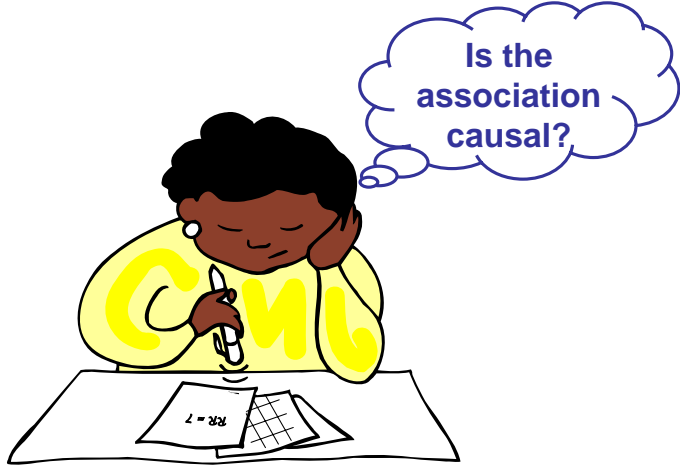


Weighing the Evidence



Is the association causal?

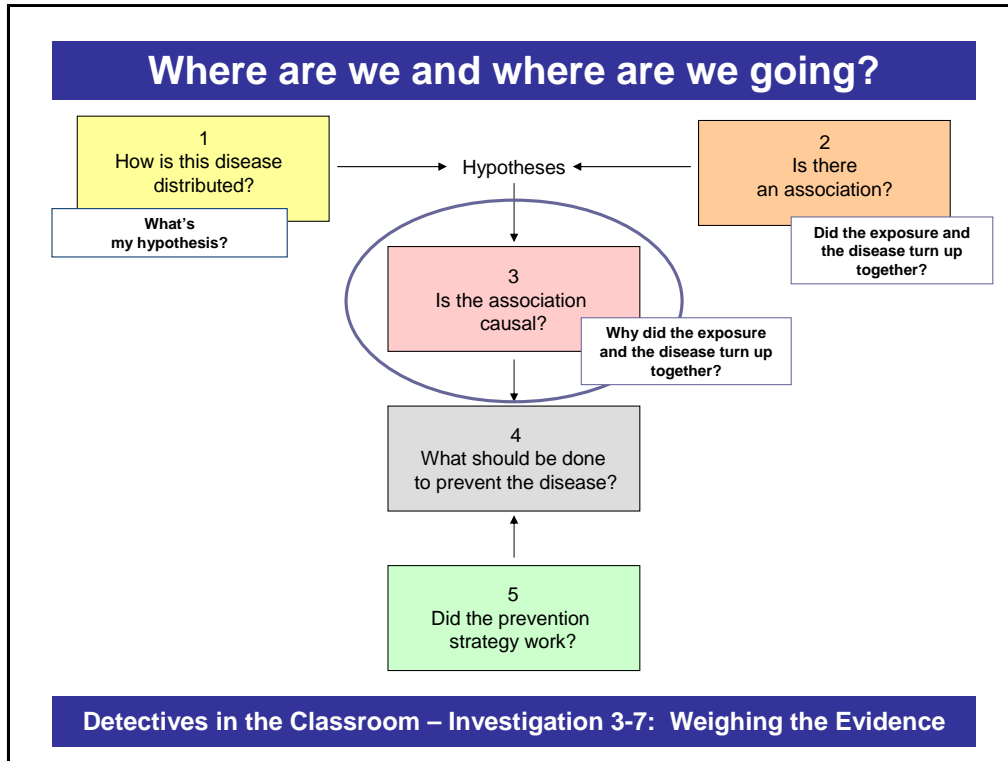
Weighing the Evidence

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

The illustration shows a student with dark skin and curly hair, wearing a yellow shirt with the letters 'CML' on it. The student is sitting at a desk, looking thoughtful with one hand on their chin. On the desk is a piece of paper with a grid and the text 'RR = 7'. A thought bubble above the student contains the question 'Is the association causal?'.

In **Investigation 3-7: Weighing the Evidence**, students will learn to explain the importance of distinguishing between associations that are causal and those that are not and begin to identify causal criteria questions.

