



Outbreak Detectives

**It Runs in the Community:
Investigating a Waterborne
Outbreak of Diarrheal Illness**

**Instructor Guide
Grades 5–7**

2014



**U.S. Department of
Health and Human Services**
Centers for Disease
Control and Prevention

Outbreak Detectives Curriculum

Grades 5 – 7
Science Inquiry
Personal Health
Disease Prevention

This curriculum was developed to increase students' knowledge of germs that can be found in recreational water, communicable disease prevention, basic steps to an outbreak investigation, the field of epidemiology, and how it is used to protect the public's health. The information within this document was developed for use and distribution by the public. When referencing the material, please use the following citation:

Suggested Citation:

Centers for Disease Control and Prevention. *Outbreak Detectives – It Runs in the Community: Investigating a Waterborne Outbreak of Diarrheal Illness*. Atlanta, GA: U.S. Department of Health and Human Services; 2014. Available at <http://www.cdc.gov/healthyswimming/outbreak-detectives.html>.

CONTENT

Instructor's Guide to the Curriculum

Lesson Plans/PowerPoint Script

Lesson One: Epidemiology and Outbreaks

Lesson Two: Outbreak Activity: The Dale City Dilemma

Outbreak Activity Materials

Lesson Three: RWI Germs

Lesson Four: Disinfection Times and Filtration System

Lesson Five: RWI Prevention

Lesson Six: Activity: Jeopardy Game

Jeopardy Activity Materials

PowerPoint Presentation

Download separately from <http://www.cdc.gov/healthyswimming/outbreak-detectives.html>

Goal of the Curriculum

The goal of the Outbreak Detectives curriculum is to increase students' knowledge of germs that can be found in recreational water, communicable disease prevention, basic steps to an outbreak investigation, the field of epidemiology, and public health.

Learning Objectives

By the end of the completion of the curriculum, students will be able to:

- Define the term *epidemiology*
- List the nine basic steps to an *outbreak investigation*
- Conduct the nine basic steps to an *outbreak investigation*
- Construct a graph showing the time pattern for a disease outbreak, called an *epi curve*
- List and describe the *transmission, disinfection times, and prevention* of the following germs that can be found in recreational water and cause illness:
 - » *Cryptosporidium*
 - » *Giardia*
 - » *E. coli*
 - » *Shigella*
- Explain the filtration/re-circulation system in a pool or other re-circulated recreational water source
- Name three ways to reduce the risk of contracting a *Recreational Water Illness*

Instructor Preparation

- Before using this curriculum in the classroom, please go to <http://www.cdc.gov/healthywater/diseases.html> for an overview of waterborne diseases.
- Please read the entire curriculum carefully.

Instructional Delivery Method

Interactive lecture, group activities

Audiovisual Aids

PowerPoint presentation, computer or laptop, LCD projector

Materials for Instructor

The instructor should have the following materials to implement the curriculum:

- Instructor Guide
- Computer or laptop
- LCD projector
- PowerPoint presentation
- Lesson plans/PowerPoint script
- Instruction sheet: *The Dale City Dilemma* (for each group)
- Dale City Spot Map (for each group)
- Victim cards (for each group)
- Clue cards (for each group — cut out in advance)
- Graph paper (for each group)
- Pencils (for each group)
- Markers (for each group)
- Healthy Swimming brochure, which can be downloaded at <http://www.cdc.gov/healthyswimming/brochure.htm>

Curriculum Content

The curriculum material can be presented as six separate lessons and class times or in its entirety if time allows. Lesson plans are user-friendly with activities listed in order and with instructor dialogue to be used with each PowerPoint slide. The lesson plans are intended to be used in the sequence listed but may be used as the instructor deems appropriate. The Table of Specifications is shown below:

Table of Specifications

Lesson Plan Topics	Percent Coverage	Time in Minutes	Slide Numbers
1. Epidemiology and Outbreaks	25	10	1 - 12
2. Outbreak Activity: The Dale City Dilemma	30	60	13 - 27
3. RWI Germs	15	10	28 - 34
4. Disinfection Times and Pool Filtration	10	10	35 - 37
5. RWI Prevention	10	10	38 - 42
6. Jeopardy Game	10	20	(separate materials)
Totals	100%	120 Minutes	

INSTRUCTOR GUIDE

Outbreak Detectives

Lesson One: Epidemiology and Outbreaks

Purpose: The purpose of Lesson One is to familiarize students with the field of epidemiology.

Time: 10 minutes

Learning Objectives: By the end of this lesson, students should be able to:

- Define *epidemiology*
- Define an *outbreak*
- Explain the relationship between the field of epidemiology and an outbreak
- Describe the eight steps to a disease outbreak investigation
- Define *epi curve*

Slides: 1 – 12

START HERE:

Go to
slide 1

Tell the Class: The title of today’s workshop is “Outbreak Detectives.” Get comfortable with talking about diarrhea and getting sick! Most of the talk will cover these subjects.

Go to
slide 2

During this lesson, we will learn what epidemiology is and how it is used to protect the public’s health. We will also complete an activity using what you will learn about the steps of outbreak investigations. This activity will exercise your investigative skills, which are necessary to become an excellent disease detective. We will also talk about diarrheal illnesses and ways to prevent them.

We all have investigative skills that we use in everyday life. If you’ve ever lost your keys you probably asked yourself and others a series of questions and took certain steps to find them. For example, you might have asked:

- When do I last remember seeing them?
- Where have I been since I last remember having them?
- Who was I talking to when I had them last?
- Where have I lost and found them before?

You then used your answers to these questions along with other clues to find your keys. These are the steps that scientists use in a field called epidemiology to identify the cause or source of a disease.

Go to
slide 3

What is epidemiology? *First allow students to answer this question before switching to slide 3.* Epidemiology is the basic science of public health. It is the study of the distribution and causes of health problems in communities. It is the use of the scientific method of problem solving using statistics and research to find the cause of a disease outbreak in a community.

Go to
slide 4

So what does this definition mean? Like detectives at the scene of a crime, epidemiologists begin disease outbreak investigations by piecing together clues. They systematically gather information about an affected population by asking questions such as: Who is sick? What are their symptoms? When did they get sick? Where could they have been exposed to the illness? What common things did these people do? Then epidemiologists study the answers to these questions to find out how an illness was spread in a community and how they can stop the spread in the future.

Go to
slide 5

What is an outbreak? *First allow students to answer this question before switching to slide 5.* It is the occurrence of more cases of illness than would normally be expected in a community.

Go to
slide 6

Why is epidemiology important? This field is very important to public health because outbreaks are tracked and controlled using epidemiology. The data collected through the investigation is used

1. To prevent future outbreaks
2. To educate the public about disease control

Go to
slide 7

For example, in 1993 more than 200 people in Washington State developed severe stomach cramps and diarrhea. Investigators traced the illnesses to undercooked hamburgers from a fast-food chain. Thanks to this discovery, health officials were able to stop the outbreak by educating restaurants and the public to cook beef until it is no longer pink so that germs would be killed.

There are eight basic steps to an outbreak investigation. They are:

Go to
slide 8

1. Prepare for the investigation.
2. Decide if there really is an outbreak.
3. Specify the nature of the disease.
4. Define and identify cases.
5. Describe, locate, and track the data by time, place, and person.
6. Develop and, if necessary, change ideas for the source of the outbreak.
7. Start programs to control and prevent the spread of disease.
8. Educate the public.

