



Lesson 4 - Waterborne Diseases

CURRICULUM CONNECTIONS:

Grade 9-12 Science

INSTRUCTIONAL METHODS:

- Visual example
- Agreement/Disagreement instructional strategy
- Whip-around instructional strategy
- Power-point presentation
- Partnered research activity

ESTIMATED TIME: 60-75 minutes

KEY QUESTIONS/IDEAS:

- What is Potable Water?
- How do we know that water is clean?
- What types of pathogens can be in water?
- What affects do the pathogens have on people?

MATERIALS

Three clear glasses filled with water – one with clean clear water, one with water mixed with dirt or soil, one that has been steeped with tea

Computer and projector to show Presentation 1 – What's in the Water,

Copies of Activity W7 - Waterborne Diseases Matching Activity, C

Computers, tablets, or library access to re-search waterborne pathogens.

Part A: Clean or Dirty?

TEACHING STRATEGY:

Agreement/Disagreement: When a student answers a question posed to the class, ask the remaining students “Who agrees (or disagrees) with that answer.” When students raise their hand in agreement (or disagreement), ask one of them “Why do you agree (or disagree)?”

Display the glasses of water for the whole class to see.

1. AGREEMENT/DISAGREEMENT EXERCISE, THE TEACHER ASKS THE STUDENTS:

- Which of you would like to drink this water? (pointing to the clean glass of water)
- Pick a student to answer. Then ask the rest of the class – Who agrees with that answer? Ask one of the students who agree, why.
- Ask students: Which of you would like to drink this water? (pointing to the dirty glass of water).
- Pick a student and ask why they wouldn't want to drink it. Then ask the rest of the class to raise their hands if they agree.
- Then ask students: Which of you would like to drink this water? (pointing to the glass of tea).
- Pick a student and ask why they wouldn't want to drink it. Then ask the rest of the class to raise their hands if they agree.

TEACHING STRATEGY:

Whiparound - This strategy actively engages students and encourages participation by all. Students write down responses to a question or prompt given to them by the teacher and quickly share their responses with the class. Students have to pay attention and listen closely to their classmates' responses to compare them to their own.

2. WHIP-AROUND ACTIVITY:

Ask students to write down quickly all their ideas of what might be in the dirty glass of water (dirt, soil, plant, poo, organisms, bugs, viruses, bacteria, etc.). Also, what might be in the clean water glass, and the tea glass. Give about 5 minutes.

In the whiparound, teachers ask students one at a time to say one of their answers. It is done very quickly. Students need to be paying attention since they should try to answer something different than what has already been said. If students have no new ideas they can pass or repeat.

Recap: After the whiparound is finished, teacher can summarize things that make water dirty (and tell students what they actually put in the water to make it look dirty). Ask about the tea water and explain that it is clean water with some tea in it (perfectly safe to drink). Then return to the clean water glass. Ask – how do you know that this water is clean? We assume that it is clean because the water is clear, but clear water is not always clean. What if this water is from the toilet? Would it be clean? (It would look the same but it would not be clean.)

Teacher's Note:

Before class please prepare three clear glasses. One with tap water, one with tap water that has some soil or dirt mixed into it (it should look obviously dirty), and one that has been steeped with tea.

3. **INTRODUCE KEY WORD: (CREATE A WORD WALL AND INCLUDE POTABLE WATER AS WELL AS CONTAMINATION)**

Potable Water: Water fit for drinking, free from contamination. Water that can be consumed without concern for adverse health effects (sickness). Potable water does not have to taste good, it is just safe to drink.

4. **DISCUSSION:**

But what is contamination? How does water get contaminated? What things in water cause adverse health effects? Students can answer from their prior knowledge.

Contamination: The process of making something dirty, polluted, or poisonous by adding a chemical, waste or infection. (MacMillan's Dictionary)

Part B: Learning about the most common Waterborne Diseases

Explore the most common waterborne diseases that plague the developing world using Presentation 1 – What's in the Water

For the Matching Activity, use Activity W7 - Waterborne Pathogens Matching Activity. Teachers can use attached Waterborne Pathogens Fact sheet for reference.

MINISTRY MOMENT:

When God created the world, He made everything. God made the sky, the sun, the moon, and the stars. He made the land, oceans and lakes, animals, big sea creatures, and the birds that fly in the sky. And He created us. The first man and woman were Adam and Eve. When God made Adam and Eve, He told them to care for the earth. He told Adam and Eve that people would look after and protect every living thing – plants, animals, and birds – and the earth would provide all the food and water they needed.

Everything God made was perfect. The earth was without problems like sickness, pollution, or hunger because God created it that way. He made everything to work together perfectly – nature, animals, and people.

But Adam and Eve disobeyed God, and because they did, He sent Adam and Eve out of the Garden of Eden and told them life would now be hard for them and for their family. They – and we – would have to live with pain and work very hard for food. Most of all, we would be separated from God and the earth would not be perfect any longer.

When Adam and Eve disobeyed, sin came into the world and the earth was not perfect anymore. The unity of God, people, and creation was broken. Now, the world is not the way God intended. It is not perfect. Sin and human nature cause people to be selfish. Many people have needs that aren't met – they don't have enough food to eat or water to drink.

