Pathogen Tracker Game

Stage One: Declare an Outbreak

Level II Student Worksheet

Answer Sheet

Vocabulary: biodiversity, colony, contaminate, database, DNA, *Escherichia coli* O157:H7, foodborne illness, genetic fingerprint, isolate, *Listeria monocytogenes,* obtundation, outbreak, pathogen, Pathogen Tracker, PCR, phenotype, restriction enzyme, riboprint, ribosome, RNA, *Salmonella,* Southern blotting, species, strain, subspecies, zoonotic

BEFORE YOU BEGIN PLAYING THE GAME, please answer the following questions:

1. What is a foodborne illness and why is it such a serious issue?

A foodborne illness is an infection or intoxication caused by the transfer of pathogenic microbial or chemical contaminants from food or water to a human. An infection is caused by the ingestion of a pathogen such as a bacterium while intoxication results from the ingestion of a toxin or chemical produced by the bacterium.

The illness can be life threatening, particularly for young children, the elderly, and those with weakened immune systems. Some foodborne illnesses can cause pregnant women to abort their fetuses. These illnesses affect nearly a quarter of the American population each year, with approximately 5,000 of these cases ending in death.

2. What is a foodborne illness outbreak?

A foodborne illness outbreak is when two or more cases of a similar illness result from eating the same food.

3. In the table below, in the column labeled “Predicted Steps” list the steps you think scientists will follow to find the cause of a foodborne illness outbreak. As you play each Stage of the game, record the actual steps the scientists used in the column “Actual Steps.” In the “Stage” column, record the stage for the actual step. **Remember,** you will not complete all of the “Actual Steps” until the end of Stage Three of the game.

The list of “Predicted Steps” that the student writes may have errors. As the student plays the game, he/she will write the “Actual Steps” that the scientists followed and the “Stage” at which that step occurred.

Predicted Steps	Actual Steps	Stage
	Patients come to the doctors or emergency rooms displaying symptoms of a foodborne illness – diarrhea, fever, chills, and/or nausea.	One
	Doctors make an initial diagnosis and send stool samples to a laboratory to be cultured.	One
	The laboratory detects a foodborne pathogen in the culture and isolates the pathogen.	One
	The pathogen is identified and compared with other foodborne illness pathogens to determine if an outbreak has occurred.	One
	If sufficient data is present, an outbreak is declared.	One
	Patients are interviewed to determine what foods they have eaten and a matched pairs analysis is done with a control group to determine which of the foods the infected group ate could be the cause of the outbreak.	Two
	Patients are interviewed to find out where they might have eaten the contaminated food.	Three
	Health officials interview employees at the establishments where the patients have eaten and inspect those establishments.	Three
	Samples taken from the establishment are sent to the lab to be cultured.	Three
	Health officials analyze the results from the cultures and if necessary request a product recall or the closing of the establishment.	Three

4. Once a cause for a foodborne illness outbreak has been declared, what do you think officials can do to protect the public's health?

Officials can request that the contaminated food be recalled and that the plant where the food was manufactured be closed and thoroughly cleaned.

Public health officials and/or regulatory authorities may also issue press releases to alert the public to the outbreak and provide advice on how to protect one's health.

YOU ARE NOW READY TO PLAY THE GAME. As you play the game, answer the questions when you come to the appropriate page.

What are foodborne pathogens?

Foodborne pathogens are microorganisms such as bacteria, parasites, or viruses that infect you when you eat contaminated food.

What symptoms were the patients with the suspected foodborne illness experiencing?

The symptoms that the patients with the suspected foodborne illness were experiencing included headache, vomiting, body aches, diarrhea, loss of balance, confusion and miscarriage.

In the table below, record the symptoms of the following foodborne pathogens*: Escherichia coli (E. coli)* O157:H7*, Listeria monocytogenes* (*L. monocytogenes*), and *Salmonella.*

Pathogen	Symptoms
Escherichia coli 0157:H7	Sudden onset of abdominal pain and severe cramps, followed within 24 hours by diarrhea which may become watery and then bloody
Listeria monocytogenes	Fever, muscle aches, and gastrointestinal symptoms such as nausea or diarrhea; also, headache, stiff neck, loss of balance, confusion, obtundation or convulsions can occur. Infection during pregnancy can lead to miscarriage, infection of the newborn, or even stillbirth.
Salmonella	Diarrhea, often with fever and abdominal cramps; nausea and vomiting; diarrhea often includes mucus and is occasionally bloody

Now compare the symptoms experienced by the patients with the symptoms for each of the pathogens. Which foodborne pathogen is responsible for the suspected foodborne illness outbreak? Be sure to give your detailed reasons for choosing this pathogen.

