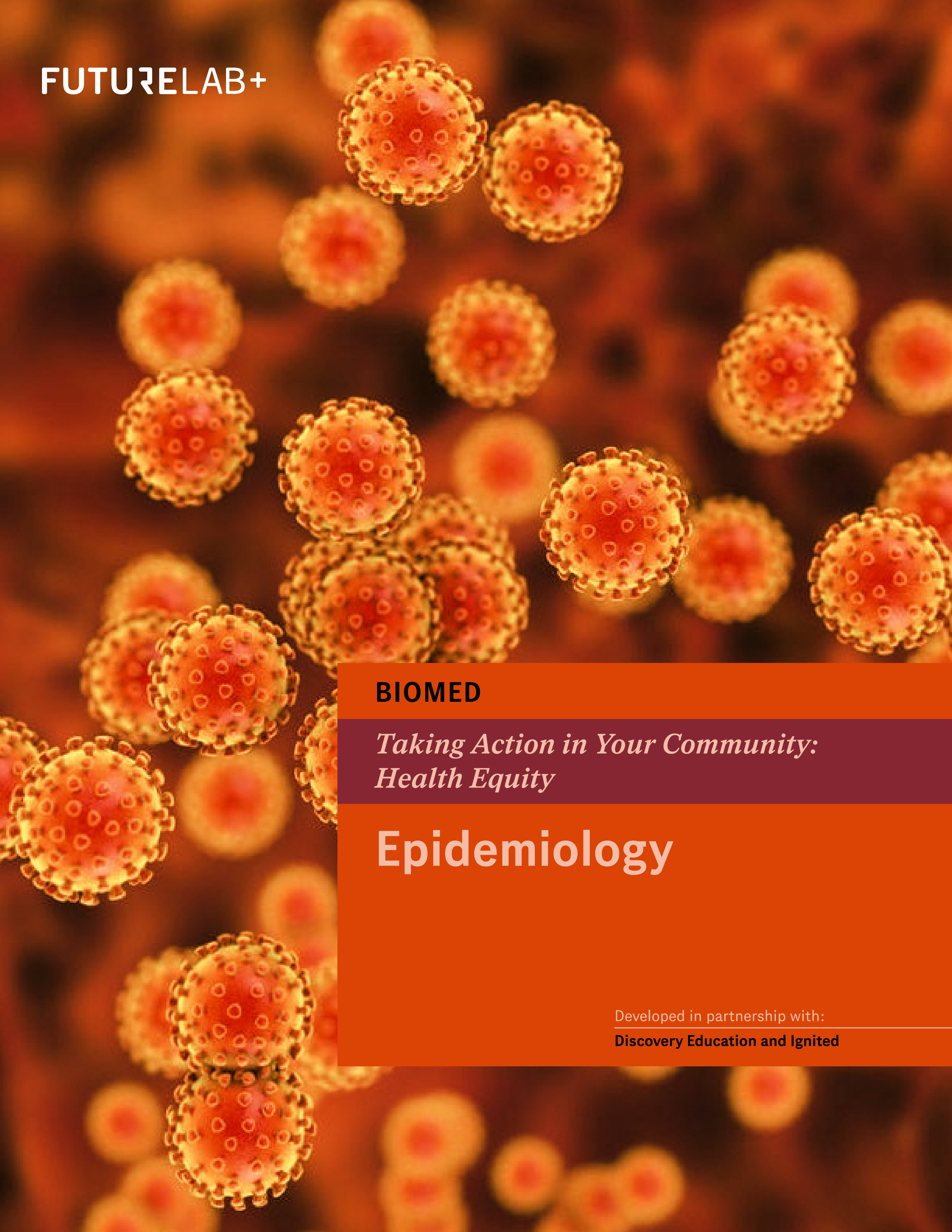


FUTURELAB+

BIOMED

Taking Action in Your Community: Health Equity

Epidemiology

Developed in partnership with:

Discovery Education and Ignited

In this Lesson Plan:

Print the **Teacher Section** →

Print the **Student Section** →

This document is separated into two sections, For Teachers [T] *and* Student Resources [S], *which can be printed independently.*

Select the appropriate printer icon above to print either section in its entirety.

Follow the tips below in the Range field of your Print panel to print single pages or page ranges:

Single Pages (use a comma): T3, T6

Page Range (use a hyphen): T3–T6

Cover Image
Coronavirus particles, (illustration).

BIOMED / TAKING ACTION IN YOUR COMMUNITY: HEALTH EQUITY

Epidemiology

DRIVING QUESTION

How does epidemiology affect and determine the prevalence of endemics, epidemics, and pandemics throughout the world?

OVERVIEW

Bacteria and viruses existed long before the first humans walked the earth. In order for modern society to operate effectively, we must identify, prevent, and treat the many diseases caused by these ancient microscopic agents.

In this lesson, students will act as epidemiologist “disease detectives” to find out the “who,” “when,” and “where” of negative health events. They will also use data to determine which populations and communities are more vulnerable to adverse health events and predict when and where the events may take place in the future.

ACTIVITY DURATION

Five class sessions (45 minutes each)

ESSENTIAL QUESTIONS

What are the most common ways local health departments uncover outbreaks?

How does the study of epidemiology uncover racial, economic, and social inequities?

What technological advances have occurred to make the study of epidemiology more accurate?

What are the fundamentals of outbreak investigation?

OBJECTIVES

Students will be able to:

Examine the general principles and purposes of epidemiology.

Explore epidemiological principles using historical cases.

Assess the impact of social, economic, and cultural factors on epidemiology throughout history and today.

Calculate epidemiological statistics for specific outbreaks.

BACKGROUND INFORMATION

Modern epidemiology can be seen as detective work for the spread of disease throughout a population. Epidemiologists piece together clues and evidence to deduce the origin of an outbreak, to recognize trends, and to predict future spread.

Materials
Computers with Internet Access
Calculators
4 to 1 Images
Epidemiologic Classification Assignment
Disease Detective Capture Sheet
Poster Presentation
Markers
Notecards
Poster Board
Writing Tools
Measures of Disease Frequency Capture Sheet
Future Outbreak Prediction Student Video Rubric
Design Journal

Pedagogical Framing

Instructional materials are designed to meet national education and industry standards to focus on in-demand skills needed across the full product development life cycle—from molecule to medicine—which will also expose students and educators to the breadth of education and career pathways across biotechnology.

Through this collection, educators are equipped with strategies to engage students from diverse racial, ethnic, and cultural groups, providing them with quality, equitable, and liberating educational experiences that validate and affirm student identity.

Units are designed to be problem-based and focus on workforce skill development to empower students with the knowledge and tools to be the change in reducing health disparities in communities.

SOCIAL-EMOTIONAL LEARNING

In this lesson, students are encouraged to practice self-awareness skills when they are asked what their idea of epidemiology is and how epidemics have affected them or their families directly. They may draw connections to the epidemic diseases they are researching as well as gain a greater knowledge of how epidemics may spread through their family and community. The lesson contains many opportunities for exercising social awareness and social management as groups work together on activities.

CULTURALLY AND LINGUISTICALLY RESPONSIVE INSTRUCTION

Students will examine the disparities of race and class and their effect on the study of epidemiology in this country and worldwide. For example, why does COVID-19 disproportionately affect BIPOC communities? The lesson provides culturally responsive instructional strategies to allow for the building of common experience, as well as ways to affirm diverse forms of communication.

