



ACTIVITY 6

Evaluating a Scientific Claim

GAME



Epidemiologists look for trends
in large sets of health data.



6: EVALUATING A SCIENTIFIC CLAIM

GUIDING QUESTION

How can an actively open mindset help to make a scientific claim?

INTRODUCTION

Previously, you used an actively open mindset to weigh evidence for and against claims, search for alternative explanations, and look for cognitive biases. Another important aspect of having an actively open mindset is to consider what new information might change your thinking. This kind of thinking is important to scientists when trying to find the cause of a disease spreading through a community. An **epidemiologist** is a scientist who studies the patterns, causes, and control of disease in groups of people. They gather and analyze data on who, where, and how people could have gotten a disease. In this activity, you will role-play as a team of epidemiologists trying to determine the mode of transmission for Southsard fever. To do so, you will use a scientific approach, which uses slow thinking and an actively open mindset.



An epidemiology team in Indonesia interviews a patient during a 2014 outbreak of the bacterial disease leptospirosis.

If you need to review concepts related to disease transmission, you will find a Science Review at the end of this activity.

CONCEPTUAL
TOOLS



MATERIALS LIST

FOR EACH GROUP
OF FOUR STUDENTS

SOUTHSAND CITY
GAME BOARD

SET OF 12
INTERVIEW CARDS

SET OF 6 DATA CARDS

SET OF 6
EVENT CARDS

NUMBER CUBE

4 GAME PIECES

STUDENT SHEET 6.1
"Southsand Fever
Hypotheses"

STUDENT SHEET 6.2
"Evidence from
Interviews:
Infected People"

STUDENT SHEET 6.3
"Evidence from
Interviews:
Healthy People"

STUDENT SHEET 6.4
"Field Notes from Data
Cards and Event Cards"

PROCEDURE

PART A: COLLECTING EVIDENCE

- 1 Read the following fictional scenario.

The number of cases of Southsand fever continues to rise, and the situation is becoming urgent. It is still unclear how people are becoming infected by Southsand fever. Public health officials have put together a Southsand Fever Investigation Team to study the situation. As experts, your team of epidemiologists will gather and evaluate evidence to find out how Southsand fever is spreading.

Southsand City has a small urban center in a mostly rural area. The economy depends on healthcare, agriculture, and construction. Many residents work at the local county hospital, on farms, or as construction workers building housing developments on unused land outside the city center. Animals that can be found in and around some of the homes and farms include rats, cats, dogs, cows, and chickens. Three weeks ago, the community showed up for the city's annual summer kite festival. Fresh locally grown food such as corn on the cob, chicken, and tomatoes was served. Everyone enjoyed the festival until the weather got too windy, and conditions became very dusty.

- 2 With your group, discuss how Southsand fever could possibly be spreading, based on the fictional scenario and your background knowledge. Consider factors such as how people interact with one another; what people eat, drink, breathe, and touch; the animals people come in contact with; and where people live or work.
- 3 Your group will role-play a team of epidemiologists investigating how Southsand fever is transmitted. Before you begin the game, discuss how your team will approach the evidence you will get during the game. Ask yourselves the following questions:
 - What role will fast thinking and slow thinking play in our decision-making?
 - What types of cognitive shortcuts and cognitive biases might we want to watch out for when gathering and interpreting data?

Share your responses to these questions with your group.

- 4 Distribute one copy each of Student Sheets 6.1, 6.2, 6.3, and 6.4 to each group so each group member has one sheet. Each student will be responsible for recording and updating information on their student sheet during the game play, as needed.
- 5 With your group, discuss some initial hypotheses that could explain the spread of the disease. Record at least two initial hypotheses on Student Sheet 6.1, “Southsland Fever Hypotheses.” For now, do not fill in the “Relevant Game Card(s)” column. Remember to listen to and discuss the ideas of other group members. If you disagree with others in your group, explain why you disagree.
- 6 Set up the game board and place the Interview cards, Data cards, and Event cards into three separate face-down stacks. All players place their game pieces on the START space.