Listeria is responsible for the suspected outbreak – one of the patients experienced a miscarriage and that symptom is related only to *Listeria.*

Using the information in the Encyclopedia, in your own words, explain what a riboprint is. Make a drawing of a riboprint.

A riboprint is a genetic fingerprint showing the banding pattern of the DNA sequences that code for the RNA portion of ribosomes.

The drawing that the student includes could be from the Pathogen Tracker pages or from the Pathogen Tracker Database.

In the table below, record the names of the patients who had the same riboprints, the date on which their symptoms first appeared, and the state in which they live.

Patient Name	Date	State
Amodini Khan	8/02	New York
Matt Rufello	8/13	New York
Roger Martin	8/09	Ohio
Franklin Spoon	8/30	Ohio
Aimee Ferguson	9/06	North Carolina

Using the information in the Encyclopedia, describe how Pathogen Tracker is used to track a foodborne illness outbreak.

Pathogen Tracker allows researchers and public health professionals to upload digital images produced in their labs and to compare these images against others stored in the database in order to track a foodborne illness outbreak.

When the screen shown on the right is reached, you should read the **INSTRUCTIONS** and then use the back button to return to the **PT DATABASE**.

In your own words, explain in detail how the Pathogen Tracker database can be used to identify the strain of *L. monocytogenes* responsible for the foodborne illness outbreak.

The patients' riboprints are submitted to the Pathogen Tracker database. The PT database tries to match the submitted riboprints to riboprints from its own database. The "percent" column shows what percent of each riboprint in the database matches the submitted riboprint. The "rank" column shows the order of the matches, with the closest match ranked one. To find the strain of *Listeria monocytogenes* of the submitted riboprint, one identifies the closest match in the PT database results. You look in the column "RIBO" for the strain ID.

Which strain of *L. monocytogenes* was identified as being present in the patients?

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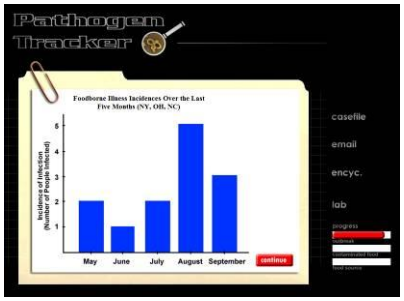
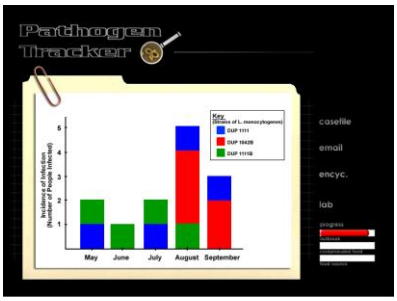
What parameters are necessary in order for a foodborne illness outbreak to be declared?

In order for an outbreak to be declared, the number of foodborne illnesses reported over the past few months that were caused by the strain being investigated are compared with the number of foodborne illnesses reported over the same period of time that were caused by other strains of the same pathogen and species (e.g., background rate). If the number of illnesses caused by the strain being investigated seems unusually high compared to the number caused by other strains, an outbreak can officially be declared.

Below are two graphs from the game entitled "Foodborne Illness Incidences Over the Last Five Months". Using the pages from the game, explain the differences beyween the two graphs and tell why Graph 2 is more appropriate to use in declaring an outbreak.





Graph 1 Graph 2

Graph 1 shows Foodborne Illness Incidences Over the Last 5 Months in NY, OH, and NC. Graph 2 shows the same data but also includes the strain of *L. monocytogenes* with which each patient was infected. Graph 1 does not have enough data to declare an outbreak while Graph 2 does.

Return to your Table on page 2. Review the steps you predicted and describe how well you did in predicting what steps the scientists would follow in finding the cause of the foodborne illness outbreak.

The answers to this question will vary – the students should at least compare their predicted steps with those the scientists actually followed.

Password to go onto Stage Two: Find the Contaminated Food - Listeria