MUSEUM OF HEALTH CARE AT KINGSTON

The Biology, Control, and Prevention of Waterborne Diseases

Curriculum-Linked Education Program
Teacher's Kit

This Teacher's Kit offers supplementary materials for ***The Biology, Control, and Prevention of Waterborne Diseases*** Education Program. It is designed to be used in your classroom before and after your program booking. We hope it will help you and your students make the most of your visit to the Museum of Health Care.

Please make use of the activities included in this kit as appropriate to your schedule and objectives. If you have any questions about the materials included here or the upcoming visit, please do not hesitate to contact the Museum.

Thank you very much, and we look forward to working with you and your class.

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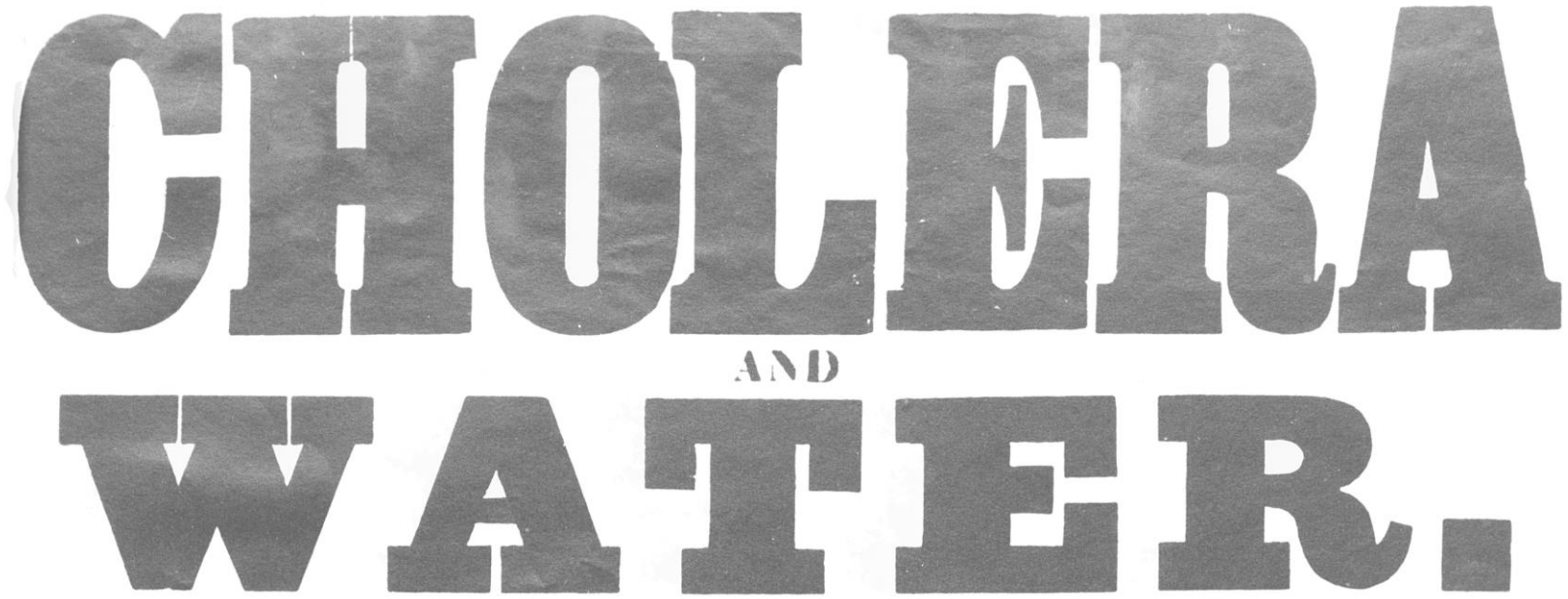

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Curriculum Links

Grade 7 Curriculum
Science and Technology:
Strand: Understanding Life Systems
Topic: Interactions in the Environment

Fundamental Concepts: Systems and Interactions, Sustainability and Stewardship

Overall expectations

C1 Assess the impacts of human activities and technologies on the environment, and evaluate ways of controlling these impacts
C2 Investigate interactions within the environment, and identify factors that affect the balance between different components of an ecosystem
C3 Demonstrate an understanding of interactions between and among biotic and abiotic elements in the environment.

Specific Expectations

C2.3 Use scientific inquiry/research skills to investigate occurrences that affect the balance within a local ecosystem
C2.4 Use appropriate science and technology vocabulary

History:
Strand: New France and British North America

Overall expectations

A1 Analyse aspects of the lives of various groups in Canada between 1713 and 1800, and compare them to the lives of people in present-day Canada
A3 Describe various significant events, developments, and people in Canada between 1713 and 1800, and explain their impact

Geography
Strand: Natural Resources Around the World

Overall expectations
B1 Analyze aspects of the extraction/ harvesting and use of natural resources in different regions of the world, and assess ways of preserving these resources.

B3 Demonstrate an understanding of the sources and use of different types of natural resources and of some of the effects of the extraction/ harvesting and use of these resources.

