

Super Sleuths

Adapted from: “Super Sleuths” in *Project Wet: Curriculum & Activity Guide*. Bozeman: The Watercourse and the Council for Environmental Education, 1995.

Grade Level: Basic

Duration: 45 minutes

Setting: classroom

Summary: Students search for other students “infected” with the same waterborne disease as them.

Objectives: Students will be able to identify common symptoms of waterborne diseases and describe how they are contracted, transmitted, and prevented.

Vocabulary: waterborne disease, epidemiologist, pathogen, bacteria, protozoan, virus, microorganism, fecal coliform

Related Module Resources:
Additional Modules Resources Fact Sheet:

- “National Primary Drinking Water Standards”
- “Microbes in Drinking Water”
- “EPA: Preventing Waterborne Disease”

Materials (Included in Module):

- 36 envelopes, each containing the symptoms of one waterborne disease [Super Sleuths Module Activity Envelope]
- Waterborne Microorganism Information Sheets
- Water Microorganisms and Illness Map, Worksheet and Answer Key
- Two cups [Main Box]

Additional Materials (NOT Included in Module):

- Tap water source
- Sediment or dirt

ACADEMIC STANDARDS: (ENVIRONMENT AND ECOLOGY)

7th Grade

4.3.7.A Identify environmental health issues.

- Identify diseases that have been associated with poor environmental quality.

10th Grade

4.3.10.A Describe environmental health issues.

- Identify the effects on human health of air, water and soil pollution and the possible economic costs to society.

12th Grade

4.3.12.A Analyze the complexity of environmental health issues.

- Identify environmental health issues and explain how they have been addressed on a worldwide level.

BACKGROUND:

The importance of a clean water supply is usually overlooked by most Americans. We take for granted that fresh, safe water will pour from our faucets, showerheads, and water fountains when we use them. This has not always been the case in the United States and there are still many places worldwide that are unable to depend on a clean source of water. This lack of a clean water supply causes many health problems by creating unsanitary conditions and spreading disease.

Waterborne diseases are contracted by a person after ingesting a **pathogen** in water. The pathogen (a disease-causing microorganism) may infect others after an infected person passes it into the waste stream, which then contaminates the drinking water supply.

About eighty percent of diseases are waterborne diseases. The infecting **microorganisms** may be **bacteria** (unicellular prokaryotes), **protozoan** (unicellular, animal-like member of the Protist kingdom), or **viruses** (microscopic “organisms” that depend on a specific host cell for reproduction). Sight, smell, or taste cannot detect the presence of these organisms, and the water often looks clear. Usually their presence is not noticed until someone gets sick. Common symptoms of waterborne diseases include intestinal problems such as gas, cramps, and diarrhea, which lead to dehydration. These conditions are life threatening to the young, elderly, and malnourished.

Most modern water treatment plants test for waterborne pathogens. Because there are so many waterborne pathogens that are difficult, treatment plants initially test the levels of *Escherichia coli*. *E. coli* is a common bacterium in human intestines that aids in food digestion and is passed out of the body during defecation. For this reason, these bacteria are called **fecal coliforms**. Although not harmful themselves, their presence means that other dangerous microbes may be entering the water through the sewage and those can be of concern. If the level of fecal coliforms is found to be above a certain standard, it indicates more testing needs to be done to make sure the human sewage is being treated fully so that waterborne diseases are not passed through the water supply. If further tests reveal that this is not the case, the amount of treatment may need to be increased or the source of the extra sewage needs to be found to avoid spreading.

Today in the United States, water treatment plants and water supply companies employ effective cleaning techniques most of the time. This was not always the case in the past as Americans suffered from cholera and typhoid fever. These diseases are still a problem in developing countries. Outbreaks of waterborne disease are common and **epidemiologists**, those who study the spread and transmission of diseases, are kept busy tracing the path of transmission back to its source and stopping any further spread.