As “disease detectives,” you will follow each step to discover the source of the disease. We will describe and go through each of these steps in more detail.

Go to
slide 9

These first **four steps of disease outbreak investigation** have been completed for you in the upcoming exercise.

1. **Prepare for the investigation** – When epidemiologists are made aware of a potential outbreak, they begin to get ready for field work by researching the possible diseases (given the symptoms), and gathering supplies for the trip.
2. **Decide if this is really an outbreak** – One of your first tasks as disease detectives is to verify that a **suspected** outbreak is an **actual** outbreak. This means you have to compare the number of infected people found in the outbreak to the number of infected people normally found in the community. If there is a significant increase in infected people, we can assume that an outbreak exists and proceed with the investigation.
3. **Specify the nature of the disease** – You must ensure that the disease has been properly diagnosed. This involves reviewing diagnoses by doctors and lab results of infected people.
4. **Define and identify cases** – This means establishing what is called a “case definition.” It includes clinical information about the disease, characteristics about affected people, information about the location, and the time the outbreak occurred.

Go to
slide 10

Pay close attention to the next steps because you will be asked to complete them during the group activity.

The next steps of an outbreak investigation are to:

5. **Describe, locate, and track the data by time, place, and person** – This type of research, called descriptive epidemiology, is **critical** because you provide a complete description of an outbreak by showing its trend over time, its place, and the populations affected by the disease. This description lets you begin to develop ideas about what happened, called a hypothesis.

6. **Develop ideas for the source of the outbreak** – This means coming up with a hypothesis about the source. **Question:** What is a hypothesis? (*Allow class to respond.*) A hypothesis is a possible explanation for a scientific problem that can be tested. You may develop a hypothesis to state the location of the disease outbreak's source. You can develop hypotheses in a variety of ways. First, consider what you know about the disease itself:

- Where is the disease (or ill people) usually seen?
- How is it usually spread?
- Is there a pattern of location or transmission?
- What are the known risk factors?

If you are having trouble finding the source with the given information, you may need to change your hypothesis and answer these questions again.

Example of an epi curve – An epi curve is one tool that can be used during step 5—to describe, locate, and track the data by time, place, and person. It plots the number of new cases of an illness (on the y-axis) by the date of illness onset (x-axis) in order to give a visual representation of the outbreak's extent and trend over time. An epi curve can be an effective tool in helping us generate hypotheses about the source of an outbreak. The epi curve on this slide tracks the spread of *E. coli* during a two-week period of an outbreak.

Ask the students what kinds of things the graph shows them about the outbreak. For example:

- Most people became sick between October 15 and 18.
- Outlier cases on October 11 and 13 may give clues to the source.
- The approximate incubation period of *E. coli* (time it takes between being infected and symptoms being present).



7. **Start programs to prevent and control the spread of disease** – As soon as possible, measures should be put in place that will stop the disease from spreading to more people. If the source of the outbreak is identified, we might try and eliminate it, or we can try and stop the illness from spreading to more people. For example, in the outbreak described above in Washington State, all remaining meat that had the potential to be contaminated could have been destroyed. Alternatively, to prevent the spread, the restaurant could make sure that all meat is thoroughly cooked by regulating cook times for all hamburgers and perhaps using timers and thermometers to assure cooks are following proper guidelines.

8. **Educate the public** – It is important to keep the public informed about the investigation and what is being done to control an outbreak in order to calm fears and implement prevention measures. The public will likely need to be informed about strategies they can use to avoid illness and protect their health in the future so a similar outbreak does not occur again.

INSTRUCTOR GUIDE

Outbreak Detectives

Lesson Two: Outbreak Activity: The Dale City Dilemma

Purpose: The purpose of Lesson Two is to complete an outbreak investigation.

Time: 60 minutes

Learning Objectives: By the end of this lesson, students should be able to:

- Conduct an outbreak investigation
- Plot an epi curve
- Describe the waterborne germ, Crypto

Slides: 13 - 27

Instructor Prepare:

Prepare in advance a copy of the instruction sheet, spot map, victim cards, and clue cards for each group. Cut out the clue cards in advance because they will be handed out one at a time.

1. Divide the class into groups of 3 to 4 students.
2. Read the instructions (below) aloud to the class.
3. Read aloud the “Dale City Dilemma” and the section that follows that describes the symptoms of cryptosporidiosis.
4. Give each group an instruction sheet (page 11), a Dale City spot map (page 14), and victim cards (page 12).
5. Give them 15 minutes to study and plot the victim cards. Every 3 to 4 minutes, read the clues aloud (page 13), starting with Number 1. After reading each clue, distribute a copy to each group.
6. **Additional Instructions:** Allow about 20 minutes for the completion of the exercise. Because students are working with only the information that is provided, try not to answer any questions. Have students write conclusions on their instruction sheets. Tell them not to read their answers aloud until every group has finished.
7. **Option:** If graphing is a current skill you are working on, you can have the students create an epi curve of the Dale City Dilemma.

START HERE:

Tell the class: Each group has been given **three handouts** to help you complete the activity.

1. The first is an **instruction sheet**. Be sure to read and follow the directions before you begin.
2. The second is a **spot map** of Dale City. Spot maps are a tool used to help identify the source of an outbreak.
 - This exercise requires you, “disease detectives,” to characterize the outbreak by location in order to map out the “Who,” “What,” “When,” and “Where” of the illness.
 - Plot where the affected people live, work, or may have been exposed. Notice common areas or groups of people.
 - Evaluate an outbreak by place to show clusters or patterns that provide clues to identify the cause of the problem.
3. The other handout is a set of **victim cards** that list a few of the residents who were sick and were interviewed by CDC epidemiologists.

Go to
slide 13

4. You have the same information the epidemiologists had as they began to “crack the case.” During an investigation, scientists uncover information that aids in identifying the source of the illness. Therefore, you will be given a **new clue every 3 to 4 minutes**.

Tell the class: Test your investigation and epidemiology skills and discover the source of the disease outbreak!

The Dale City Dilemma:

Tell the class: Like the epidemiologists who linked an outbreak of illness to undercooked hamburgers, you will use your investigative skills to identify the source of an outbreak of illness in the fictitious town of Dale City:

Go to
slide 14

Read the following newspaper article:

Dateline, July 10: Physicians in Dale City, Georgia report an increase in the number of people who are ill with cryptosporidiosis, also known as “Crypto,” an illness characterized by watery diarrhea and possible fever, nausea, and vomiting. Health department officials phoned the Centers for Disease Control and Prevention (CDC) and asked for assistance. Epidemiologists have been sent in from the CDC to investigate the source of the illness, and have determined that there is indeed an outbreak. They quickly begin the investigation hoping to contain the disease and prevent the spread of illness.

Ill people have been showing up at emergency rooms and clinics all over the area. Lab tests confirmed that Crypto was in the stool sample of several patients. Epidemiologists decided the case definition would include those who had lab confirmed cryptosporidiosis or presented with watery diarrhea and one other intestinal symptom between June 4 and June 20 in Dale City. Initial patients who reported illness attended the Sunshine Daycare Center, but other residents who complained of similar symptoms seemed to have no connection to the daycare center. Although Dale City is small and its residents regularly work and gather together, officials are having a difficult time identifying the source of illness.