ADVANCING INCLUSIVE RESEARCH

This lesson focuses on epidemics, many of which disproportionately impact communities of color. In order to prevent the spread of epidemics, scientists must understand how health phenomena vary across genotypes. This requires an effort to advance the diversity of clinical trials and genetic research.

COMPUTATIONAL THINKING PRACTICES

Epidemiologists use every computational thinking strategy in their work: they collect and analyze data, build models that make it easier to find patterns in the spread of disease, abstract commonalities out of patient experiences, decompose the process of disease prevention into manageable steps, and share those steps with the public in the form of algorithms. By using the strategies that computer programmers use, these health professionals can effectively predict, prevent, and even stop negative health events.

CONNECTION TO THE PRODUCT LIFE CYCLE

During the COVID-19 pandemic, pharmaceutical companies scaled up production in order to develop and distribute as many vaccines as possible. This effort resulted in a historic mass vaccination effort that went from the **discovery** phase to **commercialization** phase of the product life cycle in under a year.

Have you ever wondered…

How does the job of an epidemiologist differ from that of most health care workers, like doctors and clinicians?

Doctors and clinicians are typically concerned with the effects of the disease in a single person, whereas epidemiologists study how diseases affect communities and populations at large.

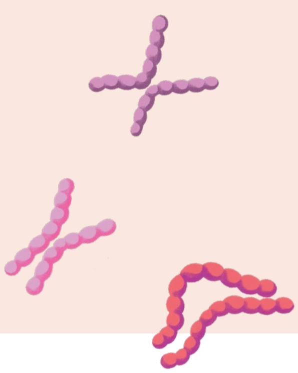
What else do epidemiologists study besides infectious diseases and their outbreaks?

Any interaction between members of a population that influences their health, such as drug abuse, chronic disease, and even more recently, *gun violence*, can be subject to study by epidemiologists. For example, an epidemiologist studying cancer rates in a certain population may look at the incidence of cigarette smoking in the same population to determine if there are any connections.

MAKE CONNECTIONS!

How does this connect to the larger unit storyline?

The knowledge and understanding of disease pathology and transmission is crucial in the development of effective treatments, such as vaccines.



How does this connect to careers?

Epidemiologists specialize in the study of diseases, such as HIV, Influenza, or COVID-19, that occur in various populations in society. They often work with doctors such as pathologists, as well as research scientists and public health professionals to ascertain the root causes of epidemics. They also collect data that determines how and where a disease is transmitted. This knowledge is crucial in recommending how best to control the spread of an outbreak in a certain population.

How does this connect to our world?

Epidemics have been a disruptive force of human life and development since the appearance of modern humans on Earth. Epidemics of infectious agents have claimed the lives of hundreds of millions of people in the past millennia. This lesson connects to those past and present issues.

Day 1

LEARNING OUTCOMES

Students will be able to:

Identify and **describe** the study of epidemiology.

Explore the practice of epidemiology through history.

COMPUTATIONAL THINKING IN ACTION

By creating one sentence that comprises the four images, students are practicing the computational thinking strategy of abstraction.

SOCIAL-EMOTIONAL LEARNING

In this exercise, students add their lived experiences into a discussion about epidemiology.

CULTURALLY AND LINGUISTICALLY RESPONSIVE INSTRUCTION

The use of culturally and linguistically responsive strategies encourages learners from all backgrounds to engage in a format that is comfortable for them. Equitable practices allow students to safely discuss sensitive topics like health disparities and questions involving specific communities, while it centers students' learning in their personal experience.

Procedure

Teacher Note > *Inform students that at the end of this lesson, they will possess a working knowledge of epidemiology, which they can take back to their own families and communities with the purpose of increasing the safety of themselves and others through knowledge of disease pathology and transmission.*

Whole Group (25 minutes)

1 Introduce the *Four to One* strategy to your students by instructing them to fold a blank piece of paper into quarters (or divide a page into quarters).

2 Use the *Four to One Teacher Images*. Display the first image for one minute and have students write one complete sentence in one of the boxes of their paper. Repeat this process for all four images. Students should end up with one sentence per box.

3 Ask students to work in pairs or small groups to discuss their individual sentences, looking for similarities and differences.

4 Students can then work again in pairs or small groups to create one complete sentence that incorporates all four images. Invite students to share what they think they will be investigating in this lesson. Anticipated answers include health and wellness, illnesses, vaccines, medicine, and health practitioners.

5 Play the video *Department of Immunology and Infectious Diseases | Harvard TH Chan School of Public Health: A Short History of Humans and Germs*. Ask students to consider different elements of modern society that make it hard for humans to avoid germs. Invite students to share their ideas.

6 Explain to students that the field of epidemiology comprises the study of patterns, frequencies, and causes of negative health events in populations. It is the main scientific discipline of the public health arena. Epidemiologists act as "disease detectives" in finding out the "who," "when," and "where" of health events. A tool scientists use for addressing the three components that contribute to the spread of disease implementation is called an "Epidemiologic Triangle." It is used to help us understand how infectious disease outbreaks spread. Invite students to sketch the triangle and label the points of the triangle using the diagram on the next page as a reference.

Continues next page >

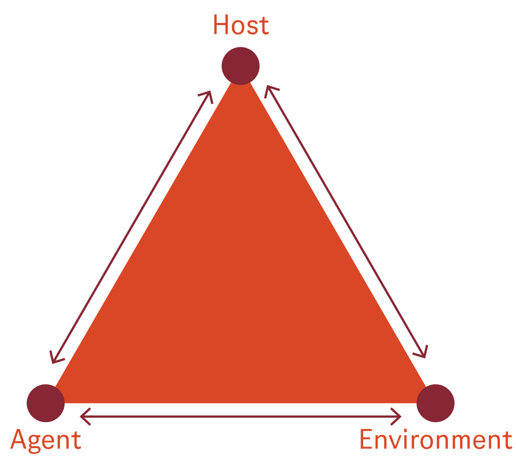
Day 1

Continued

Procedure

7 Play Part 2 of the series *A Short History Of Humans And Germs* and ask students to complete the triangle using the example featured. Ask students to turn to a partner to compare their epidemiologic triangles. Students should identify cattle or livestock as the host, the agent as rinderpest, and the environment as agricultural, with humans and animals in close proximity.

A general example of the Epidemiologic Triangle:



COMPUTATIONAL THINKING IN ACTION

Epidemiology is a profession that utilizes many computational thinking strategies to track the spread of negative health events. Epidemiologists collect and analyze health data, find patterns in information, build models to track the spread of diseases, and decompose the process of disease spread in order to prevent it.

Individual (20 minutes)

1 Guide students to use a web search to differentiate the terms *epidemic*, *endemic*, *pandemic*, and *outbreak* and complete the given *Epidemiological Classification Assignment*.

2 Ask students to turn in the capture sheet as an exit ticket OR finish as homework.

Day 2

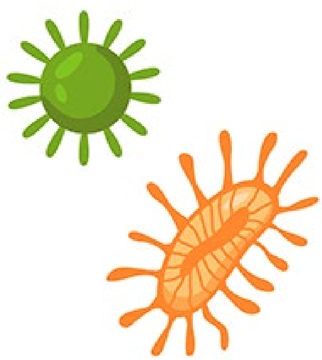
Procedure

LEARNING OUTCOMES

Students will be able to:

Carry out epidemiological research on a specific disease.

Design a poster presentation on that disease.