OVERVIEW:

In this simulation, students will be infected with an unknown disease. They will attempt to find others that have the same symptoms and determine possible causes, transmission paths, and prevention methods.

PROCEDURE:

Teacher Preparation:

1. Locate the two plastic cups, the 36 envelopes containing waterborne disease symptoms, and the Waterborne Microorganism Information Sheets. Collect some dirt or sediment to use during the activity.
2. For the opening demonstration, prepare two glasses of water. Place sediment in one of them.
3. Each student must have a partner (or two) with the same disease. Make sure you have one envelope per student and that no one is left without someone who has the matching symptoms. Use the key to make sure each diseased student has at least one diseased partner.

Student Activity:

1. Ask students to name the world's number one killer waterborne pathogen. After taking responses, explain that thousands of children die each year from diarrhea caused by microorganisms.
2. Ask students where they think these microorganisms come from.

3. Show the students the two glasses of water. Ask them which glass they would prefer to drink. After listening to responses, state that there could be disease-causing microorganisms in either glass. They are impossible to see, smell, or taste.
4. Explain to students that they will each be infected with an unknown disease. They will discover their symptoms one at a time as they pull the symptom cards from the envelope. (The number on the envelope is their patient number and each symptom inside is labeled with the same number in case symptoms are dropped or mixed up.) After reading each new symptom, they should move around the room, talking to others about their symptoms and looking for someone else with the same set of symptoms. Students must wait until the next “round” before pulling another symptom out of their envelope.
5. Continue having students pull out one symptom about every minute until all seven of the symptoms have been read.
6. After finding their partner(s) with the same infection, students should try to figure out 1) how they contracted the disease, 2) how it is transmitted, and 3) how it can be prevented.
7. Provide each set of partners with the appropriate Waterborne Microorganism Information Sheet to check their answers.

Waterborne Disease	Patient Number (on envelope and each symptom)
Shigella	1, 13, 34
Enterotoxigenic <i>E. Coli</i> Gastroenteritis	2, 5, 22
Amebiasis	3, 23, 35
Cyclosporiasis	4, 14, 24
Legionnaire’s Disease	6, 17, 29
Salmonellosis	7, 27, 33
Typhoid fever	8, 19, 30
Sparganosis	9, 12, 32
Giardiasis	10, 21, 31
Cryptosporidiosis	11, 15, 26
Cholera	16, 25, 36
Hepatitis A.	18, 20, 28

DISCUSSION:

1. What are waterborne diseases? What are common symptoms in waterborne diseases?
Common symptoms of waterborne diseases include intestinal problems: gas, cramps, and diarrhea, which lead to dehydration.

2. What is a microorganism? What are some examples of microorganisms? *See the Background section.*
3. Why are waterborne illnesses more problematic and deadly in the developing world? *Sanitation and sewage treatment are not as extensive in many areas of the developing world.*
4. Describe the conditions that promote the spread of waterborne diseases. *There is usually a connection between insufficient drinking water treatment and poor sanitation practices. Sewage is a common contaminant and sewage is what harbors many of the pathogens.*
5. Do water treatment plants test for all waterborne pathogens? If not, what do they test for and what are the steps they go through to determine if water is contaminated? *See the Background section.*

EVALUATION:

- Each student (or set of partners) should make a safety poster about his or her waterborne disease. They should include the source of the disease, information about how it is transmitted, and tips for preventing it.
- Students can complete “Water Microorganism and Illness Worksheet.” To help them, make the Background Information Cards available and/or they can use the safety posters made by other students.
- Discussion questions above.

EXTENSIONS AND MODIFICATIONS:

- Have your students do the Water Microorganisms and Illness Worksheet and use the Answer Key to check their work.
- Plot the outbreaks of waterborne diseases on a world map.
- Have students research outbreaks of waterborne diseases in the United States, both in the past (i.e., cholera and typhoid fever) and more recently (i.e., cryptosporidiosis and giardiasis)

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):

