious disease. The name on the strip is the original source of the infection.
9. Using your *Distribution Record Sheet*



Name: _____

Exchange Number	Name of person you exchanged with	Name on strip of paper you <u>received</u>	Name on strip of paper you <u>gave away</u>
1			
2			
3			
4			
5			
6			
7			
8			



Data Analysis

1. Who was the original source of the epidemic?
2. Did you get infected?
3. Were some people exposed to the infectious disease (microbe) but not infected?
4. How many people in the class were exposed to the microbe?
5. What factors might have increased the chance of exposure to the microbe?
6. It was possible to trade with the infected person but not get the disease. How do you think this relates to real life?
7. What do you think would happen if two people were the original source? What about ten people?
8. What factors affect the amount of exposure to a microbe in real life? Hint--- Does washing your hands affect your exposure? What other things may affect exposure?