Grade 8 Curriculum
Science and Technology
Strand: Understanding Earth and Space Systems
Topic: Water Systems

Fundamental Concepts: Sustainability and Stewardship, and Systems and Interactions

Overall expectations

C2 Investigate factors that affect local water quality.
C3 Demonstrate an understanding of the characteristics of the earth's water systems and the influence of water systems on a specific region.

Specific expectations

C2.2 Investigate how municipalities process water and manage water.
C2.6 Use appropriate science and technology vocabulary, including water table, aquifer, polar ice-cap, and salinity, in oral and written communication.

History
Strand: Creating Canada, and Canada: A Changing Society

Overall expectations

A3 Describe various significant events, developments, and people in Canada between 1850 and 1890, and explain their impact
B1 Assess key similarities and differences between Canada in 1890– 1914 and in the present day, with reference to the experiences of and major challenges facing different groups and/or individuals and to some of the actions Canadians have taken to improve their lives.

Geography
Strand: Patterns in Human Settlement

Overall expectations

A3 Demonstrate an understanding of significant patterns and trends related to human settlement and of ways in which human settlement affects the environment.

Waterborne Diseases: In-Museum Program

Description

This program aims to illustrate how waterborne diseases are transmitted, the conditions that contribute to their spread, and the importance of developments in science and public health for their control and prevention.

Educational Outcome

At the end of the visit, participants will be able to:

1. Understand the difference between viruses, bacteria, and protozoa
2. Identify the seven main waterborne pathogens and the diseases they cause
3. Describe how waterborne illnesses are transmitted between hosts
4. Explain why exposure to waterborne pathogens makes some people sick, but not others
5. Explain why waterborne diseases are a major problem in developing areas, even though they are preventable or treatable
6. Discuss how improvements in water quality can reduce a nation's mortality and morbidity rates
7. Proficiently construct simple innovations to purify water
8. Understand global issues relating to water pathogens, such as water scarcity in developing nations, population density and pollution control, and the importance of public health education campaigns

Length

Approximately 4 hours:

Two 60-minute periods with museum staff
30 minute guided walking tour
30 minute guided tour of Kingston's Water Treatment Plant
60 minute follow-up, in-class presentation by Kingston Public Health

Potential Audiences

- This activity can be used with school groups, summer camp groups or families
- This activity is appropriate for children ages 12-14

Pre -Museum Visit Activities

We have included a series of activities to enhance the Waterborne Diseases program for your group, both before and after your visit to the Museum of Health Care.

In addition to the activities detailed below, we encourage you and your students to explore the Museum of Health Care's online exhibition Death in a Glass via the following URL to learn more about contaminated water: http://www.museumofhealthcare.ca/explore/exhibits/glass/

Part 1: The Biology of Waterborne Diseases, Pre-visit Activity #1

Focus: This activity invites students to explore the connection between microorganisms in drinking water and the outbreak of disease, and, to investigate the conditions that contributed to the recent outbreak of illness associated with E. coli contamination in Walkerton, Ontario.

Background: The quality of water has a great impact on public health, especially the microbiological quality of water. Drinking water that is not adequately treated can contain unsafe levels of disease-causing bacteria, viruses, and protozoa.

Canadians are used to safe water and when we turn on a tap we assume that the water flowing out will be safe to drink but sometimes our drinking water has been the source of acute disease outbreaks. For example, in May of 2000, the drinking-water supply for Walkerton Ontario became contaminated with a virulent strain of the bacterium Escherichia coli. While most types are harmless, the E. coli 0157:H7 strain produces a poison that can cause severe bloody diarrhea and abdominal cramps. The Walkerton E.coli outbreak affected more than half the community taking the lives of seven people and making approximately 2300 people seriously ill.

Outbreaks are often the result of many interacting factors. For example, agricultural operations, a malfunctioning disinfection system, and improper practices by operators of the water-purification system all contributed to the Walkerton tragedy. The primary source of the contamination was manure that had been spread on a nearby farm just prior to an unusually heavy rainfall. The heavy rains resulted in increased runoff and seepage. Consequently, significant quantities of the farm manure were washed into the water supply for one of the town's wells. The operators of the water-purification system did not follow proper procedure and failed to detect the incoming contamination. Then, when test results did indicate high levels of contamination in the system, these workers failed to report this to health officials.

The Medical Officer of Health was first alerted about the outbreak by a local physician who was treating patients with symptoms that made her suspect an E. coli infection. The symptoms included bloody diarrhea, cramping, vomiting and fever. Public-health officials suspected that contaminated water might be the source of the outbreak but were informed by the water-purification-system

operators that the town's drinking water was safe. So instead, a search was begun to identify a food source of the outbreak. When none was found, public-health officials decided to conduct their own water tests. The tests confirmed the presence of a toxic strain of E. coli in the water and a Boil-Water Advisory was issued. However, this was five days after the first reports of illness. During these five days, many more people had unknowingly been exposed to the contamination.