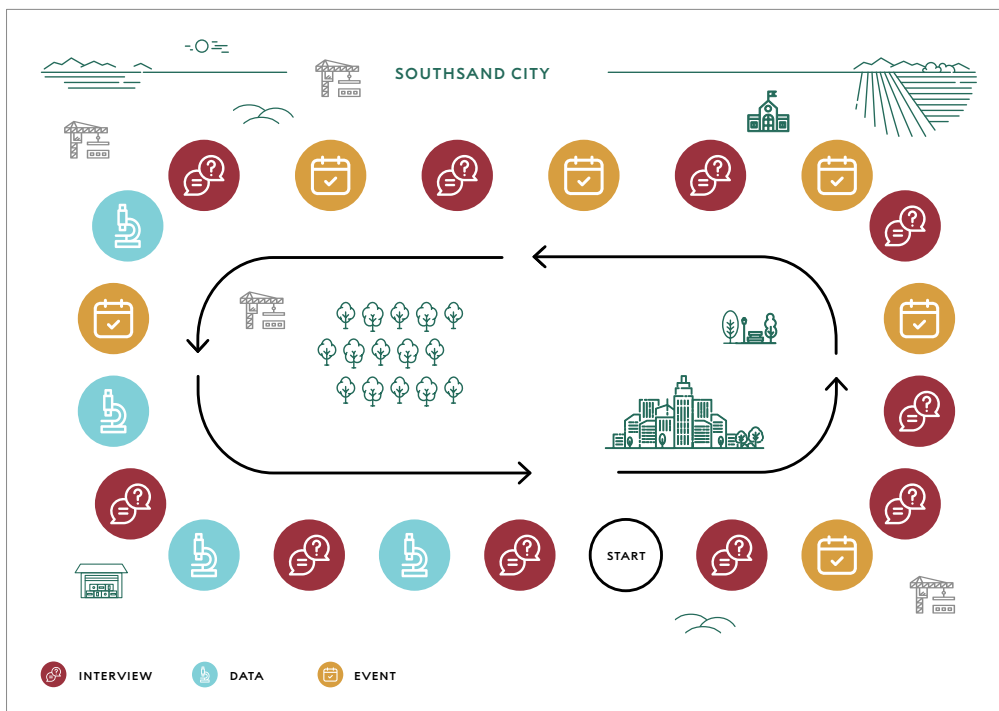


FIGURE 6.1
Game Board

- 7 Start the game. Each player takes a turn rolling the number cube and moving their game piece the corresponding number of spaces. Whenever you land on a space, draw the corresponding card and read it aloud. Record the information from the card on one of the following student sheets:
 - Interview card: Student Sheet 6.2, “Evidence from Interviews: Infected People”
 - Interview card: Student Sheet 6.3, “Evidence from Interviews: Healthy People”
 - Data card or Event card: Student Sheet 6.4, “Field Notes from Data Cards and Event Cards”

If there is no remaining card to draw on the landed space, stay on the space, but move to the next player.

- 8 After recording information from the cards, place them in separate discard piles.
- 9 Once all players have taken a turn, pause play. After each round of play, do the following:
 - a Use slow thinking to analyze the evidence gathered in that round. Discuss which of your hypotheses on Student Sheet 6.1 the evidence may support or refute. In the “Relevant Game Card(s)” column, record the cards that are relevant to the hypothesis and whether they support or help refute that hypothesis.
 - b All group members use an actively open mindset to decide if there is enough evidence to rule out each hypothesis. Update Student Sheet 6.1 based on the group’s findings by crossing out the hypotheses that have been refuted and adding any new hypotheses supported by evidence from the cards.
 - c With your group, discuss whether or not your thinking is influenced by cognitive bias (confirmation bias, conformity bias, emotion bias, conflict of interest).
- 10 Seek new evidence by continuing to play the game until the second person in your team passes the START space, remembering to complete Step 9 after each round. Turn over all the remaining cards, record all the evidence on the student sheets, and update your group’s hypotheses.

PART B: ANALYZING THE EVIDENCE

- 11 When the game is complete, use the collected evidence to compare the infected and healthy individuals. Each group member should copy the following table into their science notebook. Then use the data on Student Sheet 6.2, “Evidence from Interviews: Infected People,” and Student Sheet 6.3, “Evidence from Interviews: Healthy People” to complete the table. For example, a factor might have 6 out of 10 people who replied Yes on Student Sheet 6.3, which is 60%.

TABLE 6.1

Comparing Infected and Healthy Individuals

FACTOR	INFECTED INDIVIDUALS (%)	HEALTHY INDIVIDUALS (%)
ate locally grown corn		
works outside		
attended the kite festival		
has dog(s)		

- 12 Based on the results from Step 11, discuss with your group which factors showed the greatest differences between infected individuals and healthy individuals. Use this, along with your hypotheses and evidence from Part A, to make a claim about how the disease is spreading.
- 13 Share your group’s final claim with the rest of the class. Discuss the evidence that supports and refutes each group’s claim. As a class, compare ideas and try to come to a consensus on a single explanation for how Southsland fever is transmitted.
- 14 Reflect on your own responses and actions during the game and analysis. Ask yourself the following questions:
- Did I find myself prone to cognitive errors due to fast thinking?
 - Did I take any cognitive shortcuts while evaluating information?
 - Did I fall prey to one of the cognitive biases? If so, explain which one and why.

Share your responses to these reflection questions with the class.

BUILD UNDERSTANDING

- ① How do you think Southsand fever is being transmitted? Develop an argument supported by evidence from your disease investigation. In your response:
 - a make a claim about how Southsand fever is or is not being transmitted.
 - b support your claim, using at least 3 pieces of evidence gathered in the activity. Use reasoning to explain how each piece of evidence supports your claim.
 - c describe and explain at least 1 piece of evidence against your claim or that supports an alternate claim. Use reasoning to explain why you still support your claim as the most likely.
- ② Identify at least two cognitive thinking skills that were helpful in conducting your investigation. Explain why each was helpful.
- ③ What is the difference between simply agreeing with evidence that supports your hypothesis and maintaining an actively open mindset?



← Genuinely listening to others' viewpoints is a key part of an actively open mindset.

CONNECTIONS TO EVERYDAY LIFE

- ④ Imagine you were diagnosed with a medical illness. Why would it be important for you that the scientists studying that illness use slow thinking and an actively open mindset?
- ⑤ Describe a situation in your everyday life when using an actively open mindset could help you make a better decision.

KEY SCIENTIFIC TERMS

epidemiologist

SCIENCE REVIEW

Disease Transmission

Disease transmission describes the various ways that an infectious disease can spread. Infectious diseases can be contagious or non-contagious. They are noncontagious when they do not easily spread through close contact between organisms. Food poisoning is an example of a noncontagious infectious disease.

Infectious diseases are contagious when they are easily spread from person-to-person through close contact. This can happen through direct contact, such as touching or kissing, or through indirect contact with contaminated surfaces or objects.

Some diseases can be carried by animals and transmitted to other species. In fact, many human diseases originated in nonhumans. For example, infected mosquitoes can transmit certain diseases when they bite people. Some common diseases transmitted by mosquitoes are malaria, dengue, and West Nile fever. Rabies, also a relatively common disease, is caused by a virus that is spread from the bite of an infected animal.

Diseases can also be transmitted through things in the environment, such as air, water, soil, or food. For example, tuberculosis can spread through tiny droplets in the air. Cholera can spread in water contaminated with human feces. When someone improperly handles food, disease can spread to those who eat it. Some infectious diseases can even spread through multiple modes of transmission, making them more challenging to control. For instance, the bacteria that causes cholera can spread through contaminated water, food, and even flies.

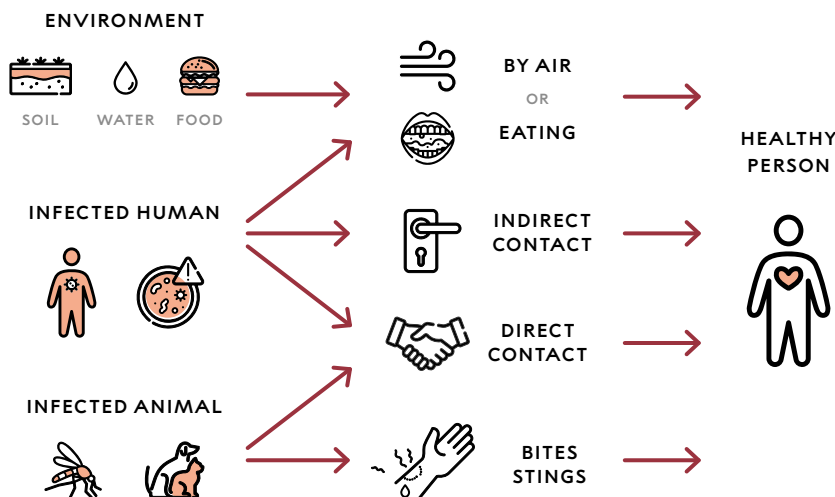


FIGURE 6.1
Different types of
disease transmission