Epidemiologists interviewed a few of the city’s residents. Most of the victims in Dale City got sick on June 13, 14, or 15. Epidemiologists calculated that they were probably infected on June 6, 7, or 8 since symptoms of Crypto usually appear about 7 days after being infected. All victims were questioned by interviewers to find out what they were doing on those days.

Go to
slide 15

Recall the first four steps of an outbreak investigation. Let’s review what the epidemiologists have done so far in order to solve the case:

- **Step 1: Prepare for the investigation** – The epidemiologists prepared by researching cryptosporidiosis and familiarizing themselves with Dale City.
- **Step 2: Decide if there really is an outbreak** – An outbreak of cryptosporidiosis has been confirmed because the number reporting illness is higher than expected based on rates from last year.
- **Step 3: Specify the nature of the disease** – Lab tests have confirmed the presence of Crypto in the stool of several patients.
- **Step 4: Define and identify cases** – People will be considered a part of the outbreak if they meet the case definition of having lab confirmed Crypto or watery diarrhea plus one other symptom and became ill between May 4 and May 20 in Dale City.

Go to
slide 16

Before they traveled to Dale City, the disease detectives researched Crypto. They found:

- **Symptoms:** Crypto is a diarrheal illness. Symptoms include diarrhea, loose or watery stool, stomach cramps, upset stomach, and a slight fever that can last one to two weeks. However, some people have no symptoms. Symptoms usually begin an average of 7 days after being infected (with a range of between 2 and 10 days) and usually last about 2 weeks.

- **People who are most likely to become infected are:**
 - » Children who attend day care centers, including diaper-aged children
 - » Child care workers
 - » Parents of infected children
 - » International travelers
 - » People who swallow water from contaminated sources
- Although Crypto can infect all people, some groups are more likely to develop more serious illness. Young children, pregnant women, and individuals with weakened immune systems are more likely to get seriously ill.
- Crypto is spread through the fecal-oral route. This is when parasites found in the feces of one person (or animal) are swallowed by another person.
- Fecal material (or the germs on the feces) can be accidentally ingested through three main ways:
 1. **Poor hygiene:** Examples include poor hand washing after using the bathroom, before preparing food, after handling baby diapers, or after having contact with ill animals—especially common in group-daycare settings, where fecal germs are commonly found on surfaces and on the hands of day care workers.
 2. **Food:** Such as eating food contaminated by people who did not wash their hands.
 3. **Water:** Swallowing contaminated water.

Go to
slide 17

To complete steps five and six of an outbreak investigation:

Be sure your group has all materials that are needed for the activity (a Dale City spot map, instruction sheet, and victim cards) and then begin!

Go to
slide 18

Clue 1: Dana Dewey is a model child in the Sunshine Daycare Center; however, her teachers are working on her hygiene—she usually forgets to wash her hands after going to the bathroom. Her parents, Phil and Jill, have noticed that she does not wash her hands at home either.

Go to
slide 19

Clue 2: When she cleans, Ella Bloom usually uses gloves to protect her hands from germs. However, because she was in such a hurry on May 8, she did not take the time to put on gloves before cleaning.

Go to
slide 20

Clue 3: Marge’s new low-impact exercise is water aerobics that she does at the only pool in town. It gets her joints moving without hurting herself and she loves being outside to enjoy the pleasant Dale City weather.

Go to
slide 21

Clue 4: Sunshine Daycare sponsors a monthly trip for its students. On May 6, they went to the Dale City Pool and Park.

Go to
slide 22

Clue 5: Ben finds a chair at the pool and lies down to relax, but gets a stomach cramp that means that disaster is soon to follow. He hurries to the bathroom. He cannot find soap near the sink, and decides to just wipe his hands on his swimming trunks instead.

If you choose to have the students work on their graphing skills, you can now have them graph the cases that are on the victim cards. Have them put dates on the x-axis and the number of new people who become sick on the y-axis. They can now use the victim cards to fill in squares on the date that each person became sick.

Go to
slide 23

Without telling the groups whether they are right or wrong, ask how they arrived at their conclusions.

- Based on the information that you have gathered, where was the outbreak primarily spread?
Answer: At the Dale City Pool.
- How do you know? What clues made you certain?
Answer: Although people who became sick lived and worked around the city, most of them were at the pool around the time of the outbreak. This is evidenced by clusters on the spot map.

Congratulate the groups who are correct!

Tell the class: Epidemiologists would have arrived at this conclusion by plotting victims' activities and whereabouts during the time of the outbreak. After they plotted the information, they would have noticed any clusters, or places where the majority of the victims visited. Although other residents got sick at different venues, the majority of victims went to the Dale City Pool and Park. In addition, they researched Crypto, and found that this germ can be spread through swimming pool water. After interviewing people who spent time at the Dale City Pool and Park, they concluded that infected individuals had visited the pool about a week before the outbreak. From this information, the disease detectives can conclude that the source of the disease outbreak is the Dale City Pool.

Go to
slide 24

Epi curve of the Dale City Dilemma – If we plotted out the number of people who became sick in Dale City by the date they first became sick, our epi curve would look like this. **If you had the students construct a graph they can compare their results with the slide.**

Go to
slide 25

Ask the class: Now that we have found the culprit and the source of the disease, what did you learn about Crypto?

- Crypto is a waterborne germ that can be spread by swallowing water that has been contaminated with feces.
- If someone who is ill with Crypto has an accident in the pool, the water will become contaminated and will cause illness if it is swallowed. Therefore, it is a recreational water illness.

Go to
slide 26

Now that you have completed steps five and six of the investigation, we now arrive at steps seven and eight of an outbreak investigation: They are to educate the public by starting programs that control and prevent the spread of disease. We can do this by two ways:

- **Step 7: Start programs that control and prevent the spread of disease** – After disease detectives have found the source of the outbreak, it is very important that they work towards controlling it and preventing it from further spreading.
- **Step 8: Educate the public** – Steps should be taken to educate the public about how to protect themselves from the disease. You might also need to communicate your findings formally to those who need to know. This communication usually takes two forms: 1) an oral briefing for local health authorities and 2) a written report.

“What’s wrong with this picture?”

Go to
slide 27

Tell the students: Scientists found that the pool in Dale City was well maintained. Despite this, Crypto was able to thrive because of its resistance to chlorine. The citizens of Dale City wanted to know what steps they could take to prevent the spread of recreational water illnesses, or RWIs. When the CDC Health Communicator explained to swimmers and other residents the cause of the outbreak, she presented the following diagram ([swimming pool graphic on slide and page 15](#)). The spread of Crypto could have been reduced at the Dale City Pool.

Click for
animation

Sunshine Daycare Kids: *These kids should be taken on bathroom breaks and have their diapers checked often.* If one or more children have a fecal accident in the pool, it can spread in the kiddie pool, and then filter to the larger, adult pool. The daycare also should have a “no diarrhea policy” where children who are ill do not come into the daycare.

Click for
animation

Jack: Jack, the lifeguard, routinely jumps into the water to save pool patrons' lives. *He can protect himself from Crypto by trying not to swallow the pool water.* He also helps maintain the pool chlorine levels that will kill most RWIs. It is important for him to make sure the pool is clean.