Next Slide



Remind students again that in the Module 3 investigations, they are learning how to answer the third Essential Question: “Is the association causal?”

Next Slide

Review

1. Cause
2. Chance
3. Confounding
4. Reversed Time Order
5. Selection Bias

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

In the previous five investigations students have explored five possible explanations for why two things may turn up together: because the exposure causes the outcome, because of chance, because of confounding, because of reversed time order, and because of selection bias.

Therefore, while we understand that an association may have been found because the hypothesized exposure causes the outcome, we know we must also consider other explanations for the association: chance, confounding, reversed time order, and selection bias.

Remember that a good detective does not jump to the conclusion that an association is causal and does consider other interpretations of why an epidemiologic study found that an exposure and an outcome turned up together.

Next Slide

Review

Epi Talk

Epidemiology

The study of how and why diseases or other health-related conditions are distributed in a population the way they are, in other words, why some people get sick and others do not.

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students to find “Epidemiology” in the **Epi Talk** list.

Review its definition.

Remind students that the ultimate purpose of epidemiology is the *control of health problems*. If we can identify exposures that cause adverse health outcomes, we can avoid or eliminate those exposures and prevent the health problems.

Next Slide

Explanations for Finding an Association

If an association were causal,



... and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome?

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students:

- If an association between an exposure and an outcome were *causal*, and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome? (If the association were *causal*, the outcome would be *prevented* by avoiding or eliminating the hypothesized causal exposure.)

Next Slide

Explanations for Finding an Association

If an association were found due to chance,

Hypothesized
Exposure



Outcome



... and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome?

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

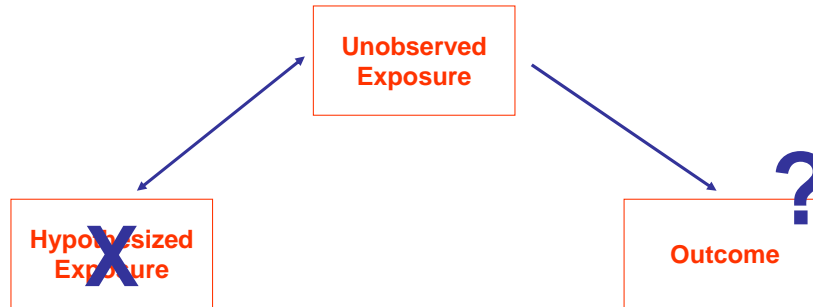
Ask students:

- If an association were found due to *chance*, and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome? (If the association were found due to *chance*, the outcome would *not be prevented* by avoiding or eliminating the hypothesized causal exposure.)

Next Slide

Explanations for Finding an Association

If the association were found due to confounding,



... and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome?

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students:

- If an association were really found due to *confounding*, and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome? (If the association were found due to *confounding*, the outcome would *not be prevented* by avoiding or eliminating the hypothesized causal exposure.)

Next Slide

Explanations for Finding an Association

If an association were found due to reversed time-order, ...



... and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome?

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students:

- If an association were found due to *reversed time order*, and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome? (If the association were found due to *reversed time order*, the outcome would *not be prevented* by avoiding or eliminating the hypothesized causal exposure.)
- ⚙ Teacher Alert: Because the time order of the hypothesized cause and outcome is really reversed (what we thought was the exposure is really the outcome and what we thought was the outcome is really the exposure), eliminating the hypothesized exposure would not prevent the outcome. For example, for the hypothesis “playing violent video games causes violent behavior” (where the time order may be reversed), eliminating violent video games would not prevent violent behavior.

Next Slide

Explanations for Finding an Association

If an association were found due to selection bias,

Hypothesized
Exposure

X

Outcome

?

... and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome?

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students:

- If an association were found due to *selection bias*, and the hypothesized causal exposure were avoided or eliminated, what would happen to the outcome? (If the association were found due to *selection bias*, the outcome would *not be prevented* by avoiding or eliminating the hypothesized causal exposure.)

- ⚙ Teacher Alert: Because a faulty assumption was made and it seemed as though an association was present when there really was none, eliminating the hypothesized exposure would not prevent the outcome.

Next Slide

Explanations for Finding an Association

Why
would an exposure
and an outcome
turn up
together?

