Search for the Epidemic Source

Adapted from: "Poison Pump", Project WET: Curriculum and Activity Guide. Bozeman: The Watercourse and the Council for Environmental Education, 1995.

Grade Level: Basic, intermediate

Duration: 30-50 minutes

Setting: Classroom

Summary: Students will attempt to solve a mysterious epidemic that spread through London in 1854

Objectives: Students will apply investigative methods used by epidemiologists to trace the source of a contagious disease (chlorea).

Vocabulary: epidemic, waterborne, bacteria

Related Module Resources:
- Microorganism Information Sheets [Binder-bacteria Section]
- FOLDER: Bacteria section
- Books

Materials (Included in Module):
- Student activity sheet, Broad Street Area Map
- Copies of Victim Cards
  Copies of Clue cards

ACADEMIC STANDARDS:

7th Grade

4.3.A Identify environmental health issues.
- identify diseases that have been associated with poor environmental quality

10th Grade

4.3.B Explain how multiple variables determine the effects of pollution on environmental health, natural processes and human practices
- explain how human practices affect the quality of the water and soil

12th Grade

4.3.C Analyze the need for a healthy environment.
- Research the relationships of some chronic disease to an environmental pollutant.

4.8.C Analyze how pollution has changed in quality, variety and toxicity as the United States developed its industrial base.
- Compare and contrast historical and current pollution levels at a given location.

BACKGROUND: *DO NOT SHARE WITH STUDENTS UNTIL AFTER ACTIVITY IS COMPLETE*

Cholera is a **waterborne** disease caused by the bacteria *Vibrio cholerae* that spreads through untreated water that has been contaminated by human or animal feces. Antibodies made by the body degrade rather rapidly (6 months-1 year), making victims vulnerable to receive the disease multiple times. Victims suffering from cholera experience vomiting, diarrhea, and perspiration. These symptoms lead the victim to severe dehydration, causing the victim's skin to darken, shrivel, and lose its elasticity. The severity of the illness is dependent upon personal health, age, and body mass. Some victims may recover in days while less healthy, elderly, or underweight victims may die within an hour.

Cholera has gained an infamous history with developing industrial countries throughout the world. In 1854, a cholera epidemic swept through London, claiming hundreds of lives. Today, researchers believe

the bacteria was spread to London via shipping routes from London carrying contaminated drinking water on board. It is possible that ships from India dumped chlorea contaminated water into the Thames River (London's water source) prior to docking. London's municipal water companies failed to adequately treat the incoming Thames River water before it was used by the city.

Dr. John Snow is credited with eventually identifying and tracking the deadly bacteria to a Broad Street public pump that poorer Londoners used for their water needs. London government officials initially rejected Dr. Snow's answer to the source of the epidemic, and initially linked the epidemic that claimed most poor citizens of London as a "deserved retribution" for their sinful living and deceitfulness.

However, the government agreed to remove the Broad Street pump upon Dr. Snow's advice, marking an end to the tragic **epidemic** that claimed hundreds of lives.

Regrettably, cholera still claims millions of lives each year in developing nations that do not have access to clean water. A vaccination does exist, but has to be administered annually to remain effective because the antibody is short-lived. Developing nations often cannot afford these multiple vaccinations. Victims in developing nations are treated with great amounts of liquids and re-hydration salts to replace lost fluids resulting from the disease and purge the bacteria out of the body faster. Although the deadly disease has not been reported in America since the early 1900's, health officials worry that it could re-appear as municipal facilities are strained to treat an increasing number of people throughout the nation.

PROCEDURE:

1. Inform the students of the London epidemic in 1854 ***without telling them it was water related***: A very deadly cholera epidemic spread through the slums of London in 1854, claiming hundreds of lives. Dr. John Snow was able to finally stop the disease when he discovered the source of the cholera.
2. Inform the students that they will be given the same information Dr. Snow had available to him, and will attempt to identify the cause of the epidemic as quickly as possible.
3. Divide the students into groups and then pass out the clues to the mystery: a Broad Street Area Map, and a set of victim cards. Once the clues have been distributed, tell the class to try and identify a source. *If they fail to figure out a strategy on their own*, tell them to fill out the map with the location of the victims, study the victim cards, and write down common characteristics.
4. After 25 minutes, ask if anyone has identified the source of the epidemic. Do not reveal if they are correct yet. Ask each group how they arrived at their answer after they reveal their conclusion.
5. Pass out the Clue Cards. Have each group read their clues out loud after each group has revealed their conclusion. The cards will reveal additional clues that will assist in determining the source. Groups should then revise or confirm their conclusion.

DISCUSSION:

1. Ask the students to explain how the water from the Broad Street pump became contaminated with the cholera bacteria.

(*It is important to note that the epidemic did not originate in London, it began in India. The cargo ships transported contaminated drinking water to London. Trade ships frequently transported foreign diseases throughout the world, endangering many trade cities such as London.)*

2. Discuss with students why cholera is currently not a threat in America.

(America's municipal facilities are currently large enough to handle the sewage effluent they receive, and then thoroughly disinfect possible contaminates by adding chlorine or treating it with UV light. Water authorities that treat our drinking water also have more modern processes than in the London scenario. To eliminate bacteria and protozoa from the water, a water authority may have a filtration process and all facilities treat water with chlorine before sending it to homes).

3. Finally, ask if any student who traveled to a foreign country had to receive a cholera immunization shot before entering the country. What does that suggest about those countries sewage treatment plants?

EVALUATION:

- Use Investigative skills to identify the source of a cholera epidemic that swept through London (steps 4 – 5).

EXTENSIONS AND MODIFICATIONS:

- Students may study their own community's water treatment by visiting a local sewage treatment plant. Alternatively, visit a local water authority plant, and ask the water managers how often water quality tests are performed to ensure that no bacteria such as cholera exists. What would health officials do if an outbreak did happen to occur?
- Have students view the slides of bacteria, protozoa, and viruses that can be found in water and can cause illnesses. Share with them the Microorganism Information Sheets.
- Students may further research waterborne diseases. Other diseases such as malaria, yellow fever, dengue fever, and encephalitis depend on water-breeding insects to survive.

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