Click for
animation

Ben: Ben was diagnosed with cryptosporidiosis a few days prior to his visit to the pool. *He had severe diarrhea, and should not have been swimming in the pool.* He could have prevented the contamination of the beach chairs by *washing his hands with soap and water after he went to the bathroom.*

Dana: Dana needs to *practice good hygiene*. She can help prevent the spread of disease by thoroughly washing her hands with soap and water after each bathroom visit and thoroughly washing hands after having contact with animals. Not only did she spread germs to her classmates, but when she had diarrhea, she spread Crypto to her family members as well. Her germs could be found on toys and other items around the home.

Phil and Jill Dewey: The Deweys should not have sent Dana to the daycare while she was ill with diarrhea. *Additionally, they should never let their child swim while ill with diarrhea.* The Deweys also need to address hygiene issues in the home since they did not go to the pool but still got sick.

Pool Patron in the Changing Room: The changing room is an excellent place to help prevent the spread of disease. *Diapers should be changed here and in the bathrooms, but NOT at poolside.* Germs can spread to surfaces and objects in and around the pool and spread illness. After pool patrons have changed diapers, it is important that they *wash their hands (with soap and water), and practice good hygiene.*

Pool Patron in the Fountain/Shower: Children and adults can help prevent disease by *taking showers before they enter the pool. Parents should wash their children thoroughly (especially the rear end) with soap and water before swimming.* We all have invisible amounts of fecal matter on our bottoms that end up in the pool.

Dale City Dilemma Instruction Sheet

1. For this exercise you will be divided into teams. Decide on a name of your “Disease Detective” team. Each team will need to designate
 - » **A team leader** to keep the group on task
 - » **Data collectors** to manage the data that is collected from the clues and victim cards
 - » **A spokesperson** to communicate your findings to entire class

2. Use the information provided in the “**Victim Cards**” plot where each victim:
 - » Lives
 - » Works
 - » Visits
 - » Plays and/or
 - » Goes to school

Look for patterns in the information that is plotted. These patterns will provide clues into the source of the outbreak.

3. Every 4 minutes the instructor will provide a **clue** that will help in identifying the source of the outbreak.

Based on the information that you have gathered, develop a **hypothesis** to explain how and why the outbreak occurred. The hypothesis should include:

1. The source of the illness (person who introduced it to the community),
2. The main vehicle of transmission (was the illness spread mainly through food, water, etc.), and
3. The primary exposures that caused the disease (how did victims contract the illness).



Provide evidence to support your hypothesis.

Dale City Dilemma The Victims

Victim - Ben Chapman, 20 years old

Job: College student

Residence: Lives in Tulip Towers with a roommate

On May 10, he participated in the annual hotdog-eating contest at Dale City University. He stopped for gas on Wilkinson Way. Afterward, he went swimming at the Dale City Pool and Park. He became ill on May 9 with watery stool.

Victim - Phil & Jill Dewey, parents of Dana Dewey

Job: Interfaith Center pastor, and teacher at the Dale City Middle School

Residence: House in Orange Grove on Wilkinson Way

On May 1, they took a family trip to the petting zoo with their daughter Dana. Their illness began on May 14.

Victim - Ella Bloom, 21 years old

Job: Groundskeeper at the Dale City Pool and Park

Residence: Canterbury Lane Apartments across from the Interfaith Center

On May 8, Ella worked all day at the pool and park. She grabbed a quick lunch at Hannah's Grocery before running off to her new part-time evening job as a security guard at the airport. She became ill on May 14.

Victim - Dana Dewey, 4 years old

School: Sunshine Daycare

Residence: House in Orange Grove on Wilkinson Way

On May 6, she joined her class on their field trip. Afterward, she went shopping with her mother at the Dale City Mall. On May 4, she was ill with diarrhea.

Victim - Laura Lind, 30 years old

Job: Sunshine Daycare teacher

Residence: Lives on Wicker Street, across from Sunshine Bakery

On May 6, took the Sunshine Daycare kids on a field trip. That same day she went to a benefit for the animal shelter at City Hall where a sit-down dinner was served. She took a 1-week sick leave starting May 13 due to diarrhea.

Victim - Marge Sumner, 75 years old

Job: Retired; recently decided to try an outdoor activity

Residence: Lives on Long St. across from Hannah's Grocery

On May 8, she went to the park to exercise her arthritic, achy joints. After exercising, Marge went bowling with her senior citizen group on Healthy Way and grabbed a bite to eat with her friends at Dixon's Deli. She became ill on May 11.

Victim - Sunshine Daycare kids, 25 sick

During the 2-week period after their spring field trip on May 6, a record number of kids missed days from school due to Crypto infection. Several of the kids had to be hospitalized. 10 children became ill on May 13, 11 on May 14, and 4 on May 15.

Victim - Jack O'Toole, 18 years old

Job: Head lifeguard at Dale City Pool and Park and college student

Residence: Lives on Eaton Street, next door to the Eaton Street Mall

On May 6, he returned to work at the park and pool after a 3-day vacation in Europe. Later that evening he went with his friends to a football game at the stadium. His diarrhea started on May 13. None of his friends got sick.

Victim - Woody Woodruf, 10 years old

School: Dale City Elementary

Residence: On the corner of Sunshine Circle and Liz Lane

On May 6, he had a busy day. He picked oranges at the orange grove. After eating them at the City Park he had lots of energy to explore the entire Dale City Pool & Park. He became ill on May 11.

Cut out each clue card along the dotted line in advance. As the groups draw conclusions from the Victim Cards, help them along by reading out a Clue Card (page 13) every 3 to 4 minutes.



Clue Card



Clue Card

1. Dana Dewey is a model child in the Sunshine Daycare Center; however, her teachers are working on her hygiene—she usually forgets to wash her hands after going to the bathroom. Her parents, Phil and Jill, have noticed that she does not wash her hands at home either.

Clue Card

3. Marge's new low-impact exercise is water aerobics that she does at the only pool in town. It gets her joints moving without hurting herself and she loves being outside to enjoy the pleasant Dale City weather.

Clue Card

2. When she cleans, Ella Bloom usually uses gloves to protect her hands from germs. However, because she was in such a hurry on May 8, she did not take the time to put on gloves before cleaning.

Clue Card

4. Sunshine Daycare sponsors a monthly trip for its students. On May 6, they went to the Dale City Pool and Park.

Clue Card

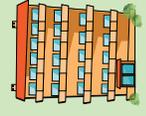
5. Ben finds a chair at the pool and lies down to relax, but gets a stomach cramp that means that disaster is soon to follow. He hurries to the bathroom. He cannot find soap near the sink, and decides to just wipe his hands on his swimming trunks instead.