The Walkerton Tragedy strongly emphasized the importance of protecting safe, clean water sources, and of proper water-treatment procedure in ensuring a safe water supply for a community.

Materials and Preparation

You will need the following materials for conducting the activity. It is all included in your teacher kit:

Online articles relating to waterborne disease outbreaks, such as:

Walkerton E.coli Outbreak
http://www.cbc.ca/news/background/walkerton/
http://www.foodsafetynews.com/2009/09/meaningful-outbreak-2-walkerton-e-coli-outbreak/

Haiti Cholera Outbreak
http://www.cdc.gov/haiticholera/
http://www.phac-aspc.gc.ca/tmp-pmv/thn-csv/quake-tremble-haiti-eng.php
http://www.cbc.ca/news/world/story/2010/10/23/haiti-cholera-outbreak.html

Typhoid Fever Outbreak United States 2010,
http://www.cdc.gov/salmonella/typhoidfever/index.html
http://www.foodsafetynews.com/2010/08/typhoid-fever-outbreak-may-spread-out-west/
http://www.cdc.gov/nczved/divisions/dfbmd/diseases/typhoid_fever/

Glossary and word search

Lesson Plan

Introduce the main idea to the students. Brainstorm ways in which water quality is very important for human health. Focus on the microbiological quality of water. Most microorganisms are harmless but some can cause disease in humans. Drinking water that contains high concentrations of disease-causing microorganisms can lead to serious illness in some people. Waterborne-disease outbreaks are very rare in Canada today, but they still happen. E.g. E.coli outbreak Walkerton.

Ask students to speculate about why waterborne diseases are rare in Canada today. (Hint: what is the major source of waterborne pathogens?) Brainstorm kinds of factors that could have contributed to the Walkerton outbreak.

Organize students into small groups (2 or 3). Their task is to conduct research on the Internet in order to learn about the circumstances surrounding a waterborne-disease outbreak, i.e., how E. coli got into the drinking water and why it was not detected until people started getting sick. Examples of internet sources are listed above to help get students started.

Reconvene as a class and ask each group to report what it learned. Discus what their findings suggest about the kinds of things that need to be considered to ensure the safety of drinking water in a community.

Review the vocabulary list and distribute the word-search puzzles

Extensions: have your students choose a waterborne disease, such as "Beaver Fever" (Giardia), cholera or typhoid. Have the students develop questions, using the five W's, to help them research the disease and produce a short report.

Glossary for Part 1

Antibiotic	A chemical that slows the growth of or kills a microorganism inside an organism.
Antibody	A protein in the blood that is produced when foreign substances (i.e., antigens) invade the body. Antibodies protect the body from disease by binding to these organisms and destroying them.
Bacteria	Microscopic organisms that reproduce by cell division and usually have a cell wall. Bacteria can be shaped like a sphere, rod or spiral and can be found in any environment
Disease	When the growth of a pathogen results in damage to cells and tissues of the body.
Epidemic	A disease outbreak that affects a large number of individuals within a population, community or region at the same time.
Epithelium, -a	The covering of all external and internal surfaces of the body.
Fecal matter	The solid waste that passes out of an animal's digestive tract.

Fecal–oral route	A path of disease transfer through the swallowing of food or liquid that has been contaminated by infected human or animal waste or through handling contaminated objects and then putting your hands to your mouth without first washing your hands.
Gastrointestinal Disease	A disease that affects the normal functioning of the stomach and the intestines.
Host	An animal or plant that nourishes and supports a parasite; the host does not benefit and is often harmed by the association.
Hygiene	Practices, such as frequent hand washing, that help ensure cleanliness and good health.
Immune	A state of being protected against infectious diseases by either immunization against a disease (through vaccination) or previous exposure to a disease.
Immune system	The body's complex system of organs and cells that defends the body against infection and disease.
Infection	When a pathogen invades and begins growing in a host.
Infectious diseases	Diseases that people can catch from other people or animals. They are also often called communicable diseases.
Microbiology	The branch of biology that deals with microscopic forms of life (viruses, bacteria and small protozoa).
Microorganism	Organism so small it is not visible to the unaided eye, e.g., bacterium.
Mode of Transmission	How an infectious agent is passed from person to person.
Pathogen	Any microorganism that has the capacity to cause disease. Its ability to cause disease is called pathogenicity.
Protozoa	One-celled animals that are larger and more complex than bacteria. They form protective coverings called cysts that are resistant to chlorine and must be filtered out of the water.

Sanitation	Maintaining clean, hygienic conditions that help prevent disease through services such as garbage collection and wastewater disposal.
Susceptible host	A person who, for reasons such as age, nutritional status, or immune status, has a higher risk of becoming ill if infected.
Symptom	Any indication of disease felt by a patient, such as pain, dizziness or nausea. In contrast, indications of disease that can be seen or measured by others (such as high blood pressure, fever, or skin rash) are called signs.
Vaccine	A mixture of dead or weakened pathogens, to be injected into an organism in order to stimulate antibody production.
Virulence Factors	The properties of a pathogen that influences its capacity to cause disease. For example, some pathogens produce powerful toxins that cause serious damage to host cells and tissues.
Virus	A microorganism that must infect a living cell in order to reproduce and grow. A virus is not a living cell itself.
Waterborne disease	Any illness transmitted through the ingestion of water contaminated by disease-causing organisms.

Waterborne Diseases: Word Find

B M W N V N M B N B O E G S E
Y D S I V O V O E U P Q Y S P
V G R V T I I O G I D F W J I
Y U O P P T O X D L Y D R C D
S N M L C A N E G O H T A P E
B Y E E O T M H Y G I E N E M
S A F N O I T A Z I N U M M I
B N Y D O N B A C T E R I A C
I T D L I A J O O T S O H N V
A I O Z L S D F R Z G J K Q S
B G B K P Y E B Q C O O I N O
Y E I Y Y N E A Q W I T H U I
K N T X G J E D S E U M O Q T
M N N P S J X O W E G N I R Y
C D A E N D Z X O N J H A O P

A - a protein in the blood that protects the body from disease (8)
B - microorganisms that can be shaped like a sphere, rod or spiral (8)
D - damage to cells or tissues of the body (7)
E - a disease outbreak that affects many people at the same time (8)
H - an organism that supports a parasite (4)
H - practices that help ensure good health (7)
I - the process by which a person becomes protected against an infectious disease (12)
I - when a pathogen invades and begins growing in a host (9)
M - the study of microscopic forms of life (12)
P - a disease-causing microorganism (8)
P – one-celled organisms that are bigger and more complex than bacteria (8)
S - activities such as proper sewage disposal that help prevent the spread of disease (10)
S – any indication of a disease felt by a patient such as pain, dizziness or nausea (7)
V- a microorganism that can only reproduce when inside another living cell (5)

Waterborne-disease Word Search Part I: Answers

A → antibody (8)
B → bacteria (8)
D → disease (7)
E → epidemic (8)
H → host (4)
H → hygiene (7)
I → immunization (12)
I → infection (9)
M → microbiology (12)
P → pathogen (8)
P → protozoa (8)
S → sanitation (10)
S → symptom (7)
V → virus (5)

Part 2: Prevention & Control of Waterborne Diseases, Pre-Visit Activity #2

Materials and Preparation

Review the water cycle and some of the ways human activities can change how water moves or is polluted in a watershed. The students should also be familiar with the following word list.

Glossary for Part 2

Coliform	A group of related bacteria that mainly live in the intestines, especially the lower intestine (colon), of humans and other warm-blooded animals. These bacteria are also found in decaying plants and in the soil.
Contaminant	Something added to water to make it impure.
Disinfection	The killing or inactivation of disease-causing microorganisms, may involve disinfecting agents such as chlorine, or physical processes such as heating.
Excrement	Waste from the digestive system that is ejected from the body; dung, manure.
Fecal coliform	Bacteria found in the digestive waste (dung) of warm-blooded animals, since these bacteria live in the intestinal tracts of these animals. The presence of these bacteria in water is an indicator of pollution by excrement and possible contamination by pathogenic bacteria.
Filtration	The process of running water through a screening process to remove impurities
Ground water	Water below the earth's surface and which serves as the source of water for wells and springs.
Impermeable	Impossible for a substance to pass through.
Latrine	A hole in the ground used as a toilet
Runoff	Rain, melting snow, or irrigation water that drains from land into lakes, rivers, and streams. It can carry sediments and pollutants into the receiving waters.

Sanitation	Processes, such as proper sewage disposal, that prevent the spread of disease
Sewage	Sewage is the waste water that comes from homes and industry. It contains vast amounts of water and a diversity of organic (produced by living organisms) and inorganic matter, such as detergents, pharmaceuticals, petroleum-based oil, heavy metals and pesticides. It also contains viruses, protozoa, and bacteria, many of which are pathogenic.
Surface water	The water that is on top of the earth, in streams, lakes, rivers, oceans and reservoirs.
Watershed	The area of land that drains into a particular body of water

Waterborne Quality Word Find

D	I	S	I	N	F	E	C	T	I	O	N	M	F	G
P	E	T	Z	C	B	R	Z	S	X	O	S	I	D	R
A	G	N	O	Q	O	B	H	A	T	I	L	E	Y	O
T	A	A	N	Y	G	N	Q	S	N	T	H	M	D	U
H	W	L	P	N	N	E	T	A	R	S	I	B	Z	N
O	E	U	V	O	Y	R	G	A	R	A	Q	E	D	D
G	S	G	I	V	L	R	T	E	M	Z	H	O	N	W
E	F	A	F	N	O	I	T	A	T	I	N	A	S	A
N	C	O	G	O	O	A	B	W	F	E	N	H	K	T
S	R	C	R	N	W	J	Z	V	H	F	Y	A	B	E
R	S	C	O	L	I	F	O	R	M	G	O	Y	N	R
K	I	E	N	I	R	T	A	L	I	U	D	N	P	T
M	U	B	J	W	G	C	G	E	O	L	U	Q	U	I
R	B	G	J	D	Z	M	N	U	S	Z	R	X	N	R
I	O	V	F	X	Y	E	M	F	J	R	P	H	C	V

C – a group of bacteria common in soils, plants, and animals (8)
C – any substance that makes water impure and unfit for human use (11)
D – any process that destroys or removes disease-causing organisms (12)
F – the process of running water through a screening process to remove impurities (10)
G – the source of water for wells and springs (11)
H – practices, such as hand washing, that help ensure good health (7)
L – a hole in the ground used as a toilet (7)
M – a tiny, one-celled organism, which cannot be seen with the unaided eye (13)
R – water that drains from land into lakes, rivers, and streams (6)
S – processes, such as proper sewage disposal, that prevent the spread of disease (10)
S – the waste water that comes form homes and industry (6)
S – the water that exists on top of the earth (12)
W – the area of land that drains into a particular body of water (9)

Waterborne-disease Word Search Part II: Answers

C – coliform (8)
C – contaminant (11)
D – disinfection (12)
F – filtration (10)
G – ground water (11)
H – hygiene (7)
L – latrine (7)
M – microorganism (13)
R – runoff (6)
S – sanitation (10)
S – sewage (6)
S – surface water (12)
W – watershed (9)

Post-visit Activities

#1 Concept Map for Part 1: Biology of Waterborne Diseases

The wrap-up offers students the opportunity to express their understanding of the ideas explored at each activity station. As students share their ideas with those of their classmates, they can refine and revise them. As you listen to them reasoning out loud, you can assess their individual understanding.

Summary Activity:

Students will have 10 minutes to develop a (spider) concept map with their group (see example below). They will record ideas that relate in a meaningful way to the central theme of water quality. Each group will have a maximum of 2 minutes to present its concept map to the class.

Materials:

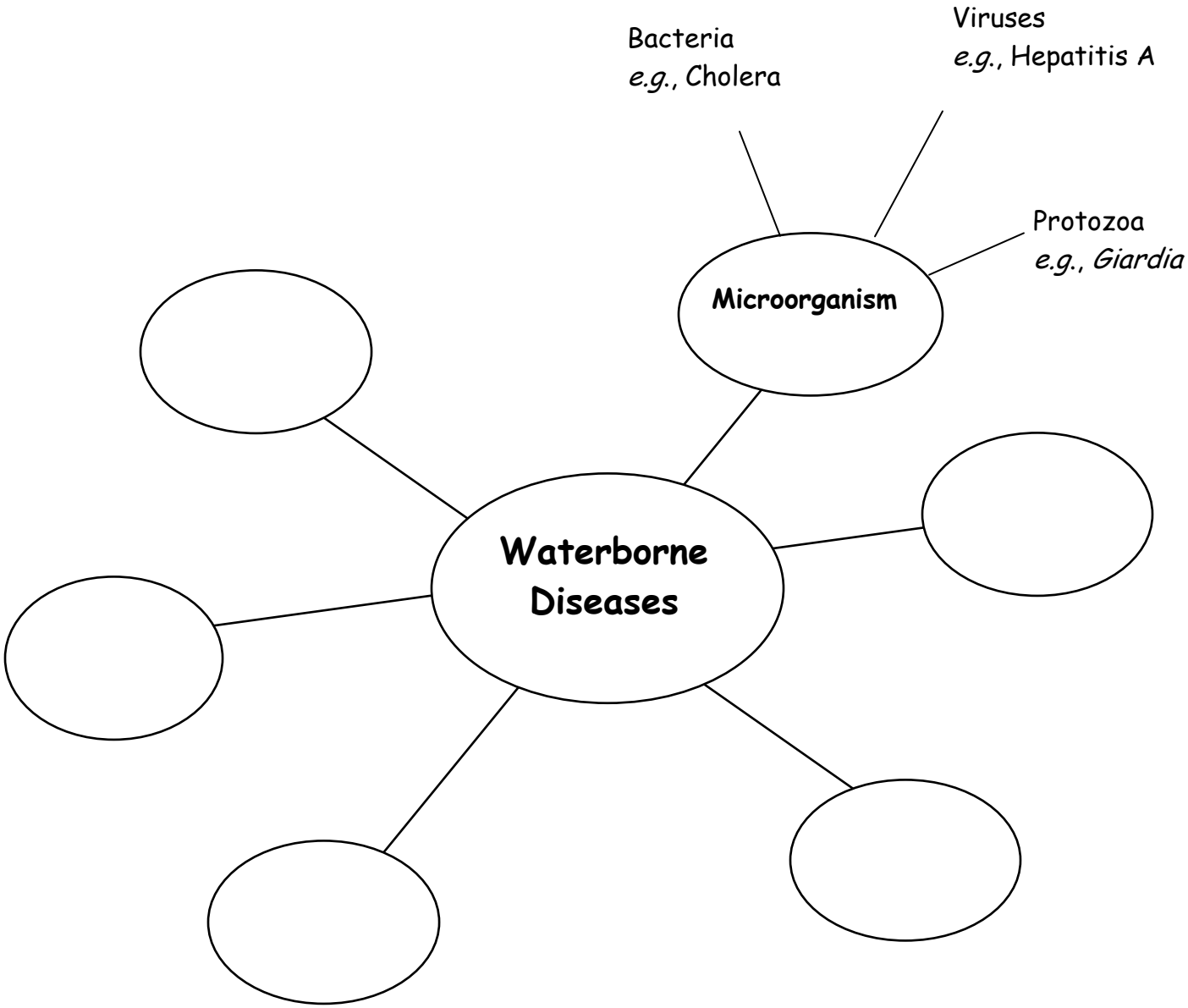
Markers
Poster paper
Example of (spider) concept map

Instructions on how to fill in the concept map:

In the circles put ideas that relate to the central concept – waterborne diseases.

On the lines that connect the circles add a verb that helps explain the connection between the central concept and the related ideas.

On the outer branches include details, facts or examples that support the main ideas (see example)


Bacteria
e.g., Cholera
Viruses
e.g., Hepatitis A
Protozoa
e.g., *Giardia*
Microorganism
Waterborne Diseases

#2 Concept Map for Part 2: The Control and Prevention of Waterborne Diseases

The wrap-up offers students the opportunity to express their understanding of the ideas explored at each Activity Station. As students share their ideas with those of their classmates, they can refine and revise them. As you listen to them reasoning out loud, you can assess their individual understanding.

Summary Activity:

Students will have 10 minutes to develop a (spider) concept map with their group (see example below). They will record ideas that relate in a meaningful way to the central theme of water quality. Each group will have a maximum of 2 minutes to present its concept map to the class.

Materials:

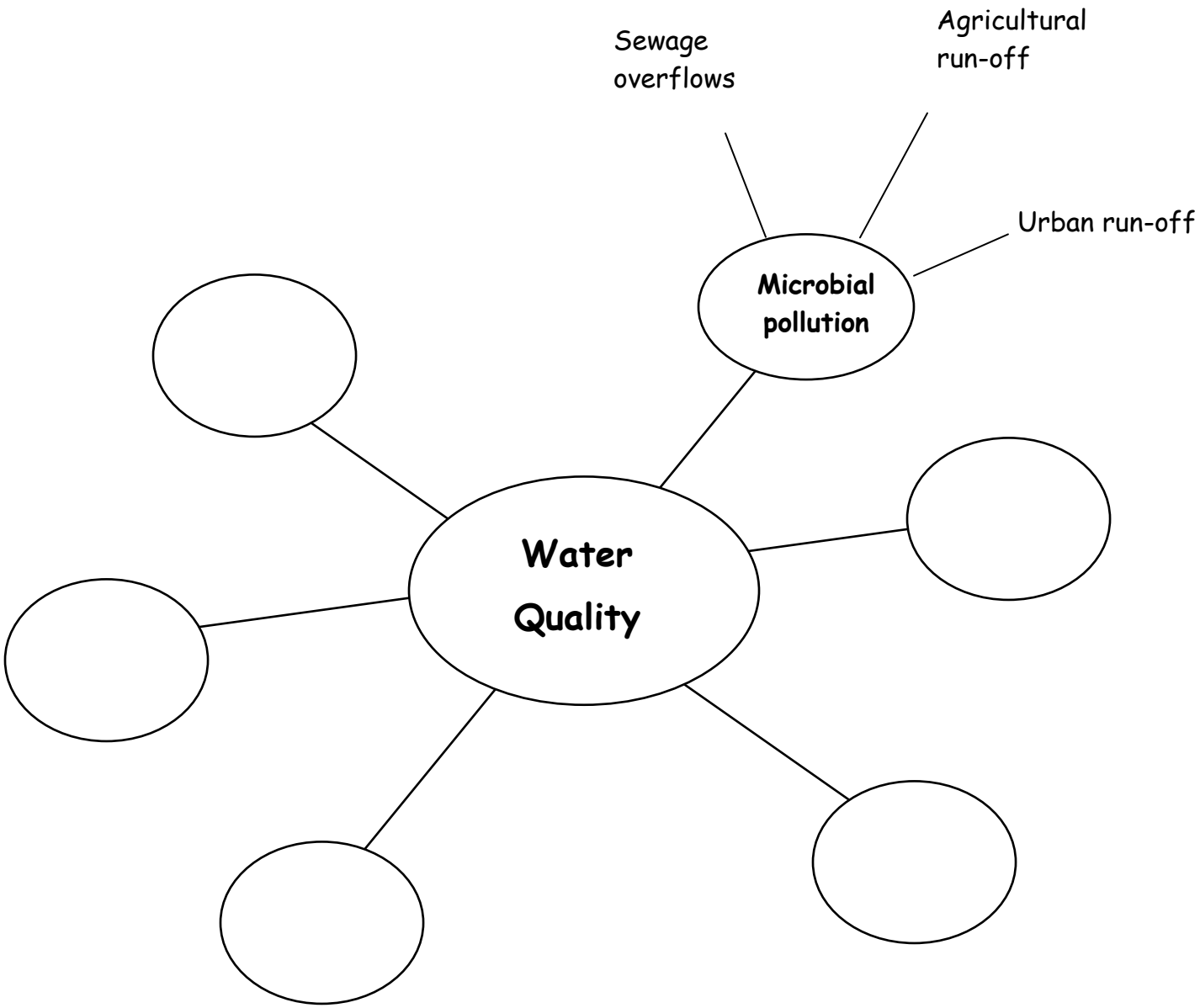
Markers
Poster paper
Example of (spider) concept map