DISCUSSION QUESTIONS:

How is the world not perfect today? What are things that are wrong in creation? Have we taken good care of the earth? (Pollution, extinct animals, sickness and disease)

The world is not the way God intended, and because of this many people today have a very hard life.

Safe water is very important to people and to the earth. People, animals, and plants cannot live without water. But many places in the world do not have enough water, or they only have very dirty, contaminated water, and people have no way to get safe water. When we turn on the tap, water is safe and good for us to drink.

In Canada, our tap water is cleaned before we drink it – all of the germs and bacteria are removed.

But millions of impoverished kids around the world have no choice but to drink contaminated water from rivers, ponds, creeks, or even from mud puddles or muddy holes in the ground. The germs in the dirty water make them very sick, and many children die from drinking this water.

ACTIVITY:

Reflecting on creation, the fall, contamination of water and the real need for clean water in many parts of the world, write a Haiku that summarizes the state of the world, or your feelings, or what you feel are God's feelings about this topic.

“Haiku” is a traditional form of Japanese poetry. Haiku poems consist of 3 lines. The first and last lines of a Haiku have 5 syllables and the middle line has 7 syllables. Example of a Haiku:

I am first with five Then seven in the middle -- Five again to end.

Activity W7: Meet the Most Common Waterborne Diseases and Pathogens

With a partner, research each disease/pathogen matching the name on the left with the correct description on the right.

Disease/Pathogen Name	Description
Ameoba	A microscopic parasite that infects animals and humans causing Diarrheal disease. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very tolerant to chlorine disinfection. While this parasite can be spread in several different ways, water (drinking water and recreational water) is the most common way to spread the parasite. It is a leading cause of waterborne disease among humans in the United States.
Giardia	An acute, diarrheal illness caused by infection of the intestine with bacteria. The bacteria is typically ingested by drinking contaminated water, or by eating improperly cooked fish, especially. This illness is one of the oldest known causes of epidemics. It has caused 7 recorded pandemics since 1816.
Cryptosporidium	This bacteria was discovered more than 100 years ago. It is spread through human or animal feces. Drinking water can be contaminated when humans or animals leave their droppings in or near surface water sources such as springs, streams, rivers, lakes, ponds or shallow wells. The most common symptoms of the disease include diarrhea, fever, vomiting and abdominal cramps. Dehydration can also occur, most notably in infants.
Escherichia Coli (E. Coli)	A virus that is spread from person to person. It occurs by putting something in your mouth that had been contaminated with the stool of a person with the disease. When water sources are contaminated with feces from infected humans, the water will spread the virus. The most common symptoms are Jaundice (yellowing of the skin and eyes), dark urine, fatigue, loss of appetite, nausea, vomiting, fever and stomach pain.
Campylobactor	This is a disease caused by parasitic worms (known as helminths). More than 200 million people are infected world-wide. The parasites that cause the disease live in certain types of freshwater snails. The infectious form of the parasite emerge from the snail, hence contaminating water. You can become infected when your skin comes in contact with contaminated freshwater. Signs and Symptoms include a rash or itchy skin, and fever, chills, cough, and muscle aches can begin within 1-2 months of infection.
Hepatitis A	This disease is caused by infection with a virus spread most often by contaminated drinking water. These infections occur mainly in developing countries where human waste is allowed to get into drinking water without first being purified. Typical signs and symptoms include jaundice, loss of appetite, an enlarged, tender liver, abdominal pain and tenderness, nausea and vomiting, and fever.
Cholera	A parasite that can affect anyone, although it is more common in people who live in tropical areas with poor sanitary conditions. Infected people do not always become sick, and it is treatable. It causes diarrhea, fever and stomach pain.
Hepatitis E	A life-threatening illness caused by ingesting a particular bacteria. This bacteria lives only in humans and people carry the bacteria in their bloodstream and intestinal tract. You can get this disease if you eat food or drink beverages that have been handled by a person who has the disease or if sewage contaminated with bacteria gets into the water you use for drinking or washing food. Therefore, the disease is more common in areas of the world where hand washing is less frequent and water is likely to be contaminated with sewage. Persons with this disease usually have a high sustained fever and are weak, have stomach pains, headache, fatigue, rash or loss of appetite.
Typhoid Fever	There are many different strains of this common bacteria. Most strains are harmless and live in the healthy intestines of humans and animals. However, some strains produce powerful toxins that can cause severe illness. This bacteria may be found in water sources that have been contaminated with feces from infected humans or animals. The disease can cause severe bloody diarrhea and abdominal cramps although sometimes the infection causes non bloody diarrhea or no symptoms at all.
Schistosomiasis	The parasite causes a disease known as 'beaver fever'. It can be found all over North America and is likely to infect campers or hikers who do not filter or treat their drinking water. It causes diarrhea, cramping, malaise possible fever and vomiting.
Salmonella	This bacteria are a major cause of diarrheal illness in humans and are generally regarded as the most common bacterial cause of gastroenteritis (diarrhea) worldwide. The main route of transmission is generally believed to be food-borne, via undercooked meats and meat products, as well as raw or contaminated milk. The ingestion of contaminated water or ice is also a recognized source of infection. The most common symptoms include diarrhea (frequently bloody), abdominal pain, fever, headache, nausea, and/or vomiting. A fatal outcome is rare and is usually confined to very young or elderly patients, or to those already suffering from another serious disease such as AIDS.