Dale City Spot Map

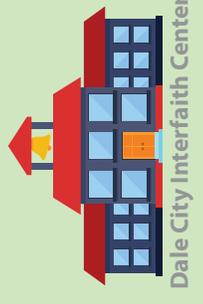


Sunshine Circle

Stadium

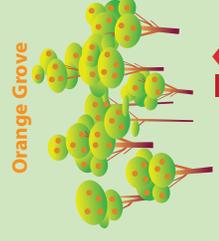


Wicker Street



Dale City Interfaith Center

Peebles Path



Orange Grove



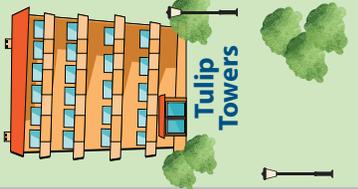
Flowers Road



Sunshine Bakery



Liz Lane



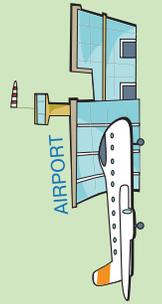
Tulip Towers



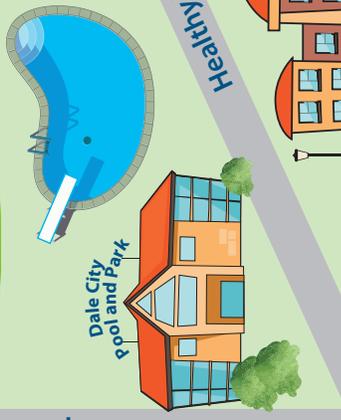
Dale City Mall



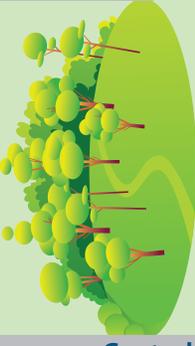
Hannah's Grocery



AIRPORT



Dale City Pool and Park



House



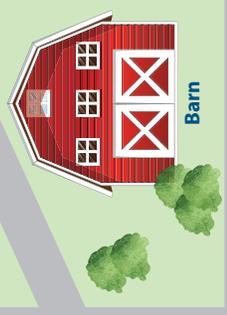
Park Point



CITY HALL

Healthy Way

Wilkinson Way



Barn



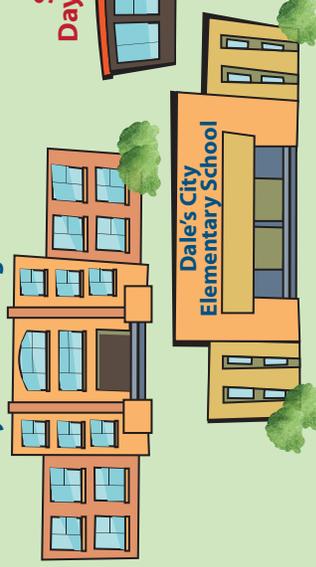
Greenfield



Bowling Alley

Main Street

Dale's City Middle & High School



Sunshine Daycare Center



Main Street

Dale City University



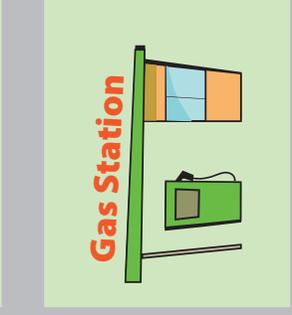
Main Street



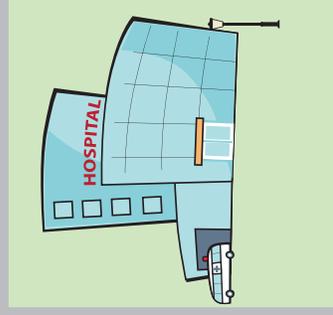
Eaton Street



Eaton Street Mall



Gas Station



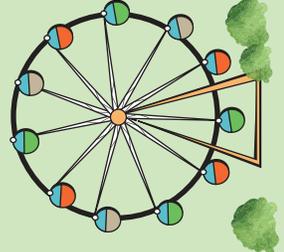
HOSPITAL

Peachtree Street

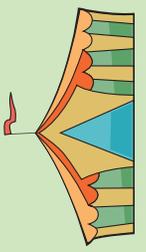


Dixon's Deli

Cantana Street



Friendly Towne Amusement Park



Bathrooms



~~Dana~~

Changing Rooms



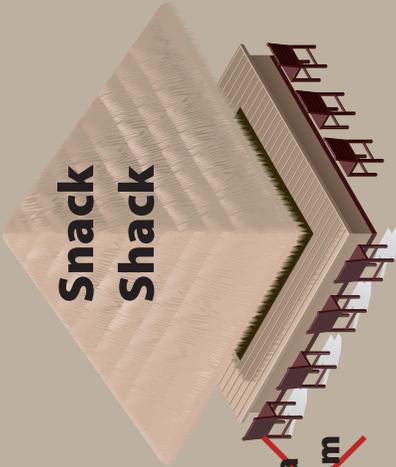
~~Pool Patron~~

Showers



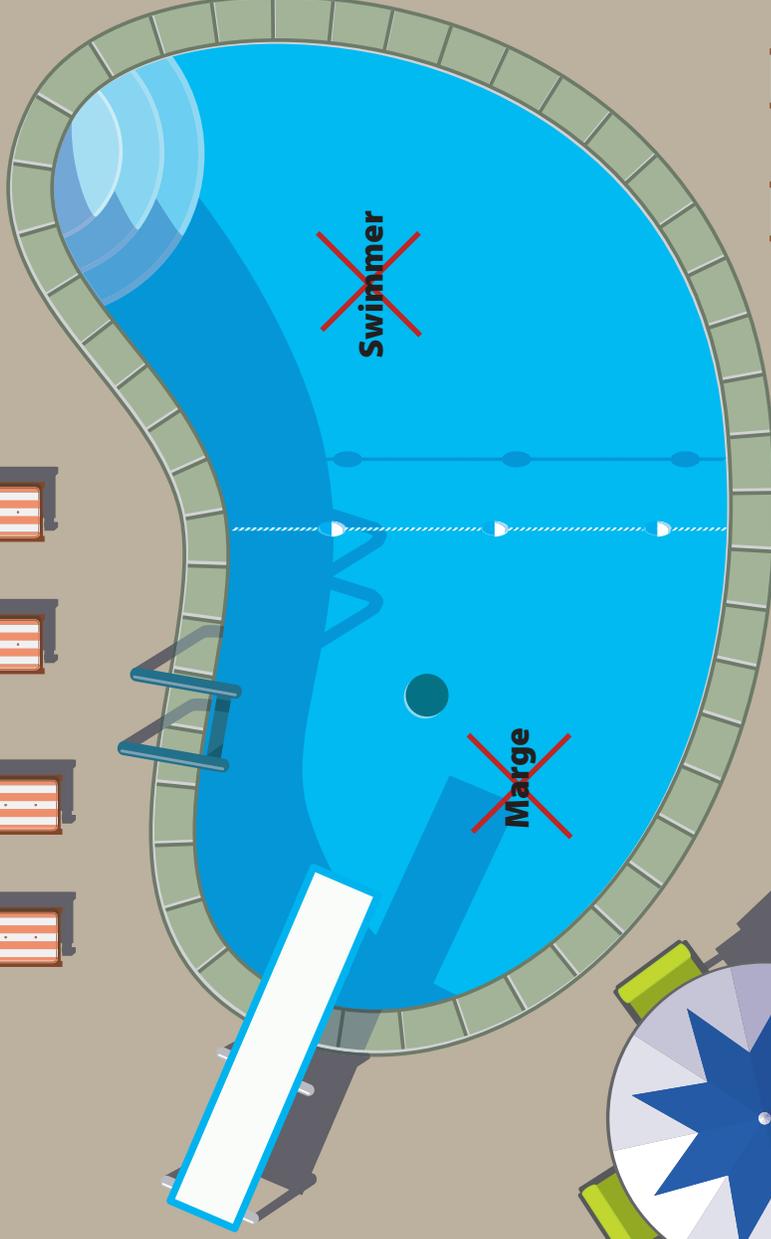
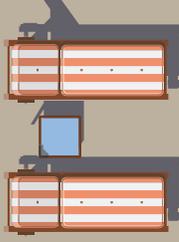
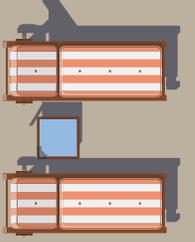
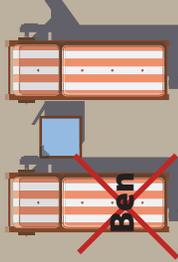
~~Pool Patron~~