1. Cause
2. Chance
3. Confounding
4. Reversed Time Order
5. Selection Bias



Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Emphasize that *identifying the correct explanation for an association is important.*

Only when the association between the exposure and outcome is causal will avoiding or eliminating the exposure help prevent the outcome. If the association is due to any of the other four explanations— chance, confounding, reversed time order, or selection bias— avoiding or eliminating the hypothesized cause will *not affect* the outcome.

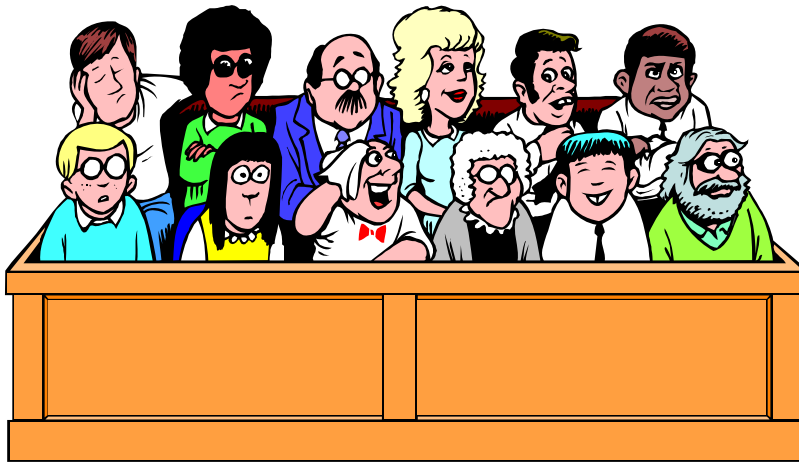
Ask students:

- What could happen if a hypothesized cause, in a non-causal association, were avoided or eliminated?

Discuss. (Not only would this measure fail to prevent the outcome but also the real cause of the outcome would still be present. Valuable time, energy, and money might have been wasted. The people who suggested eliminating the exposure would have lost credibility and may not be believed the next time they make a suggestion.)

Next Slide

The Weight of the Evidence



Guilty or Not guilty?

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Tell students that juries listen to evidence, weigh its persuasiveness, and reach a verdict of guilt or not guilt.

Next Slide

The Weight of the Evidence



Causal or Not Causal?

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Just as juries weigh evidence, epidemiologists can review the evidence for a hypothesized association and reach a verdict on whether or not the association is causal.

Next Slide

The Weight of the Evidence



Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Reiterate that the ultimate purpose of epidemiology is to prevent or control adverse health outcomes. If we can identify exposures that cause adverse health outcomes, we can avoid or eliminate those exposures and prevent the outcomes.

Given the flaws in observational studies, judgments about whether or not an association is causal are rarely based on the results of a single epidemiologic study. Judgments about causality are based on a number of studies that look at the same hypothesis using different study designs.

In the remainder of this investigation, students will explore a set of guidelines for helping to determine if a causal explanation for an association is correct.

Next Slide

The Weight of the Evidence



Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Emphasize that evidence accumulates over time. The evidence that exists at a particular point may not be sufficient to answer the questions and reach a verdict about whether or not an association is causal. However, this does not mean that as evidence accumulates we will not want to change our minds. For example, sometimes a person is convicted of a crime, but as more evidence is uncovered, such as DNA tests, the verdict needs to be reversed and the person is found not guilty. In epidemiology, a “verdict” can be reversed in either direction. Sometimes, as evidence builds, the case for causality becomes stronger (smoking and lung cancer). Other times, the weight of evidence for an association weakens as more evidence comes to light (artificial sweeteners and cancer).

Ask students:

- Can you identify a guideline for judging whether or not an association is causal? If a number of studies have reported an association, what should the evidence look like if the association is causal?

Write students’ suggested guidelines on the board and refer to them as you proceed through the remaining slides.

Next Slide

The Weight of the Evidence

“Does Playing Video Games Cause Asthma?”



Explain why you believe that playing video games does or does not cause asthma

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Divide the class into Epi Teams of four or five students per team.

On the basis of the article “Does Playing Video Games Cause Asthma?” students are to explain why they believe that playing video games *does* or *does not* cause asthma.