SOCIAL-EMOTIONAL LEARNING

By evaluating one another's work, students strengthen interpersonal relationships and practice the skill of delivering constructive feedback.

INDUSTRY AND CAREER CONNECTION

In this activity, students will be tasked with using the soft skills of openness to learning, organizing skills, attention to detail, and paying close attention. These are important skills in the career field of epidemiology. In addition to the skills above, being a motivated, organized, and committed learner is important for success in this career area.

Teacher Note > *Students will have the opportunity to select an infectious disease that interests them and research the various important aspects of the disease. The activity will integrate their ability to conduct and present research in a creative manner. The activity is also designed for students to have the opportunity to provide constructive feedback through peer evaluation.*

Individual (5 minutes)

1 Play the video *Epidemiologist/Latoya Simmons/60 Seconds*.

2 Have students write any questions they have about epidemiologists and share these questions in class. Explain that students will play the role of disease detectives and investigate a disease that they want to learn more about.

Small Group (35 minutes)

1 Place students in small groups. Explain that groups will use the *Disease Detective Capture Sheet* to select an infectious disease that they want to learn more about. The disease options are listed below.

I want to learn about…

a. the most severe pandemic in recent history—**1918 Spanish Influenza**

b. a virus that attacks the body's immune system—**HIV/AIDS**

c. a rare and deadly disease in people and nonhuman primates—**Ebola**

d. an eradicated virus that used to be contagious and often deadly—**Smallpox**

e. the most fatal pandemic recorded in human history—**Bubonic Plague**

f. one of the most severe epidemics in United States History—**Philadelphia Yellow Fever**

g. one of the most feared diseases in the U.S.—**American Polio epidemic**

h. a bacterial disease usually spread through contaminated water—**Cholera**

Continues next page >

Day 2

Continued

Procedure

COMPUTATIONAL THINKING IN ACTION

As students research their selected disease, they utilize the computational thinking strategy of analyzing data and take on the role of epidemiologists.

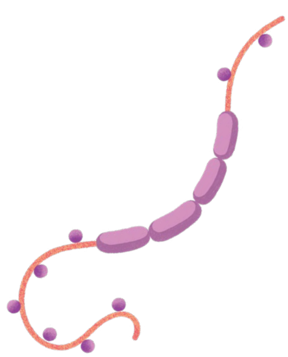
2 Using web sources, have groups conduct research on the epidemiology of their chosen disease. Explain that they will use the research to create a poster presentation for a *Gallery Walk*. The poster should include the following information:

- **a.** The origin of the disease (geographical and chronological)
- **b.** The epidemiologic triangle of the disease (agent, host, environment)
- **c.** Groups affected by the disease (ethnicity, race, socio-economic if applicable)
- **d.** Method of disease transmission from person to person
- **e.** Method of disease transmission from one area to the next
- **f.** Morbidity (number of people affected during outbreaks) and mortality (number of deaths)
- **g.** Description of treatments and preventive measures where applicable

3 Ask groups to place their posters in the classroom. Guide the class to perform a *Gallery Walk* to view the different poster presentations.

Whole Group (5 minutes)

Teacher Note > *Engage the class in a brief question and answer session about the different epidemics that were reviewed. Ask students to summarize similarities in the infectious diseases they examined.*



Day 3

Procedure

LEARNING OUTCOMES

Students will be able to:

Calculate and **interpret** the following measures of epidemiology: ratio, proportion, incidence proportion (attack rate), incidence rate, prevalence, mortality rate.

Determine and **establish** the correct measures of association and measures of impact on public health.

Teacher Note > *This day's task will provide ample opportunities for computational thinking. Students will familiarize themselves with epidemiological measures and related mathematical formulas. They will use data provided in an exemplar task to calculate epidemiological measures.*

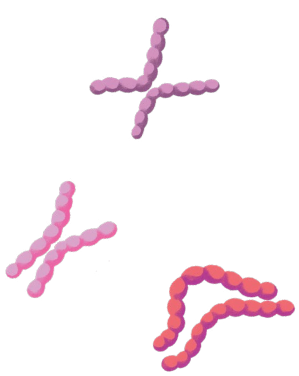
Individual (35 minutes

Distribute the *Measures of Disease Frequency Capture Sheet*. Ask students to reference Part 1 and Part 2 as they complete Part 3.

Teacher Note > *Some students may not know how to calculate risk and odds ratios. Walk through a sample problem or two with students so they gain familiarity or provide students with the link to this short instructional video: Odds Ratio (OR)—How To Calculate It.*

Individual (10 minutes)

Ask students to respond to the guiding questions in their **Design Journal.** They will consider how to investigate, track, and predict outbreaks, as well as impacts of outbreaks on various populations.

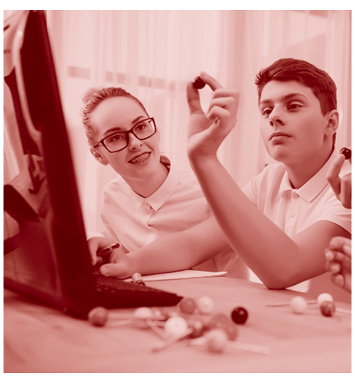


Day 4

LEARNING OUTCOMES

Students will be able to:

Play and **critique** the CDC computer game "Solve the Outbreak."



Procedure

Teacher Note > *This lesson will tap into student knowledge and experience in gaming to bring about greater knowledge and practice in the study and practice of epidemiology.*

Whole Group (10 minutes)	
1	As a class, watch the CDC video *CDC Global Disease Detectives: Clues and Answers*.
2	Conduct a brief discussion about the professional health hazards of being a disease detective.

Small Group (35 minutes)	
1	In pairs, let students play the *Solve the Outbreak* game (this can be played on classroom laptops OR tablets OR even student smartphones as a free app).
2	Let students know that they will log their average scores after three rounds of playing. Allow the class to compare average scores.
3	Let student pairs play *Outbreak at WatersEdge: A Public Health Discovery Game*.
4	Let students know that they will log their average scores after three rounds of playing. Allow the class to compare average scores.

Day 5

LEARNING OUTCOMES

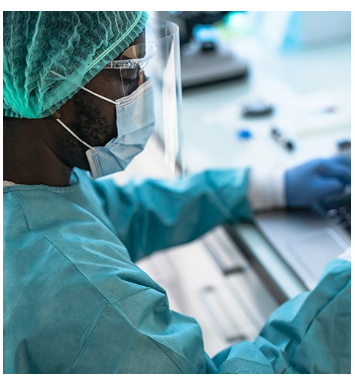
Students will be able to:

Predict when and where future outbreaks of disease can and will occur using computer modeling and big data.

Create an informative new report on where and when the next epidemic may occur, using collected data and factual information.

SOCIAL-EMOTIONAL LEARNING

In this section, students make connections between epidemics and their own communities. This allows them to personalize the content and makes it relevant to their day-to-day life.



Procedure

Teacher Note > *Students will have the opportunity to become predictive epidemiologists by using data to determine where and when future outbreaks of infectious diseases may occur. By doing this, they are able to take possible preventative measures to protect themselves and their communities, thereby giving them added personal ownership of this assignment. It is also important to note that authentic role plays are key to increasing the level of inclusivity in all facets of the biotechnology industry.*

Whole Group (10 minutes)

As a class, watch the TED Talk video *How data can predict the next pandemic/Adam Kucharski* as an example of how data mining can be used.

Small Group (35 minutes)

Teacher Note > *Remind students to only include the epidemics that have run their entire course.*

1 Ask student groups to create an informative video based on their prediction about where and when the next major epidemic will occur. Each video should be no longer than five minutes and contain the following information:

- **a.** Where might the next epidemic occur? Why?
- **b.** When might the next epidemic occur? Why?
- **c.** What technology was used to determine your predictions?
- **d.** Where was the data collected to make these predictions?
- **e.** What are the morbidity and mortality rates of your prediction?

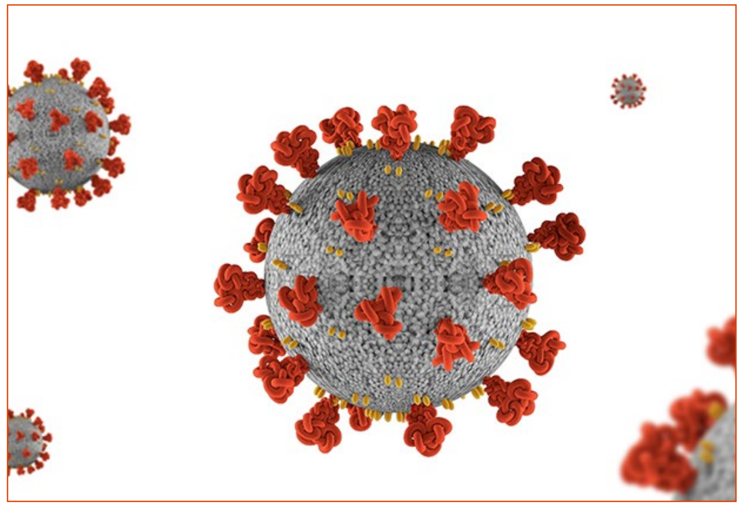
2 Have students upload their videos to the class website or platform, such as *Flipgrid*, to conduct peer evaluation. Let students know that peer evaluation of the videos should be performed based on the *Future Outbreak Prediction Student Video Rubric*.

3 Afterwards, have students reflect in their **Design Journal**, continuing to make connections to the social awareness campaign project.

National Standards

Next Generation Science Standards	**Science and Engineering Practices** Using math and computational thinking Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
	Crosscutting Concepts Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. Scale, Proportion, and Quantity Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).
Career and Technical Education (CTE)	**A6.1** Apply knowledge of symbols, algebra, and statistics to graphical data presentation.

4 to 1 Images



Epidemiologic Classification Assignment, Part 1

ANSWER KEY — **Do not share with students**

Directions
Answer the questions below.

1. Endemic

1a. Epidemiologic Definition/Description

An infection within a population in a particular geographic location that has a constant presence and exists perpetually

1b. Your Definition

Answers will vary.

1c. Memory Clue *Draw a picture.*

Answers will vary.

1d. Possible Vectors

Parasites, bacteria, viruses, protozoa, worms, insects

1e. Historical Example

Chickenpox is an example of an endemic disease in the United States, as it occurs at similar rates among similar populations annually.

2. Outbreak

2a. Epidemiologic Definition/Description

An increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area; if not quickly controlled, an outbreak can become an epidemic.

2b. Your Definition

Answers will vary.

2c. Memory Clue *Draw a picture.*

Answers will vary.

2d. Possible Vectors

Parasites, bacteria, viruses, protozoa, worms, insects

2e. Historical Example

In 1854, a mother washed a dirty diaper in a drinking well in the Soho suburb of London. An outbreak of cholera resulted, killing 616 people.

3. Epidemic

3a. Epidemiologic Definition/Description

A disease that affects a larger than expected number of people within a community, population, or region

3b. Your Definition

Answers will vary.

3c. Memory Clue *Draw a picture.*

Answers will vary.

3d. Possible Vectors

Parasites, bacteria, viruses, protozoa, worms, insects

3e. Historical Example

In 1793, yellow fever seized Philadelphia, the United States' capital at the time. Officials wrongly believed that slaves were immune. As a result, abolitionists called for people of African origin to be recruited to nurse the sick.

The disease is carried and transmitted by mosquitoes, which experienced a population boom during the particularly hot and humid weather in Philadelphia that year. It wasn't until winter arrived—and the mosquitoes died out—that the epidemic finally stopped. By then, more than 5,000 people had died.

Continues next page >

Epidemiologic Classification Assignment, Part 1

ANSWER KEY

Continued

4. Pandemic

4a. Epidemiologic Definition/Description

An epidemic that has spread over several countries or continents, usually affecting a large number of people

4b. Your Definition

Answers will vary.

4c. Memory Clue *Draw a picture.*

Answers will vary.

4d. Possible Vectors

Parasites, bacteria, viruses, protozoa, worms, insects

4e. Historical Example

The Black Death was a bubonic plague pandemic occurring in Afro-Eurasia from 1346–53 and resulting in the deaths of 75 to 200 million people during that time. It was caused by a bacillus bacteria called *Yersinia pestis* and carried by fleas on rodents. These rodents were on trading ships originating in Mongolia in central Asia and taken to the Crimean region of Europe.

Epidemiologic Classification Assignment, Part 2

ANSWER KEY | **Do not share with students**

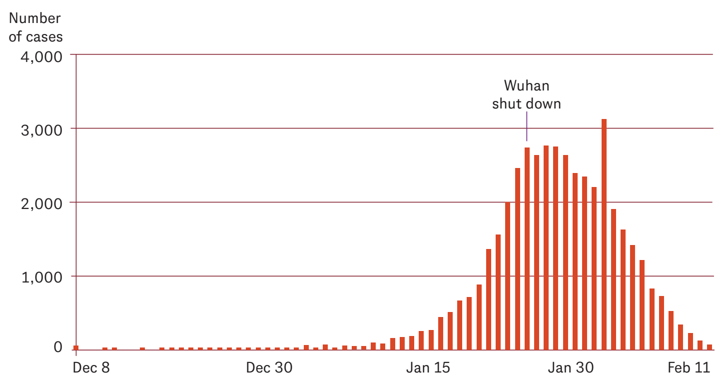
Directions

Analyze the following graphs. Indicate whether they represent an endemic, outbreak, epidemic, or pandemic and why. Write your description and how you came to that conclusion below each chart.

1.

COVID in Wuhan, China

From date of onset to February 11, 2020

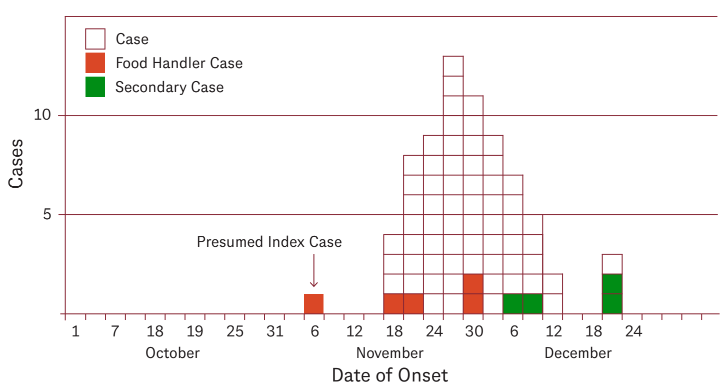


Looking at the number of cases, the timeline, and the fact that this was isolated to one city, this is an epidemic.

2.

Hepatitis A, Cases by Date of Onset

November – December, 1978

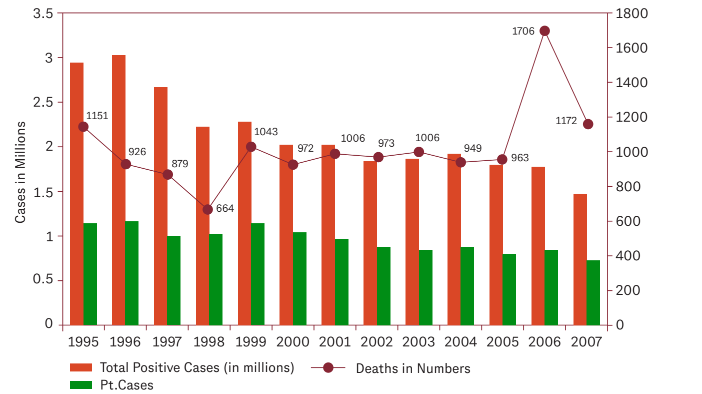


Small number of cases over an approximately 8-week period of time dictates that this is a local outbreak.

3.

Malaria in India

1995 – 2007

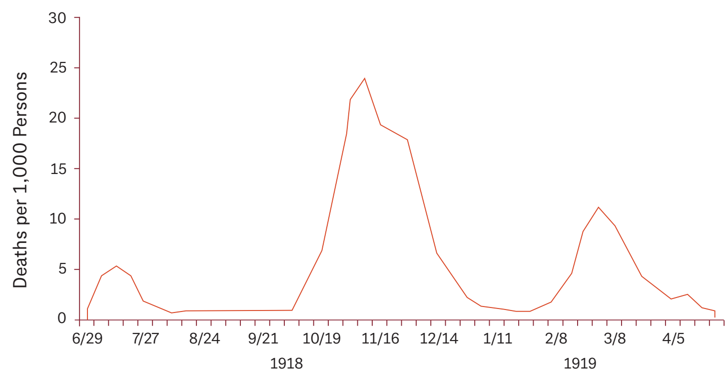


This chart shows that malaria has been present in India for a number of years at roughly the same numbers. This is an endemic disease here.

4.

Influenza

1918 – 1919



This took place over many months and had a high death toll at the peaks of the waves. This is a pandemic.

Epidemiologic Classification Assignment, Part 3

ANSWER KEY **Do not share with students**

Directions

For each of the following situations, identify whether it reflects:

A Endemic disease

B Disease outbreak

C Epidemic disease

D Pandemic disease

1. Thirty five cases of Legionnaires Disease occurred within three weeks among attendees of a meeting in a particular neighborhood, which usually averages zero or one case per year.

B

2. Smallpox sweeps across North America from 1775 and 1782, claiming at least 130,000 lives.

C

3. Caribbean Dengue first appeared in the 1950s. Due to the failure of regional governments to eradicate the mosquito vector responsible for the illness, the disease has continued to be transmissible at a relatively steady rate in the area.

A

4. In 2009, a swine flu pandemic caused by a new strain of H1N1 that originated in Mexico spread to the rest of the world. In one year, the virus infected as many as 1.4 billion people across the globe and killed between 151,700 and 575,400 people.

D

Measure of Disease Frequency, Part 3

Rate Calculations

ANSWER KEY

Do not share with students

Directions

Using the information provided in Part 1 and Part 2, complete the measures of disease frequency rates for three cities of your choice.

1. Go to the *Johns Hopkins Coronavirus Resource Center* and select three cities in different countries.

   City A: Answers will vary.

   City B: Answers will vary.

   City C: Answers will vary.

2. Propose a three-way comparison of COVID-19 prevalence in the cities you selected. Note: numbers in the tables are sample data only.

	Existing Cases	Population Size	Prevalence	Prevalence *per 10,000 of population*
City A	530	25,000	0.0212	212 per 10,000
City B	8,432	50,000	0.168	1864 per 10,000
City C	2,589	100,000	0.0259	259 per 10,000

3. Now, calculate the attack rate for those same three cities for a two-month period from the beginning of the year (Jan. 1 to March 1).

	# of New Cases of COVID-19 from Jan. 1 to March 1	Size of City Population on Jan. 1	Attack Rate *Incidence Proportion*
City A	482	25,000	1.928 OR 192.8 per 10,000
City B	7,858	50,000	15.71 OR 1571 per 10,000
City C	1,726	100,000	1.726 OR 172.6 per 10,000

4. Now, calculate the mortality rate.

	# of New Cases of COVID-19 from Jan. 1 to March 1	Size of City Population on Jan. 1	Mortality Rate
City A	84	25,000	0.336 OR 33.6 per 10,000
City B	471	50,000	0.942 OR 94.2 per 10,000
City C	105	100,000	0.105 OR 10.5 per 10,000

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Epidemiologic Classification Assignment, Part 1

Directions
Answer the questions below.

1. Endemic

1a. Epidemiologic Definition/Description

1b. Your Definition

1c. Memory Clue *Draw a picture.*

1d. Possible Vectors

1e. Historical Example

Continues next page >

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Epidemiologic Classification Assignment, Part 1

Continued

2. Outbreak

2a. Epidemiologic Definition/Description

2b. Your Definition

2c. Memory Clue *Draw a picture.*

2d. Possible Vectors

2e. Historical Example

Continues next page >

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Epidemiologic Classification Assignment, Part 1

Continued

3. Epidemic

3a. Epidemiologic Definition/Description

3b. Your Definition

3c. Memory Clue *Draw a picture.*

3d. Possible Vectors

3e. Historical Example

Continues next page >

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Epidemiologic Classification Assignment, Part 1

Continued

4. Pandemic

4a. Epidemiologic Definition/Description

4b. Your Definition

4c. Memory Clue *Draw a picture.*

4d. Possible Vectors

4e. Historical Example

Continues next page >

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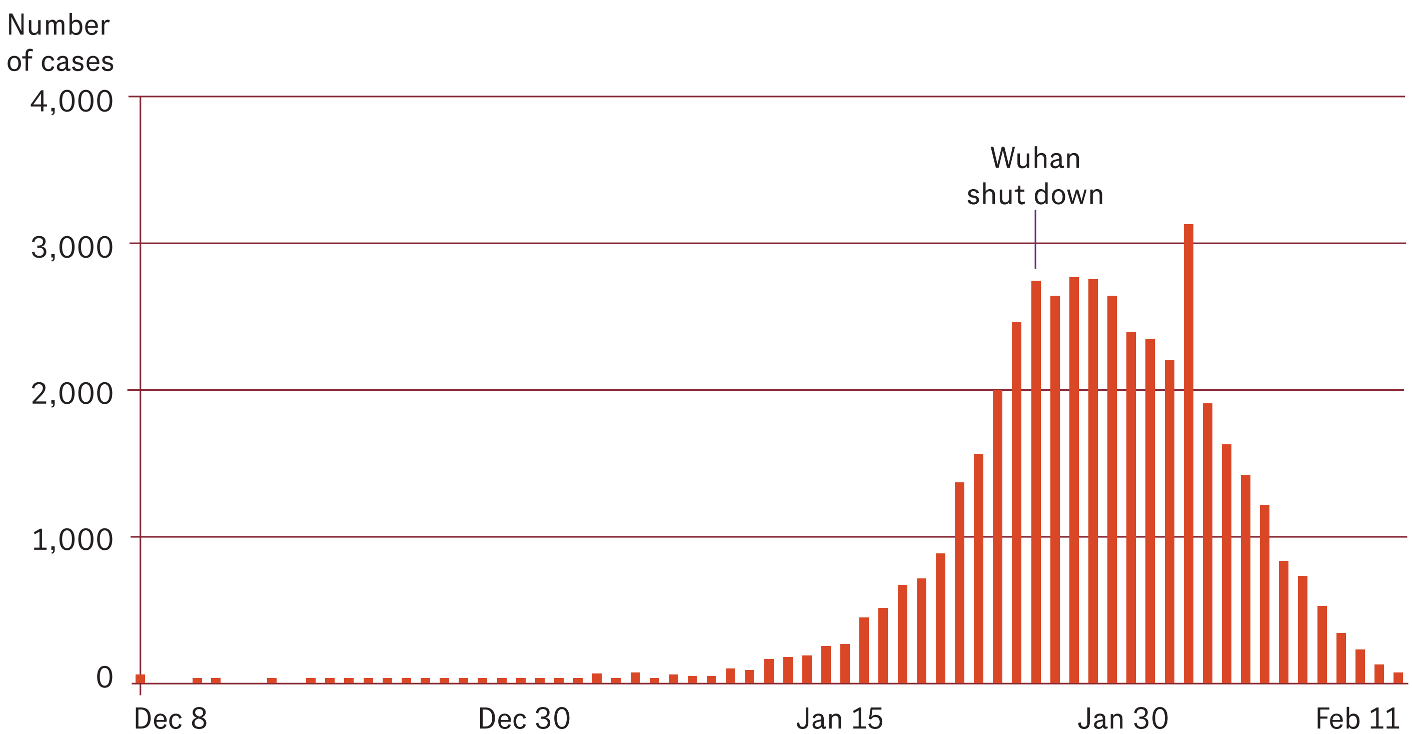
Epidemiologic Classification Assignment, Part 2

Directions
Analyze the following graphs. Indicate whether they represent an endemic, outbreak, epidemic, or pandemic and why. Write your description and how you came to that conclusion below each chart.

1. Classify and explain the graph below.

COVID in Wuhan, China
From date of onset to February 11, 2020



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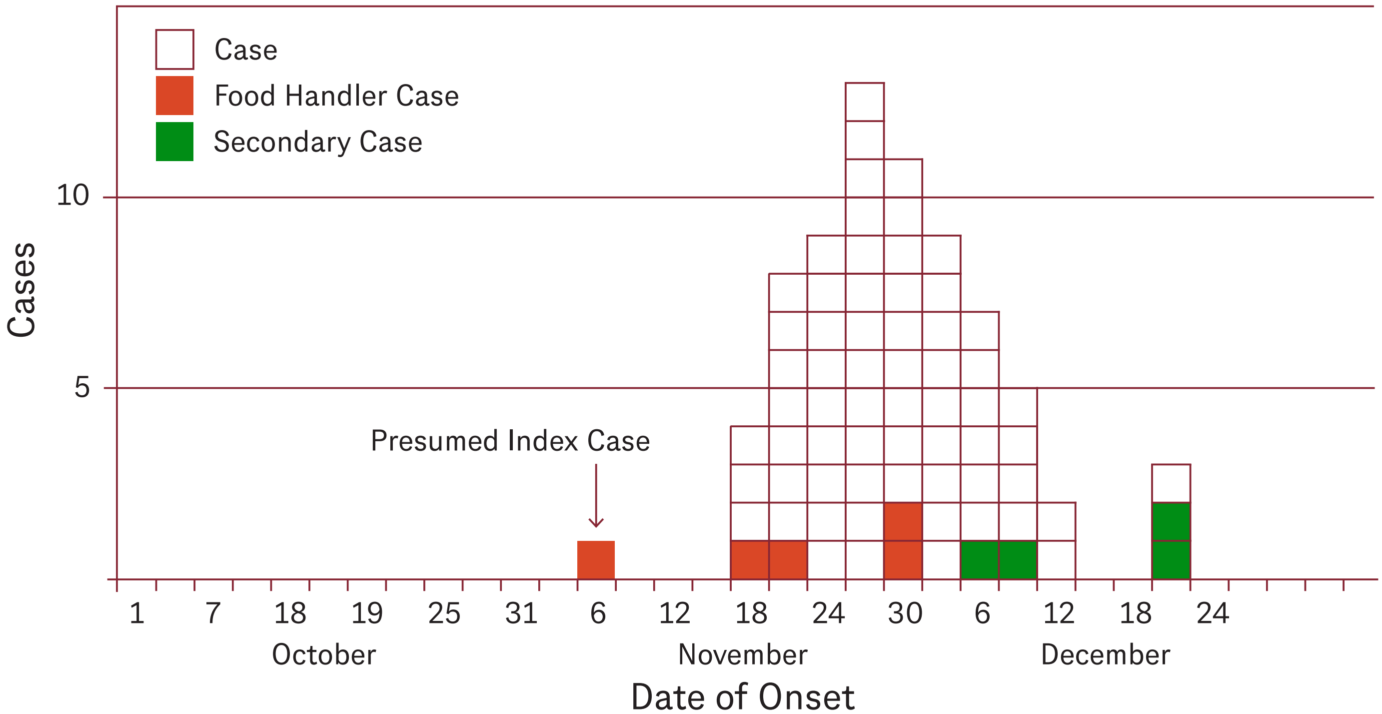
Epidemiologic Classification Assignment, Part 2

Continued

2. Classify and explain the graph below.

Hepatitis A, Cases by Date of Onset
November–December, 1978



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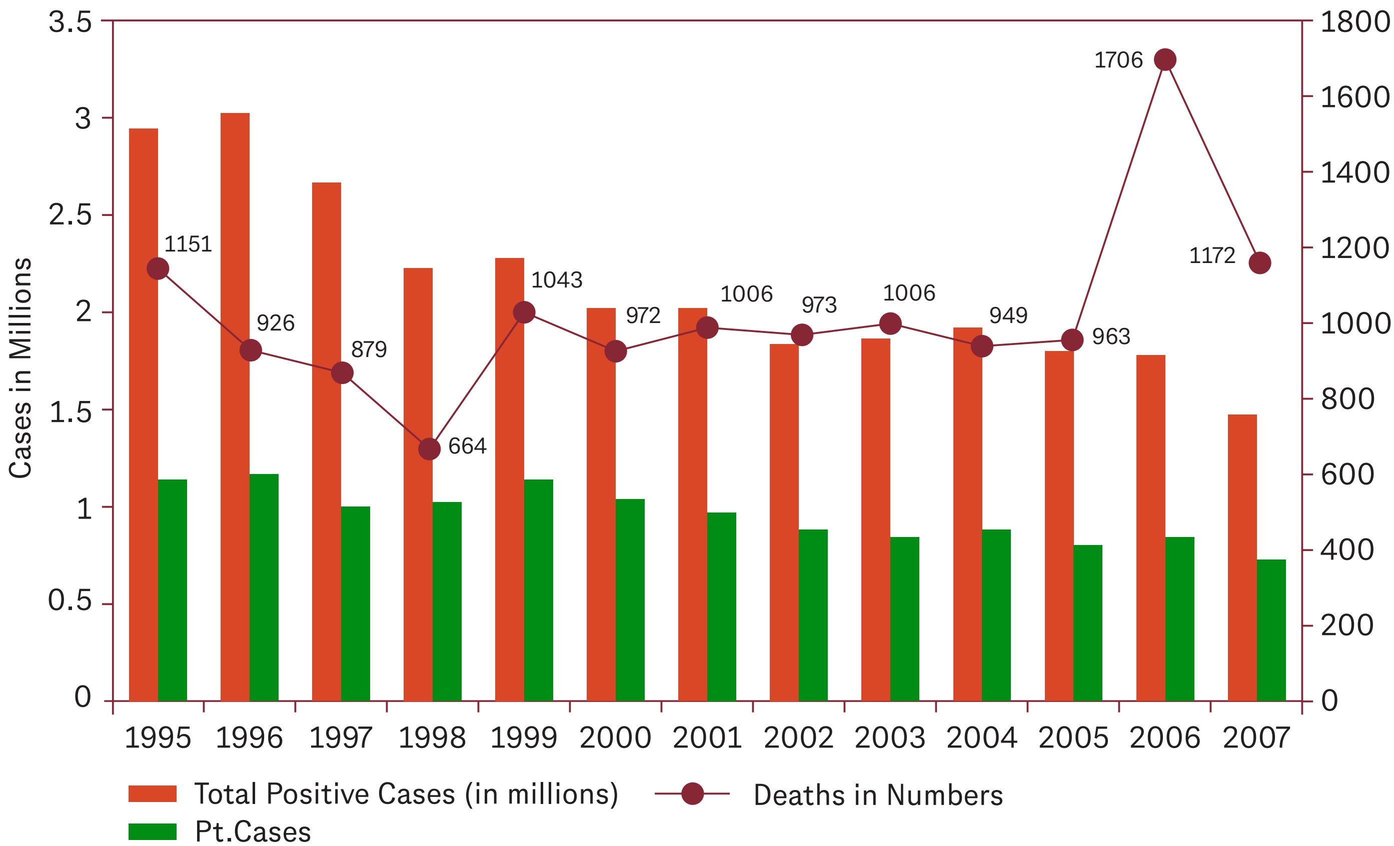
Epidemiologic Classification Assignment, Part 2

Continued

3. Classify and explain the graph below.

Malaria in India
1995–2007



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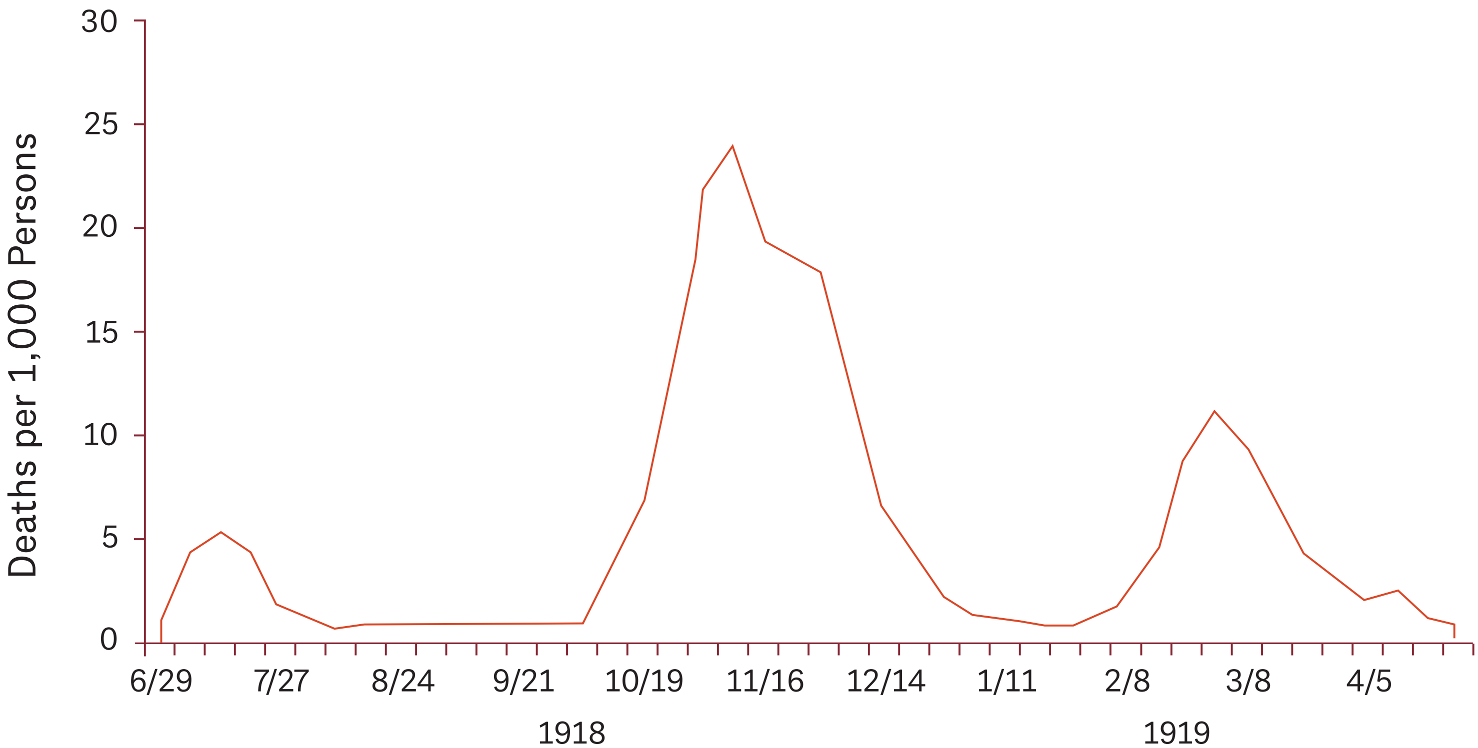
Epidemiologic Classification Assignment, Part 2

Continued

4. Classify and explain the graph below.

Influenza
1918–1919



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Epidemiologic Classification Assignment, Part 3

Directions
For each of the following situations, identify whether it reflects:

A Endemic disease

B Disease outbreak

C Epidemic disease

D Pandemic disease

1. Thirty five cases of Legionnaires Disease occurred within three weeks among attendees of a meeting in a particular neighborhood, which usually averages zero or one case per year.

2. Smallpox sweeps across North America from 1775 and 1782, claiming at least 130,000 lives.

3. Caribbean Dengue first appeared in the 1950s. Due to the failure of regional governments to eradicate the mosquito vector responsible for the illness, the disease has continued to be transmissible at a relatively steady rate in the area.

4. In 2009, a swine flu pandemic caused by a new strain of H1N1 that originated in Mexico spread to the rest of the world. In one year, the virus infected as many as 1.4 billion people across the globe and killed between 151,700 and 575,400 people.

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Disease Detective Capture Sheet

Directions

Using web sources, research the epidemiology of a specific disease for a poster presentation gallery walk. Complete the chart and include that information in your poster.

I want to learn about:

the most severe pandemic in recent history—*1918 Spanish Influenza*

a virus that attacks the body's immune system—*HIV/AIDS*

a rare and deadly disease in people and nonhuman primates— *Ebola*

an eradicated virus that used to be contagious and often deadly—*Smallpox*

the most fatal pandemic recorded in human history—*Bubonic Plague*

one of the most severe epidemics in United States history—*Philadelphia Yellow Fever*

one of the most feared diseases in the United States—*American Polio epidemic*

a bacterial disease usually spread through contaminated water—*Cholera*

1. The origin of the disease (geographical and chronological)

2. The epidemiologic triangle of the disease (agent, host, environment)

3. Groups affected by the disease (ethnicity, race, socio-economic, if applicable)

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Disease Detective Capture Sheet

Continued

4. Method of disease transmission from person to person

5. Method of disease transmission from one area to the next

6. Morbidity (number of people affected during outbreaks) and mortality (number of deaths)

7. Description of treatments and preventive measures where applicable

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Poster Presentation Rubric

Group Members:

	Score Criteria	Student Evaluation	Teacher Evaluation
Organization *30 total points*	Poster is organized in categories of agent, host, environment, Other Factors. *10 points*		
	Text is simple and can be read from a distance. (A standard, easy to read text is used. Both capital and small-case letters are used.) *10 points*		
	Sequence is easy to follow, using visual clues provided. (Clues may include numbers, letters, or arrows.) *10 points*		

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Poster Presentation Rubric

Continued

	Score Criteria	Student Evaluation	Teacher Evaluation
Content *50 total points*	The research subject is well covered in the poster. Details indicate the topic was sufficiently researched and accurate information is presented. *10 points*		
	Agent section includes: name of the disease, an image of the microbe with scientific name, brief description, how the disease is transmitted. *10 points*		
	Host section includes: the animals or people who host the disease, symptoms of the disease. *10 points*		
	Environment section includes information on what is necessary for the disease to exist and spread. *10 points*		
	Other factors about the disease are covered in the poster. *10 points*		

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Poster Presentation Rubric

Continued

	Score Criteria	Student Evaluation	Teacher Evaluation
Presentation *20 total points*	Information is arranged neatly and logically. *10 points*		
	Artistic elements of the poster are subtle and do not distract from the message of the poster. (Scientific posters present information clearly.) *10 points*		
Final Score *100 total points*			

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Measures of Disease Frequency, Part 1

Vocabulary and Formulas

Directions

Use this information to complete the measures of disease frequency rates on Part 3.

Words to Know

Ratio	the relative magnitude of two quantities or a comparison of two values
Proportion	comparison of a part to the whole; a ratio in which the numerator is included in the denominator
Rate	a measure of the frequency with which an event occurs in a particular population of a particular time period
Attack Rate *Incidence Proportion*	the proportion of a population that develops illness during an outbreak
Incidence Rate	how quickly a disease occurs in a population
Prevalence Rate	the proportion of a population that has a health condition at a particular point in time
Mortality Rate	the proportion of people with a disease who die from that disease

Calculation Formulas

Ratio = $\dfrac{\text{Number or rate of events, items, persons, etc. in one group}}{\text{Number of rate of events, items, persons, etc. in another group}}$

Proportion = $\dfrac{\text{Number of persons or events with a particular characteristic} \times 100}{\text{Number of persons or events of which the numerator is a subset}}$

Attack Rate *Incidence Proportion* = $\dfrac{\text{Number of new cases of disease or injury during a specific period of time} \times 100}{\text{Size of population at the start of that time period}}$

Incidence Rate = $\dfrac{\text{Number of new cases of disease or injury during a specified period of time}}{\text{Time each person was observed totalled for ALL persons}}$

Prevalence Rate = $\dfrac{\text{All new and pre-existing cases during a given period of time} \times 100}{\text{Population during the same time period}}$

Mortality Rate = $\dfrac{\text{Deaths occurring during a given time period} \times 100}{\text{Size of population among which the deaths occurred}}$

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Measures of Disease Frequency, Part 2

Calculation Examples

Directions

Use this information to complete the measures of disease frequency rates on Part 3.

Calculating people with disease is a basis for measuring disease frequency. This is important in detecting trends or the sudden occurrence of a problem, such as an outbreak.

Example:
The table below describes the annual incidences of cholera in a particular city.

	Total Cholera Cases in City A
2010	1
2011	6
2012	18
2013	41
2014	79

The table above would raise the suspicions of the epidemiologists and the Health Department of City A. However, these data alone would not give a full understanding of the problem. There is no way to tell if these patients developed cholera while living in City A. We also do not know how many of these patients recovered or died, or left the city.

To measure disease frequency, proportions and rates are useful in comparing groups because they relate the number of people with the disease to the size of the population in which they occur. Therefore, prevalence and incidence are two important measures of the frequency of a disease.

Example:
Cases of cholera in Cities A and B

	Existing Cases
City A	102
City B	47

The above table would suggest that City A has a larger cholera problem than City B. However, the population of both cities must be considered before making this decision. Assume the population of City A was 90,000, whereas the population of City B was 55,000. To calculate prevalence, we would have to divide the number of cases in each city by the population size of that city.

Example:
Cholera cases, population size and prevalence in Cities A and B

	Existing Cases	Population Size	Prevalence
City A	102	90,000	0.0011
City B	47	25,000	0.0019

Looking at the calculations this way, we can see that City B has a higher prevalence of cholera than City A. By multiplying each prevalence number by 10,000, we can provide a more understandable description of the prevalence of cholera in each city.

	Existing Cases	Population Size	Prevalence	Prevalence *per 10,000 of population*
City A	102	90,000	0.0011	11 per 10,000
City B	47	25,000	0.0019	19 per 10,000

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Measures of Disease Frequency, Part 3
Rate Calculations

Directions
Using the information provided in Part 1 and Part 2, complete the measures of disease frequency rates for three states of your choice.

1. Go to the *AIDSVu dataset resource*. Choose 3 different states that you will use to complete your analysis.

   State A: ______________________

   State B: ______________________

   State C: ______________________

2. Propose a three-way comparison of HIV prevalence in the states you selected. Use the United States Census table to obtain state population size. Calculate the prevalence per 100,000.

	Existing Cases of Persons Living with HIV in 2020	Population	Prevalence	Prevalence *per 10,000 population*
State A				
State B				
State C				

3. Now, calculate the attack rate for those same three states.

	Newly Diagnosed Persons with HIV in 2020	Population	Attack Rate Incidence Proportion
State A			
State B			
State C			

4. Now, calculate the mortality rate.

	Deaths of Persons Diagnosed with HIV in 2020	Population	Mortality Rate
State A			
State B			
State C			

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Future Outbreak Prediction Student Video Rubric

Group Members:

Score	4	3	2	1
Content	Video clearly explains where and when the next epidemic may occur and provides sufficient evidence to support the stance, including data and technologies used to make the prediction.	Video explains where and when the next epidemic may occur and provides evidence to support the stance, including adequate data and technologies used to make the prediction.	Video attempts to explain where and when the next epidemic may occur and provides minimal evidence to support the stance, missing some data and technologies used to make the prediction.	Video includes little explanation about where and when the next epidemic may occur and does not provide enough evidence to support the stance, with little or no reference to the data and technologies used to make the prediction.
Design	Video clips and pictures are in focus and of good quality; effective camera techniques used for the video and sound.	Video clips and pictures are clear and in focus; sound quality is OK.	Some video clips may be “shaky” or pictures out of focus; sound is lacking or inappropriate or scratchy.	Video clips are “shaky” and pictures out of focus; too many graphics or sounds detract from the content.
Collaboration	Presentation represents something that would have been impossible to accomplish working alone.	Presentation is a result of students working together and assigning different roles.	Presentation is a result of a group effort, but only some members contributed.	It is obvious that the presentation was created by one person.
Final Score				

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