Snack Shack



~~Ella Bloom~~

~~Ben~~



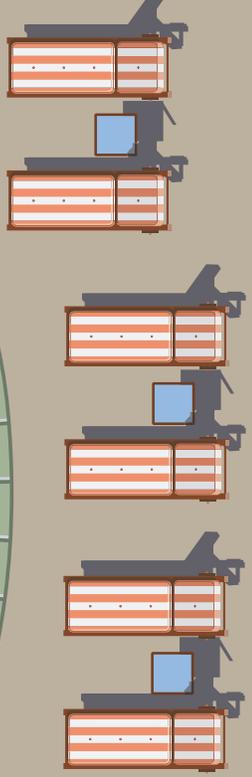
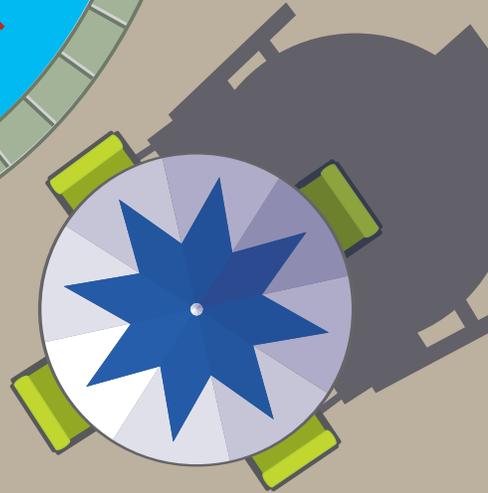
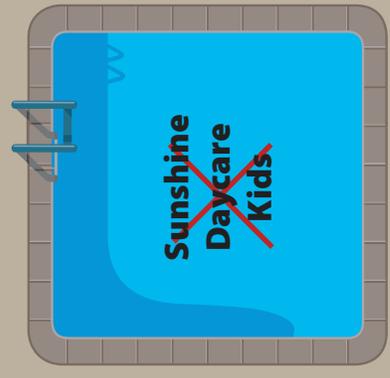
~~Swimmer~~

~~Marge~~

~~Jack~~



~~Sunshine Daycare Kids~~



INSTRUCTOR GUIDE

Outbreak Detectives

Lesson Three: RWI Germs

Purpose: The purpose of Lesson Three is to review Recreational Water Illnesses.

Time: 10 minutes

Learning Objectives: By the end of this lesson, students should be able to:

- Define Recreational Water Illnesses, or RWIs
- List four major germs that cause Recreational Water Illnesses
- Explain how diarrheal RWIs are spread

Slides: 28 - 34

START HERE:

Go to
slide 28

Ask the class: What are Recreational Water Illnesses (RWIs)?

- **RWIs** are illnesses that are spread by swallowing, breathing, or having contact with contaminated water from swimming pools, spas, splash pads, lakes, rivers, or oceans.
- **RWIs** can cause a wide variety of symptoms, including skin, ear, eye, respiratory, and wound infections.
- The most commonly reported RWI is **diarrhea**, which is the focus of our workshop.

Go to
slide 29

Ask the class: Can anyone name other RWI germs that cause diarrheal illness?

Answer: Probably the most widely known germ that causes diarrheal illness is *E. coli* O157:H7. It is infamous for the outbreak of severe diarrheal illness at a water park in Georgia that infected 22 children and led to the death of 1 child. This *E. coli* O157:H7 was also the cause of the outbreak mentioned earlier in the undercooked hamburger incident. Diarrheal illnesses can also be caused by germs such as *Giardia* and *Shigella*.

The most common waterborne germs in the United States that cause diarrhea outbreaks are *Crypto*, *Giardia*, *Shigella*, and *E. coli* O157:H7. General symptoms include diarrhea, loose or watery stool, stomach cramps, and a slight fever. Some people have no symptoms.

Germs that Cause Most Recreational Water Illnesses:

Crypto:

Go to
slide 30

Ask the class: Can anyone list a few parasites?

When most people think of parasites they think of leeches, fleas, or ticks. Did you know that not all parasites are visible to the naked eye? Cryptosporidiosis is a diarrheal disease caused by a microscopic parasite, *Cryptosporidium*. Both the disease and **the parasite are also known as “Crypto.”** Crypto has become recognized as one of the most common causes of waterborne disease (drinking and recreational) in humans in the United States. 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 resistant to chlorine disinfection. It can live in the intestine of humans and animals and is passed in the stool of an infected person or animal. For people with weakened immune systems it may become life-threatening.

Go to
slide 31

Giardia:

Giardiasis (GEE-are-DYE-uh-sis) is a diarrheal illness caused by a one-celled microscopic parasite called *Giardia intestinalis*. It lives in the intestine of people and animals. The parasite is protected by an outer shell that allows it to survive outside the body and in the environment for long periods of time.

- **Onset of Illness:** Symptoms generally begin 1-2 weeks after being infected. In healthy persons, symptoms may last 2-6 weeks. Occasionally, symptoms last longer. Luckily, effective treatment is available.
- **Most at Risk:** Child care workers; children who attend day care centers.

Go to
slide 32

Shigella:

Shigellosis is an infectious disease caused by a group of bacteria called *Shigella*.

- **Onset of Illness:** Symptoms start 12 hours to 6 days after infection. On average, they begin 2 to 4 days later. Shigellosis usually resolves in 5 to 7 days.

Go to
slide 33

E. coli O157:H7:

- *E. coli* O157:H7 is one of hundreds of strains of the bacterium *Escherichia coli*. This strain produces a powerful toxin and can cause severe illness. In some people, particularly children under 5 years of age and the elderly, *E. coli* O157:H7 infection can also cause a complication called hemolytic uremic syndrome, in which the bacteria creates a toxin causing red blood cells to be destroyed and the kidneys fail.
- **Onset of Illness:** Symptoms usually show 3 to 4 days after infection. The illness resolves in 5 to 10 days.
- **Most at Risk:** Bacteria in diarrheal stools of infected persons can be passed from one person to another if hygiene or handwashing habits are inadequate.

Go to
slide 34

Ask the class: How are diarrheal RWIs spread?

If swimmers are ill with diarrhea, the germs that they carry can contaminate the water if they have an “accident” in the pool. On average people have about 0.14 grams of feces (which is about the amount that can fit on your pinky fingernail) on their bottoms which, when rinsed off, can contaminate recreational water. When people are ill with diarrhea, their stool can contain millions of germs, possibly spreading disease to most people swimming that day. Therefore, swimming when ill with diarrhea can easily contaminate large pools or water parks. In addition, lakes, rivers, and the ocean can be contaminated by sewage spills, animal waste and water runoff following rainfall. Some common germs can also live for long periods of time in salt water.