Next Slide

Is the association causal?			
	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Give each student an **Investigation 3-7: Epi Log Worksheet**.

Have students take a closer look at six statements from the article “Does Playing Video Games Cause Asthma?” and rephrase the underlined portions of the statements so that the evidence would be more persuasive or less persuasive for deciding that a hypothesized exposure actually caused an outcome. Then, students should try to create their own criterion that could be applied to another hypothesized association, for example, the hypothesis “cell phones cause brain cancer.”

Next Slide

Is the association causal?

1

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3	1. "... they found that children who visited the ER because of an asthma attack were <u>four times as likely</u> to play video games as the control group of hospitalized children who visited the ER because of broken bones."		
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should begin Part 1 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 1 so that the description of the evidence is *more persuasive*. (5 times as likely, 10 times as likely, or any number greater than 4)

Next Slide

Is the association causal?

1

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4			
5			
6			

1. "... they found that children who visited the ER because of an asthma attack were four times as likely to play video games as the control group of hospitalized children who visited the ER because of broken bones."

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should continue with Part 1 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 1 so that the description of the evidence is *less persuasive*. (2 times as likely, 1.3 times as likely, or any number less than 4)

Next Slide

Is the association causal? 1

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4			
5			
6			

1. "... they found that children who visited the ER because of an asthma attack were **four times as likely** to play video games as the control group of hospitalized children who visited the ER because of broken bones."

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should finish Part 1 on their **Investigation 3-7: Epi Log Worksheets** by completing the "I would be *more likely* to believe an exposure caused an outcome if" statement in the third column of the table. ("... the exposed group were many more times as likely to have the outcome as the unexposed group.")

Next Slide

Is the association causal? 2

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3	<p>2. <u>“As the frequency of ER visits increased, the amount of time spent playing video games increased up to a point.”</u></p>		
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should begin Part 2 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 2 so that the description of the evidence is *more persuasive*. (As the frequency of ER visits increased, the amount of time spent playing video games steadily increased.)

Next Slide

Is the association causal? 2

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3	<p>2. <u>“As the frequency of ER visits increased, the amount of time spent playing video games increased up to a point.”</u></p>		
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should continue with Part 2 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 2 so that the description of the evidence is *less persuasive*. (As the frequency of ER visits increased, there was **no** increase in the amount of time patients spent playing video games.)

Next Slide

Is the association causal?

2

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3	<p>2. <u>“As the frequency of ER visits increased, the amount of time spent playing video games increased up to a point.”</u></p>		
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should finish Part 2 on their **Investigation 3-7: Epi Log Worksheets** by completing the “I would be *more likely* to believe an exposure caused an outcome if” statement, in the third column of the table. (“... the frequency of the outcome steadily increased as the amount of exposure increased.”)

Next Slide

Is the association causal?

3

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4	3. "... they had found an association between playing video games and asthma, an association that <u>had been found only once before.</u> "		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should begin Part 3 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 3 so that the description of the evidence is *more persuasive*. (Had been found in 20 other studies)

Next Slide

Is the association causal?
3

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4	3. "... they had found an association between playing video games and asthma, an association that <u>had been found only once before.</u> "		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should continue with Part 3 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 3 so that the description of the evidence is *less_persuasive*. (Had never been found before)

Next Slide

Is the association causal? 3

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4	3. "... they had found an association between playing video games and asthma, an association that had been found only once before. "		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should finish Part 3 on their **Investigation 3-7: Epi Log Worksheets** by completing the “I would be *more likely* to believe an exposure caused an outcome if ...” statement, in the third column of the table. (“... an association between the exposure and outcome had been found consistently in many previous studies.”)

Next Slide

Is the association causal?

4

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4			4. "... the research design <u>did not determine the time-order to the playing of the video games and the asthma.</u> "
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should begin Part 4 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 4 so that the description of the evidence is *more persuasive*. (Was able to determine that playing video games came before the asthma)

Next Slide

Is the association causal?