FOR TEACHERS REFERENCE:

WATERBORNE DISEASES FACT SHEET:

Source: WHO Fact sheets, globalhydration.com

Ameoba

This is a parasite that can affect anyone, although it is more common in people who live in tropical areas with poor sanitary conditions. Infected people do not always become sick, and it is treatable. It causes diarrhea, fever and stomach pain.

Giardia

This parasite causes a disease known as 'beaver fever'. It can be found all over North America and is likely to infect campers or hikers who do not filter or treat their drinking water. It is a Protozoan parasite found in human, beaver, muskrat, and dog feces that causes diarrhea, cramping, malaise possible fever and vomiting.

Cryptosporidium

A microscopic parasite that infects animals and humans causing Diarrheal disease. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very tolerant to chlorine disinfection. While this parasite can be spread in several different ways, water (drinking water and recreational water) is the most common way to spread the parasite. It is a leading cause of waterborne disease among humans in the United States.

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Escherichia coli (common name – E. Coli)

There are many different strains of this common bacteria. Most strains are harmless and live in the healthy intestines of humans and animals. However, some strains produce powerful toxins that can cause severe illness. This bacteria may be found in water sources that have been contaminated with feces from infected humans or animals. The disease can cause severe bloody diarrhea and abdominal cramps although sometimes the infection causes non bloody diarrhea or no symptoms at all.

Typhoid Fever

A life-threatening illness caused by ingesting a particular bacteria. This bacteria lives only in humans and people carry the bacteria in their bloodstream and intestinal tract. You can get this disease if you eat food or drink beverages that have been handled by a person who has the disease or if sewage contaminated with bacteria gets into the water you use for drinking or washing food. Therefore, the disease is more common in areas of the world where hand washing is less frequent and water is likely to be contaminated with sewage. Persons with this disease usually have a high sustained fever and are weak, have stomach pains, headache, fatigue, rash or loss of appetite.

FOR TEACHERS REFERENCE:

Cholera

This is an acute, diarrheal illness caused by infection of the intestine with bacteria. Approximately one in 20 infected persons has severe disease characterized by profuse watery diarrhea, vomiting, and leg cramps. In these persons, rapid loss of body fluids leads to dehydration and shock. Without treatment, death can occur within hours. The bacteria is typically ingested by drinking contaminated water, or by eating improperly cooked fish, especially. This illness is one of the oldest known causes of epidemics. It has caused 7 recorded pandemics since 1816. Rare in developed countries, it still occurs frequently in countries with poor sanitation and crowded living conditions.

Hepatitis A

A virus that is spread from person to person. It occurs by putting something in your mouth that had been contaminated with the stool of a person with the disease. For this reason, the virus is more easily spread in areas where there are poor sanitary conditions or where personal hygiene is poor. When water sources are contaminated with feces from infected humans, the water will spread the virus. The most common symptoms are Jaundice (yellowing of the skin and eyes), dark urine, fatigue, loss of appetite, nausea, vomiting, fever and stomach pain.

Hepatitis E

This disease is caused by infection with a virus spread most often by contaminated drinking water. These infections occur mainly in developing countries where human waste is allowed to get into drinking water without first being purified. Typical signs and symptoms include jaundice, loss of appetite, an enlarged, tender liver, abdominal pain and tenderness, nausea and vomiting, and fever. Most often the illness is mild and disappears within a few weeks with no lasting effects but on rare occasions the acute illness damages and destroys so many liver cells that the liver can no longer function. This is called fulminant liver failure, and may cause death.

Campylobacter

This bacteria are a major cause of diarrheal illness in humans and are generally regarded as the most common bacterial cause of gastroenteritis (diarrhea) worldwide. The main route of transmission is generally believed to be food-borne, via undercooked meats and meat products, as well as raw or contaminated milk. The ingestion of contaminated water or ice is also a recognized source of infection. The most common symptoms include diarrhea (frequently bloody), abdominal pain, fever, headache, nausea, and/or vomiting. A fatal outcome is rare and is usually confined to very young or elderly patients, or to those already suffering from another serious disease such as AIDS.

Schistosomiasis

This is a disease caused by parasitic worms (known as helminths). More than 200 million people are infected world-wide. The parasites that cause the disease live in certain types of freshwater snails. The infectious form of the para-site emerge from the snail, hence contaminating water. You can become infected when your skin comes in contact with contaminated freshwater. Signs and Symptoms include a rash or itchy skin, and fever, chills, cough, and muscle aches can begin within 1-2 months of infection. Most people have no symptoms at this early phase of infection. When adult worms are present, the eggs that are produced usually travel to the intestine, liver or bladder, causing inflammation or scarring. Children who are repeatedly infected can develop anemia, malnutrition, and learning difficulties. After years of infection, the parasite can also damage the liver, intestine, lungs, and bladder.