So, if someone swallows water that has been contaminated with feces, he/she may become sick. Many of these diarrhea-causing germs do not have to be swallowed in large amounts to cause illness.

INSTRUCTOR GUIDE

Outbreak Detectives

Lesson Four: Disinfection Times and Filtration System

Purpose: The purpose of Lesson Four is to review the relationship between chlorine, germs, and disinfection times in providing properly disinfected pool water, and review a pool filtration system.

Time: 10 minutes

Learning Objectives: By the end of this lesson, students should be able to:

- Explain how chlorine kills germs
- Describe the relationship between three germs and disinfection times
- Describe how pool filtration and chemical treatment of pools work together

Slides: 35 - 37

START HERE:

Go to
slide 35

Ask the class: Does chlorine kill all germs?

Go to
slide 36

Answer: Chlorine in swimming pools does kill the germs that may make people sick, but it takes time. Chlorine in properly disinfected pools kills most germs that can cause RWIs in less than an hour. Chlorine takes longer to kill some germs such as Crypto, which can survive for up to 7 days in even a properly disinfected pool.

Table 1: Disinfection Time for Microbes in Chlorinated Water

MICROBE	DISINFECTION TIME <i>in minutes</i> (1ppm free chlorine, 25°C)
<i>E. coli</i> O157:H7 Bacterium	Less than 1 min.
<i>Giardia</i> Parasite	About 45 min.
<i>Cryptosporidium</i> (Crypto) Parasite	About 9600 min. (6.7 days)

Table 1 lists the disinfection time for microbes in chlorinated water. As you can see, all of the microbes can be eliminated from chlorinated recreational water in time. In fact, research indicates that chlorination controls the spread of most RWIs. It is very important to note, however, that the length of time that it takes to kill germs varies according to the type of microbe.

Ask the class: Based on the short time that it takes for chlorine to kill *E. coli* O157:H7, what conclusions can we then draw about pools that spread *E. coli* O157:H7?

Answer: The pools are probably not well maintained.

Go to
slide 37

Pool overview and filtration system:

Swimming pools come in all shapes and sizes, but nearly all of them work in the same basic way. They use a combination of filtration and chemical treatment to continually treat and filter a large volume of water, germs, dirt, and debris.

In some pools, water from the large, adult pools and the kiddie pools are filtered together. When being filtered, these pools share the same water. This is important to note because if there is a fecal accident in the kiddie pool (which is more likely in diaper babies), it will eventually flow into the larger pool and infect adults there.

INSTRUCTOR GUIDE

Outbreak Detectives

Lesson Five: RWI Prevention

Purpose: The purpose of Lesson Five is to review healthy swimming behaviors that should be practiced while at the pool to prevent Recreational Water Illnesses (RWIs).

Time: 10 minutes

Learning Objectives: By the end of this lesson, students should be able to:

- List behaviors that all swimmers should practice
- List behaviors that parents should practice

Slides: 38 - 40

START HERE:

Go to
slide 38

Healthy Swimming behaviors should be practiced to protect yourself and others for Recreational Water Illnesses (RWIs). (Refer to *Healthy Swimming* brochure).

- **Keep the poop, germs, and pee out of the water.**
 - » Don't swim when you have diarrhea.
 - » Shower with soap before you start swimming.
 - » Take a rinse shower before you get back into the water.
 - » Take bathroom breaks every 60 minutes.
 - » Wash your hands after using the toilet or changing diapers.
- **Check the free chlorine level and pH before getting into the water.**
 - » Pools: Proper free chlorine level (1–3 mg/L or parts per million [ppm]) and pH (7.2–7.8) maximize germ-killing power.
 - » Hot tubs/spas: Proper disinfectant level (chlorine [2–4 parts per million or ppm] or bromine [4–6 ppm] and pH [7.2–7.8]) maximize germ-killing power.
 - » Most superstores, hardware stores, and pool-supply stores sell pool test strips.
- **Don't swallow the water you swim in.**

Go to
slide 39

Parents of young children should take a few extra steps:

- **Take children on bathroom breaks every 60 minutes or check diapers every 30–60 minutes.**
 - » Change diapers in the bathroom or diaper-changing area and not at poolside where germs can rinse into the water.

Go to
slide 40

Instructor Says:

- For more information about Recreational Water Illnesses, go to CDC's *Healthy Swimming* website at <http://www.cdc.gov/healthyswimming>.
- Are there any questions?
- Distribute the *Healthy Swimming* brochures.

Go to
slide
41–42

INSTRUCTOR GUIDE

Outbreak Detectives

Lesson Six: Jeopardy Game

Purpose: The purpose of the *Jeopardy Game* is to test the knowledge your students have gained about Recreational Water Illnesses.

Time: 20 minutes

Materials for Instructor:

- RWI *Jeopardy* question-and-answer poster board
- RWI *Jeopardy* score sheet or board to write the scores on

START HERE:

Instructor Prepare:

Cut out each of the cards below and make your own *Jeopardy Game* board.

On a poster board, tape or glue the title and dollar amount cards to the board. With plain paper, make a pocket to hold each of the *sentence* cards and paste them in the appropriate place on the game board. Place each *sentence* card in its appropriate pocket.

Below is how the *Jeopardy Game* board should be laid out on the poster board:

	<i>Epi Episodes</i>	<i>Outbreak</i>	<i>What's Bugging You</i>	<i>Pool-Pourri</i>
100	(Paste a pocket ...	here to hold each...	of the...	<i>sentence</i> cards.)
200	“ ”	“ ”	“ ”	“ ”
300	“ ”	“ ”	“ ”	“ ”
400	“ ”	“ ”	“ ”	“ ”

Keep the set of *question* cards (marked “Instructor”) out of student view, and use them to check for correct answers.

Instructor Says:

Now let's see what you have learned today, following the format of America's favorite game show, *Jeopardy*. First of all, let's split into two teams to play the game.

Instructor Do:

Designate a team leader who will respond for the team. Decide on how team leaders will respond, either by a short blast on a whistle or by raising a hand and announce how teams should respond. Have the teams either flip a coin or use another method to determine who goes first. The first team chooses the first category and dollar amount.