4

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			4. "... the research design <u>did not determine the time-order to the playing of the video games and the asthma.</u> "
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should continue with Part 4 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 4 so that the description of the evidence is *less persuasive*. (Was able to determine that asthma came before playing video games)

Next Slide

Is the association causal? 4

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			4. "... the research design <u>did not determine the time-order to the playing of the video games and the asthma.</u> "
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should finish Part 4 on their **Investigation 3-7: Epi Log Worksheets** by completing the “I would be *more likely* to believe an exposure caused an outcome if ...” statement, in the third column of the table. (“... the time order of the exposure and the outcome had been determined.”)

Next Slide

Is the association causal? 5

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3	5. "... there have been <u>several hints</u> of an association between playing video games and asthma before."		
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should begin Part 5 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 5 so that the description of the evidence is *more persuasive*. (Many other types of evidence)

Next Slide

Is the association causal? 5

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3	5. "... there have been <u>several hints</u> of an association between playing video games and asthma before."		
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should continue with Part 5 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 5 so that the description of the evidence is *less persuasive*. (No other types of evidence)

Next Slide

Is the association causal? 5

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3	5. "... there have been <u>several hints</u> of an association between playing video games and asthma before."		
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should finish Part 5 on their **Investigation 3-7: Epi Log Worksheets** by completing the “I would be *more likely* to believe an exposure caused an outcome if ...” statement, in the third column of the table. (“... there had been many other types of evidence suggesting an association between the exposure and the outcome.”)

Next Slide

Is the association causal?

6

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4	6. “It <u>is a mystery why, biologically,</u> playing video games would increase the risk of asthma.”		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should begin Part 6 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 6 so that the description of the evidence is *more persuasive*. (Makes sense, biologically)

Next Slide

Is the association causal?
6

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4	6. “It <u>is a mystery why, biologically,</u> playing video games would increase the risk of asthma.”		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should continue with Part 6 on their **Investigation 3-7: Epi Log Worksheets** by rephrasing the underlined phrase in Statement 6 so that the description of the evidence is *less persuasive*. (Does not makes sense, biologically)

Next Slide

Is the association causal?

6

	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4	6. "It <u>is a mystery why, biologically,</u> playing video games would increase the risk of asthma."		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Working in their Epi Teams, students should finish Part 6 on their **Investigation 3-7: Epi Log Worksheets** by completing the "I would be *more likely* to believe an exposure caused an outcome if" statement, in the third column of the table. ("... it made biological sense that the exposure could cause the outcome.")

Next Slide

Is the association causal?			
	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2			
3			
4			
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Point out that when epidemiologists want to distinguish associations that are causal from those that are not, they refer to a list of questions, the answers to which help them make that distinction.

You are now going to show students some of these questions. Have them look back at their statements in the third column of their **Investigation 3-7: Epi Log Worksheets** and identify the statement that would answer each question.

Next Slide

Is the association causal?			
	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1	What is the strength of the association between the exposure and the disease?		
2			
3			
4	1. "... they found that children who visited the ER because of an asthma attack played video games were four times as likely to play video games as the control group of hospitalized children who visited the ER because of broken bones."		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Show students the following question: What is the strength of the association between the exposure and the disease?

Ask students:

- Can you identify a statement from the third column that answers this question? (The number 1 statement)

Next Slide

Is the association causal?			
	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1	Have studies established that the risk factor comes before the disease?		
2			
3			
4			
5	4. "... the research design <u>did not determine the time-order</u> of the playing of the video games and the asthma."		
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Show students the following question: Have studies established that the risk factor comes before the disease?

Ask students:

- Can you identify a statement from the third column that answers this question? (The number 4 statement)

Next Slide

Is the association causal?			
	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1	Is the finding consistent? Has it been replicated by others in other places?		
2			
3			
4	3. "... they had found an association between playing video games and asthma, an association that had <u>been found only once before.</u> "		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Show students the following question: Is the finding consistent? Has it been replicated by others in other places?

Ask students:

- Can you identify a statement from the third column that answers this question? (The number 3 statement)

Next Slide

Is the association causal?		
More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1	Do the implications of the observed findings make biological sense?	
2		
3		
4	6. "It <u>is a mystery, biologically</u> , why playing video games would increase the risk of asthma. "	
5		
6		

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Show students the following question: Do the implications of the observed findings make biological sense?

Ask students:

- Can you identify a statement from the third column that answers this question? (The number 6 statement)

Next Slide

Is the association causal?			
	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1			
2	Can a dose-response be demonstrated?		
3			
4	2. <u>“As the frequency of ER visits increased, a correlation with an increased amount of time spent playing video games was observed up to a point.”</u>		
5			
6			

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Show students the following question: Can a dose-response be demonstrated?

Ask students:

- Can you identify a statement from the third column that answers this question? (The number 2 statement)

Next Slide

Is the association causal?			
	More Persuasive	Less Persuasive	I would be more likely to believe an exposure caused an outcome if ...
1	<p>Is the new finding coherent with earlier knowledge about the risk factor and the disease?</p>		<p>5. "... there have been several hints of an association between playing video games and asthma before."</p>
2			
3			
4			
5			
6			

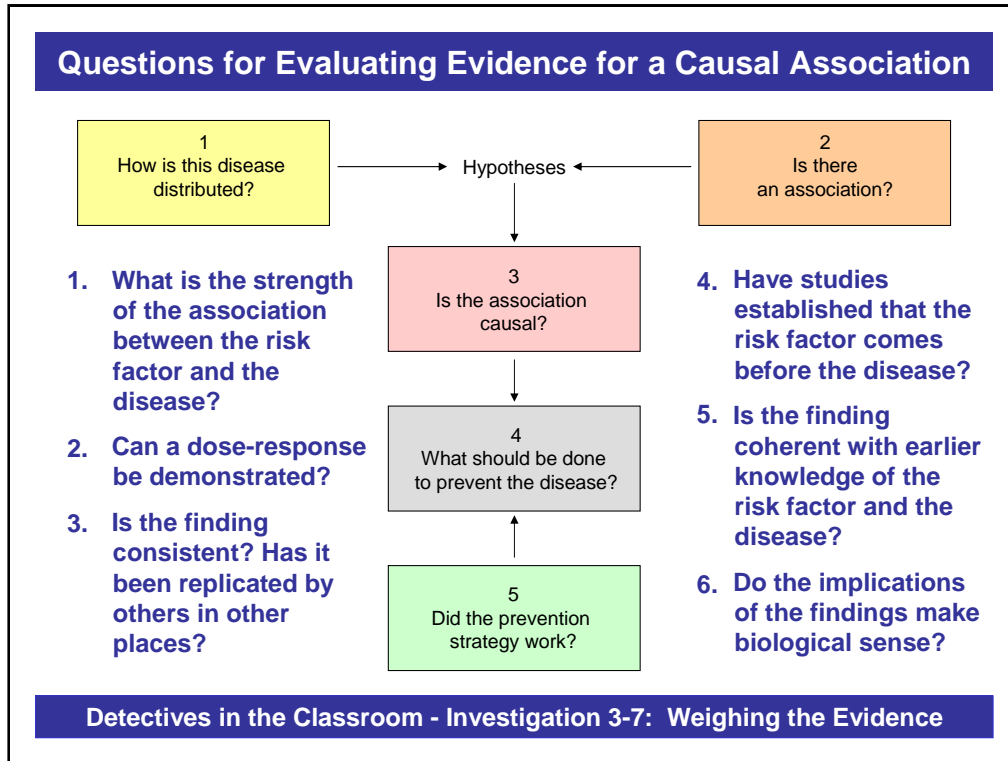
Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Show students the following question: Is the new finding coherent with earlier knowledge about the risk factor and the disease?

Ask students:

- Can you identify a statement from the third column that answers this question? (The number 5 statement)

Next Slide



When epidemiologists weigh the evidence for a hypothesized association, in terms of the answers to these six questions, it helps them answer the Third Essential Question, “Is the association causal?”

Next Slide

Epi Talk

Epi Talk

Strength of Association

A criterion for judging causality.

The size of the relative risk.

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students to find “Strength of association” in the **Epi Talk** list.
Review its definition.

Next Slide

Epi Talk

Epi Talk

Dose-Response Relationship

A criterion for judging causality.

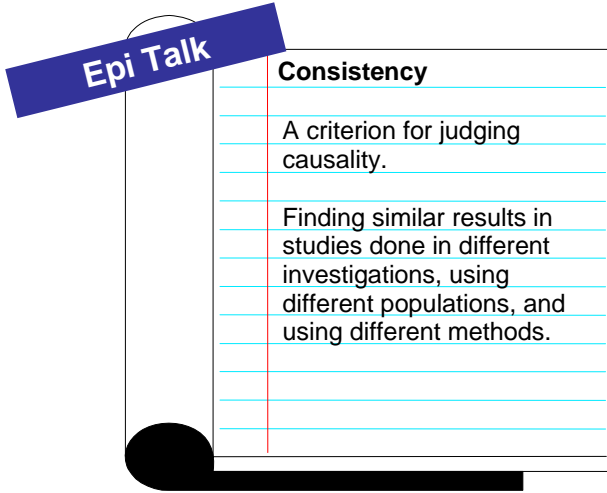
The degree to which risk increases as exposure increases.

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students to find “Dose-response relationship” in the **Epi Talk** list.
Review its definition.

Next Slide

Epi Talk



Consistency

A criterion for judging causality.

Finding similar results in studies done in different investigations, using different populations, and using different methods.

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students to find “Consistency” in the **Epi Talk** list.
Review its definition.

Next Slide

Epi Talk

Epi Talk

Time Order

A criterion for judging causality.

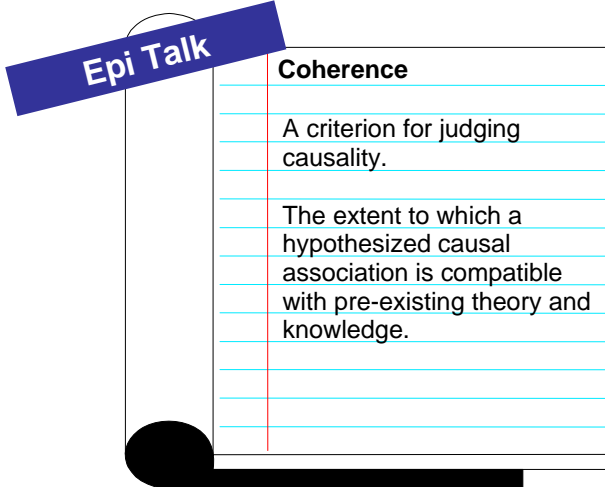
The degree to which evidence can show that the hypothesized cause actually came before the outcome.

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students to find “Time order” in the **Epi Talk** list.
Review its definition.

Next Slide

Epi Talk



Coherence

A criterion for judging causality.

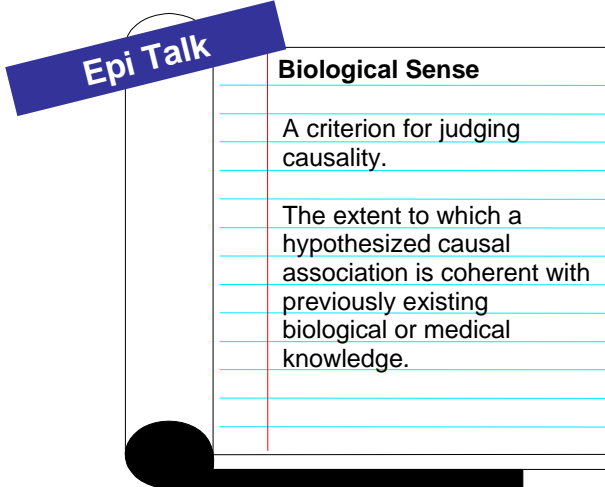
The extent to which a hypothesized causal association is compatible with pre-existing theory and knowledge.

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students to find “Coherence” in the **Epi Talk** list.
Review its definition.

Next Slide

Epi Talk



Biological Sense

A criterion for judging causality.

The extent to which a hypothesized causal association is coherent with previously existing biological or medical knowledge.

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Ask students to find “Biological sense” in the **Epi Talk** list.
Review its definition.

Next Slide

Is the association causal?



Association Found Between Coffee and Diabetes

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Remind students that in **Investigation 3-1: In the News**, they read the headline “Association Found Between Coffee and Diabetes.” At that time, they were asked what the headline meant to them, what they would be thinking when they read the headline, and what they thought the article would tell.

Next Slide

Association Found Between Coffee and Diabetes 7

7. _____

Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Students should complete Part 7 of their **Investigation 3-7: Epi Log Worksheets** by describing what the headline “Association Found Between Coffee and Diabetes” means to them *now*. What would they be thinking if they read that headline today?

Now have them turn to the answers they wrote in Part 1 on their **Investigation 3-1: Epi Log Worksheets**.

Ask students:

- After comparing your answers, can you explain how your thinking has changed between **Investigation 3-1** and **Investigation 3-7**?
 - Have you considered the five possible explanations for finding an association?
 - Are you interpreting the headline more cautiously than you did before? That is, are you more likely to think that the association may not be causal?
 - Are you better detectives now? If so, why? (Good detectives do not draw conclusions quickly; they understand the need to consider more than one possible explanation for why an association was found.)
- ⚙ Teacher Alert: Be sure students appreciate why their interpretation of the headline should be different now.
- They have learned the distinction between association and causation.
 - They have learned that association does not necessarily mean causation.
 - They have learned about several alternative explanations for an association.

Next Slide

Good Detectives Weigh the Evidence



Don't conclude that an exposure causes an outcome simply because they are reported to be associated.

It is important to consider other possible explanations for an association besides causality.

By using the criteria questions to weigh the evidence, some associations can be shown to be causal.



Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

With their new understanding of possible explanations for an association, students should be better able to weigh evidence and interpret the news. When they see a headline about an association between an exposure and an outcome, they will know what to ask about other possible explanations. When they learn about an association that is well supported in terms of the causal criteria questions, they will appreciate that the causal hypothesis has a scientific basis and is more likely to be correct.

These skills should help students evaluate information and make personal health-related decisions based on scientific evidence.

Next Slide

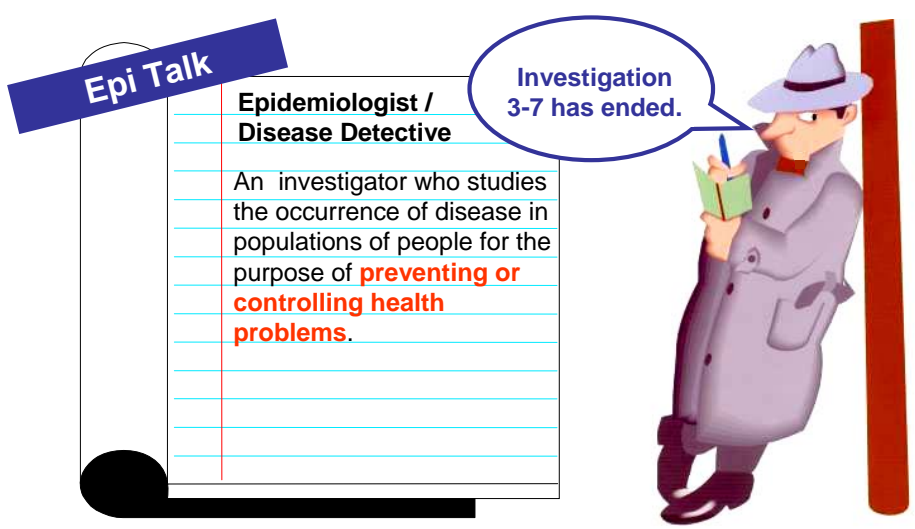
Weighing the Evidence

Epi Talk

Epidemiologist / Disease Detective

An investigator who studies the occurrence of disease in populations of people for the purpose of **preventing or controlling health problems**.

Investigation 3-7 has ended.



Detectives in the Classroom - Investigation 3-7: Weighing the Evidence

Remind students that an epidemiologist studies the occurrence and causes of disease in populations of people, for the purpose of *preventing or controlling health problems*.

If we want to prevent or control health problems, we must be able to distinguish associations that are causal from those that are not.

If we avoid or eliminate exposures that are associated with the outcome because of chance, confounding, reversed time order, or selection bias, we will not prevent or control health problems.

Only when associations are causal can we prevent or control health problems by avoiding or eliminating the exposure.

This concludes **Investigation 3-7: Weighing the Evidence** and students can now put away their **Epi Logs**.