Instructions on how to fill in the concept map:

In the circles put ideas that relate to the central concept – water quality.

On the lines that connect the circles add a verb that helps explain the connection between the central concept and the related ideas.

On the outer branches include details, facts or examples that support the main ideas (see example)


Sewage overflows
Agricultural run-off
Urban run-off
Microbial pollution
Water Quality

#3 Daily Water Use Activity

Activity: How much water do you use each day?

Method:
Go online and use the Water Footprint Calculator to estimate your own unique water footprint:
http://www.waterfootprint.org/?page=cal/WaterFootprintCalculator

Reflection:

In Canada, we are fortunate to have a large abundance of water from our Great Lakes. However, as we have learned today, water in other countries can be scarce and only a small number of people consistently have access to water in their homes. It is important for us to protect our natural water resources, and to conserve the water in our communities.

Most Canadians use about 300 liters of water per day in their homes. If you lived in Baghdad and had 171 liters to use each day, how would you use it? What else can you do to decrease your water consumption and reduce pollution in our marine environments?

#4 Water Purification Activity

At the bottom of the settling tanks used for water purification, a sludge remains. Research:

What is in such sludge?

What happens to this sludge?

Research Milorganite and similar products ("biosolids"), and assess them for safety with regard to human health.

#5 Waterborne-disease outbreaks following natural disasters

Focus:

Students will investigate the impact of natural disasters, such as the recent South Asian tsunami, on public health. Specifically, they will investigate why waterborne-disease outbreaks comprise one of the biggest threats to health following a disaster and the immediate and long–term interventions that are needed to minimize the waterborne route of disease transmission.

Background:

Tsunamis, such as those that recently hit South Asia, can have serious public-health consequences. One of the biggest threats following a natural disaster is the drinking of contaminated water. In hard-hit areas, it may be virtually impossible to find a source of clean water. Drinking water may be contaminated by damaged and leaking sewage pipelines, and by people defecating directly into or near the source water. Unclean water and hands can contaminate water containers, utensils, and foods after a disaster, when basic hygiene is lacking. Overcrowding in temporary-relief shelters can increase the spread of infections and a poor diet can increase susceptibility to infection. An important component of disaster relief is helping people meet basic hygiene needs by providing survivors with clean water and simple water-purification products. Also key is education regarding disease transmission, to minimize the waterborne route of infection.

Materials and Preparation:

1. Write the words "Natural disaster" on the board or chart paper. Ask students to brainstorm definitions and examples of current and historical natural disasters and note their responses (examples include 1988 Bangladesh flood disaster, 1998 Hurricane Mitch, 2004 Asian tsunami). Brainstorm with the whole class the potential health risks for survivors of a natural disaster.

2. In groups of two or three, have students choose a natural disaster and research the answers to the questions on the student worksheet. Direct students to the topic of infectious diseases, epidemics following natural disasters on the following web sites.

CBC News in-depth: Forces of Nature
http://www.cbc.ca/news/background/forcesofnature/index.html

WHO (World Health Organization): Disasters
http://www.who.int/topics/disasters/en/

BBC News Health: Medical Notes - Natural Disasters
http://news.bbc.co.uk/2/hi/health/medical_notes/264110.stm

BBC News: Natural Disasters on the rise
http://news.bbc.co.uk/1/hi/world/3666474.stm

PAHO (Pan American Health Organization): Disasters and Humanitarian Assistance
http://www.paho.org/english/DD/PED/HOME.HTM

3. Have students share their information with the class, by asking each group to do the following.
   - Choose three objects that represent the primary health concerns of the disaster survivors
   - Explain to the class the significance of the objects chosen.
   - Identify a short-term strategy and a long-term strategy that each address the health risks for survivors

Worksheet: Waterborne-Disease Outbreaks following Natural Disasters

Name of disaster:	
Date:	
Location:	
Cause:	
Brief description of impact:	
Public-health risks for the survivors	
The main causes of the health risks	

The immediate priorities for protecting public health	
The long-term priorities for protecting health	
Intervention strategies that have been initiated	
How long the effects of the disaster are expected to last	
Types of organizations that are/were contributing to the disaster relief	

Self Evaluation and Reflection

Name: _____

Learning Skills

N - needs improvement S - satisfactory work G - good work E - excellent work

Independent Work

- worked well without supervision N S G E
- followed rules and instructions independently N S G E

Initiative

- responded to a new situation or challenge N S G E
- showed interest in the activity and a willingness to learn N S G E

Use of Information

- asked questions to clarify meaning and ensure understanding N S G E

Cooperation

- showed positive relationships with other students N S G E
- helped others N S G E
- shared in cleaning duties after an activity N S G E

Conflict Resolution

- resolved conflicts in socially accepted ways N S G E
- assisted others to resolve conflicts appropriately N S G E

Class Participation

- willingly worked with a new grouping N S G E
- took responsibility for my share of the work N S G E
- encouraged others to participate N S G E

Problem Solving

- applied successful strategies to new problem situations N S G E

What I did best during this activity	**What I need to improve on and how I will achieve that goal**
What I liked best about the activity and why I liked it	**What I would change about the activity if given the opportunity**
Something new I learned	**What I would like to learn more about**

Background Resources

CDC (U.S. Centre for Disease Control and Prevention)
http://www.cdc.gov

National Water Research Institute of Canada
http://www.ec.gc.ca/inre-nwri/

National Institute of Allergies and Infectious Disease
http://www.niaid.nih.gov/publications/microbes.htm#a

Public Health Agency of Canada
http://www.phac-aspc.gc.ca

Report on Great Lakes Water Quality
http://www.ijc.org/php/publications/html/12br/english/report/biological/mc.html

Toronto and Region Conservation for the Living City
http://www.trca.on.ca/

Water and Germs
http://www.mwra.state.ma.us/germs/intro.htm

Massachusetts Water Resource Authority's introduction to basic germ knowledge.

WHO (World Health Organization)
http://www.who.int

Appendix A

Background

In the 19th century, waterborne diseases were major causes of illness and death in Canada. One of the major public-health advances of the twentieth century has been the development of centralized drinking- water and waste-treatment systems. Safe drinking water, combined with changes in hygiene practices, has reduced the incidence of waterborne diseases like cholera and typhoid by up to 100%.

Despite considerable success in controlling waterborne pathogens, periodic outbreaks of waterborne diseases still occur in Canada. The outbreak of illness caused by E. coli in Walkerton, Ontario during 2000, in which seven people died and 2000 more became ill, was a difficult reminder that the safety of our drinking water cannot be taken for granted and that protecting the microbiological quality of drinking water requires constant vigilance.

Water of poor microbiological quality increases the possibility of human exposure to waterborne pathogens and therefore to waterborne disease. The likelihood of acquiring a waterborne infection depends on many factors, including the level of contamination and susceptibility of the person (host). When contamination levels are high, everyone is at risk for waterborne infections, but for the very young, the aging, and the immune-compromised (i.e., persons suffering from cancer, AIDS, or malnourishment), these situations can be life-threatening.

Understanding how waterborne pathogens make us sick is important because it can lead to better tools, including drugs and vaccines, for treating and preventing waterborne diseases. An understanding of how waterborne pathogens are transmitted is also important because it can help identify effective control strategies. For example, in cases in which transmission is primarily person-to-person, education about personal hygiene may be more important than improvements in water quality in reducing the prevalence of waterborne infections.

The adverse health effects of waterborne diseases are an issue of major global concern. Waterborne diseases still account for over 80% of deaths in developing countries and prevent millions of people from leading healthy lives. Many of these deaths could be prevented by improved access to safe water and effective medicines.

Program Organization

This five part program introduces students to the biology, control and prevention of water pathogens. June pilot presentations of this program will be offered free of charge, but as of September 2012 the in-Museum and Kingston Water Treatment Plant portions

will be offered at our standard education program price of $3 per participant, no charge for supervisors. A follow-up, in-classroom presentation by the Kingston, Frontenac, Lennox, and Addington Public Health Center, to be arranged by the teacher, is offered free of charge.

Part 1: The Biology of Waterborne Diseases, students will examine the types of micro-organisms that can cause waterborne infections. By engaging in hands on activities, students will learn how infections are transmitted between hosts, how infections can make us sick, and how our body can defend itself against harmful invaders.

Part 2: The Prevention and Control of Waterborne Diseases, examines the microbiological quality of water that is safe to drink. Students will analyze the safety of water samples and construct simple water purification systems that can be used when centralized water-treatment systems are absent or inadequate. Students will also explore the incidence of waterborne diseases in different regions of the world and discuss global issues relating to contaminated drinking water.

The final three parts of this program take place outside of the Museum. Students will participate in a 30 Minute Guided Tour from the Museum of Health Care to the King Street Water Treatment Plant, and then complete a 30 minute tour of Kingston's Water Treatment Plant.

Part 5 involves a follow-up, in-classroom presentation by the Kingston, Frontenac, Lennox, and Addington Public Health Center. Interested teachers can contact Sarah Le Roy from the KFL&A Public Health via e-mail or telephone if they are interested in setting up a date and time for a free, in-classroom presentation. Her contact information can be found below.

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