Instructor Announces the Following Rules:

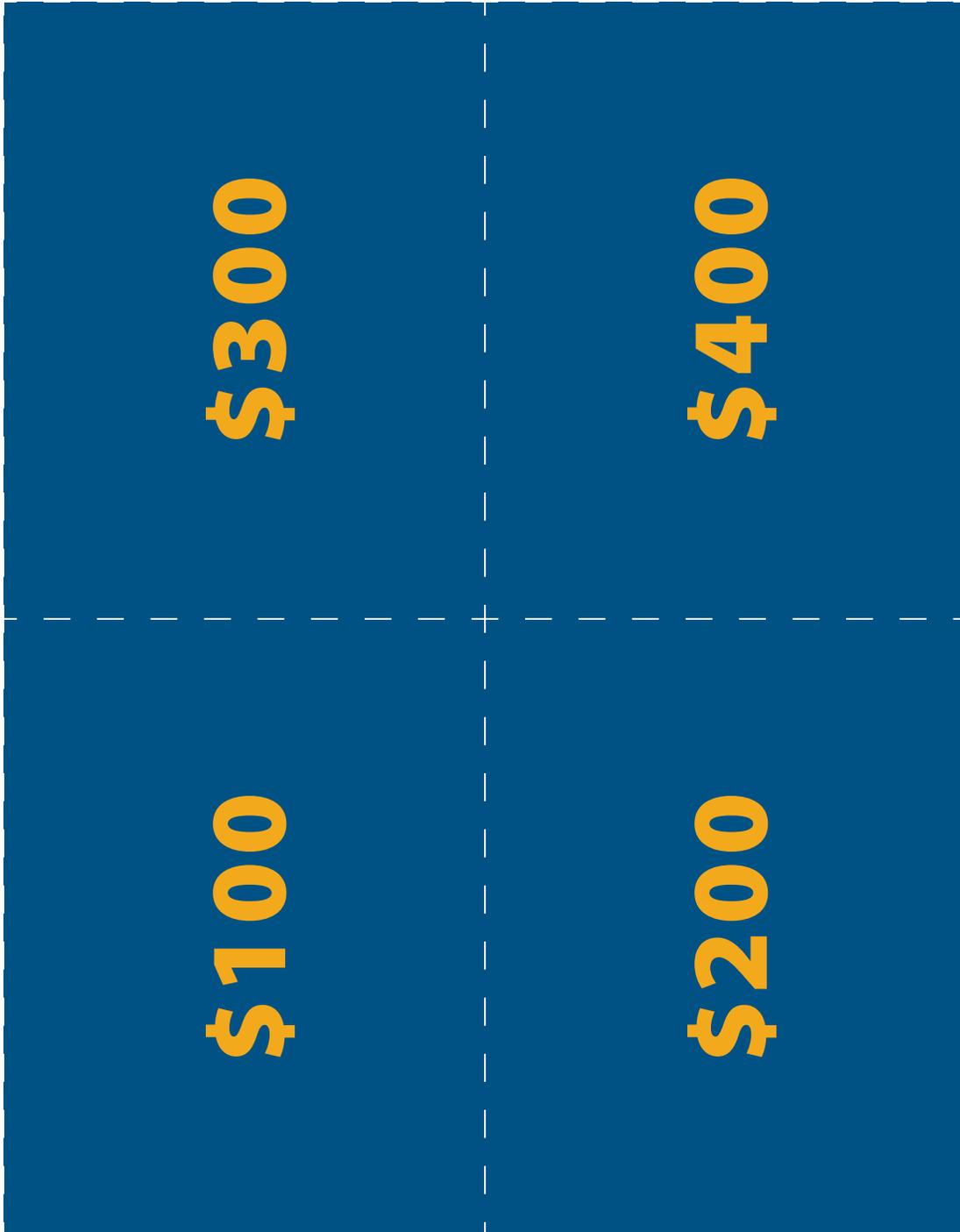
- Each “answer” by a team leader must be in the form of a question.
- An “answer” by the instructor must be completely read before a team responds, or its turn is defaulted.
- After a team signals, it has ten seconds to respond.

Playing the Game:

The instructor reads an *answer* and the first team to provide the correct *question* has its name or number written in the appropriate square. The *question* provided is considered correct without providing the exact wording found on the *question* card.

The team that first responds correctly chooses the next category and dollar amount. If a team provides an incorrect response, the other team gets the opportunity to respond. If both teams respond incorrectly, neither of the teams receives a dollar amount, and the next category and dollar amount is chosen by the original team to choose. The game continues until all of the question squares contain a team name or number. Announce which team earned the largest dollar amount.

Cut out the following:



**Epi
Episodes**

Outbreak

**What's
Bugging You**

**Pool-
Pourri**

<p>Epi Episodes for \$100</p> <p>These experts are also called disease detectives.</p>	<p>Epi Episodes for \$200</p> <p>This occurs when there are more cases of a disease than normally expected in a community.</p>
<p>Epi Episodes for \$300</p> <p>Epidemiologists look for these by asking questions, such as “Who is sick?” and “When did they get sick?”</p>	<p>Epi Episodes for \$400</p> <p>Based on information gathered from the public, epidemiologists come up with ways to do this.</p>
<p>Outbreak for \$100</p> <p>Deciding if an outbreak has really occurred and identifying the cases are known as these.</p>	<p>Outbreak for \$200</p> <p>This plots the number of new cases of an illness by the date of an illness.</p>
<p>Outbreak for \$300</p> <p>This is the step to help the public avoid illness and calm fears.</p>	<p>Outbreak for \$400</p> <p>This is called a possible explanation for a scientific problem that can be tested.</p>

What's Bugging You
for \$100

This type of illness is spread by swallowing or having contact with contaminated water.

What's Bugging You
for \$200

This is the most common RWI.

What's Bugging You
for \$300

This germ caused a severe diarrheal outbreak at a Georgia water park and at a fast-food chain in Washington State.

What's Bugging You
for \$400

This germ causes most of the diseases in both drinking and recreational water.

Pool-Pourri
for \$100

It takes chlorine about seven days to kill this germ.

Pool-Pourri
for \$200

Chlorine kills all germs that make people sick, it just takes this.

Pool-Pourri
for \$300

Please don't swim if you have this.

Pool-Pourri
for \$400

Young kids should take these often while at the pool.

<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Epi Episodes for \$100</p> <p style="text-align: center;">What are epidemiologists?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Epi Episodes for \$200</p> <p style="text-align: center;">What is a disease outbreak?</p>
<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Epi Episodes for \$300</p> <p style="text-align: center;">What are clues?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Epi Episodes for \$400</p> <p style="text-align: center;">What is contain an outbreak?</p>
<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Outbreak for \$100</p> <p style="text-align: center;">What are steps to an outbreak investigation?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Outbreak for \$200</p> <p style="text-align: center;">What is an epi curve?</p>
<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Outbreak for \$300</p> <p style="text-align: center;">What is educate the public?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Outbreak for \$400</p> <p style="text-align: center;">What is a hypothesis?</p>

<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">What's Bugging You for \$100</p> <p style="text-align: center;">What is a Recreational Water Illness?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">What's Bugging You for \$200</p> <p style="text-align: center;">What is diarrhea?</p>
<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">What's Bugging You for \$300</p> <p style="text-align: center;">What is <i>E. coli</i>?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">What's Bugging You for \$400</p> <p style="text-align: center;">What is Crypto?</p>
<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Pool-Pourri for \$100</p> <p style="text-align: center;">What is Crypto?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Pool-Pourri for \$200</p> <p style="text-align: center;">What is time?</p>
<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Pool-Pourri for \$300</p> <p style="text-align: center;">What is diarrhea?</p>	<p style="text-align: center;">For Instructor</p> <p style="text-align: center;">Pool-Pourri for \$400</p> <p style="text-align: center;">What are bathroom breaks?</p>

HEALTHY SWIMMING JEOPARDY

	Epi Episodes	Outbreak	What's Bugging You	Pool-Pourri
\$100	Square winner:	Square winner:	Square winner:	Square winner:
\$200	Square winner:	Square winner:	Square winner:	Square winner:
\$300	Square winner:	Square winner:	Square winner:	Square winner:
\$400	Square winner:	Square winner:	Square winner:	Square winner: