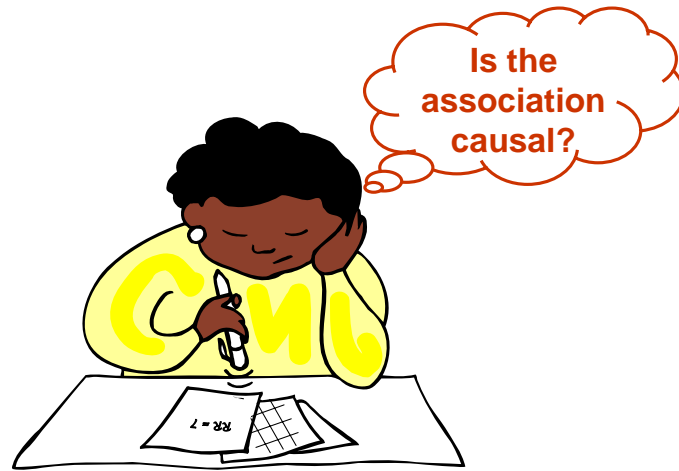


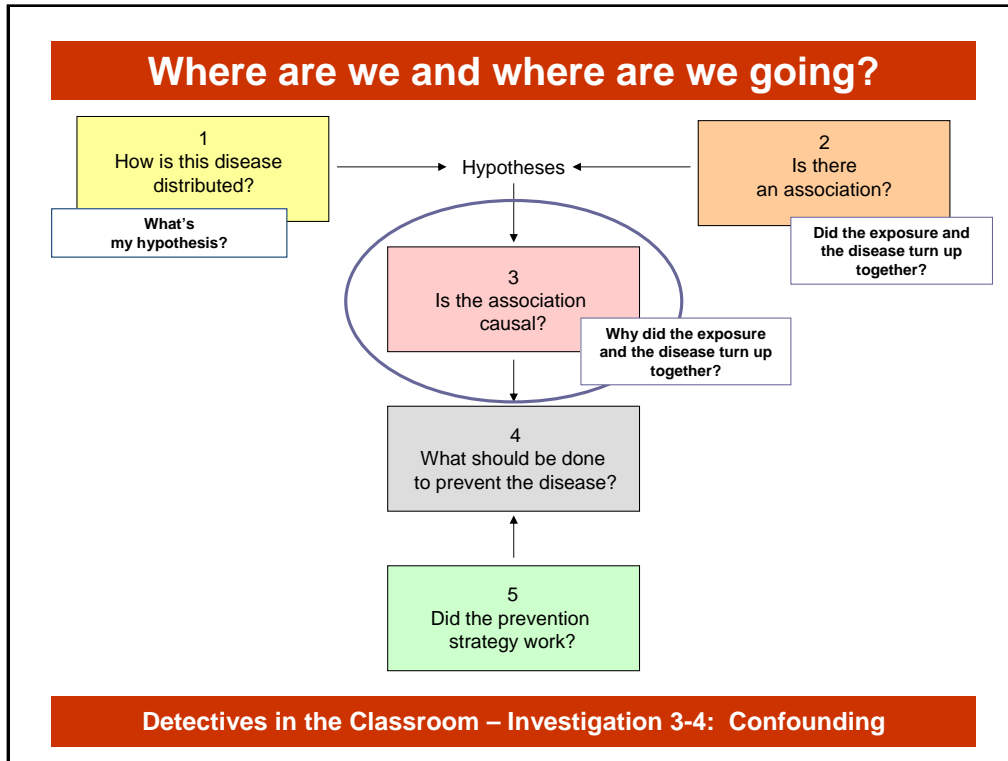
Confounding



Detectives in the Classroom – Investigation 3-4: Confounding

In **Investigation 3-4: Confounding**, students will uncover another explanation for why an epidemiologist might find an association between an exposure and an outcome.

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.
- 5.

Detectives in the Classroom – Investigation 3-4: Confounding

In Module 3, students are exploring five explanations for why two things turn up together.

In **Investigation 3-2: Cause**, they examined the possibility that an exposure and an outcome turn up together because the exposure causes the outcome.

In **Investigation 3-3: Chance**, they explored the possibility that an exposure and an outcome turn up together by chance.

In **Investigation 3-4: Confounding**, they will look at another reason why an exposure and an outcome turn up together: confounding.

Next Slide

Scenario 1



Detectives in the Classroom – Investigation 3-4: Confounding

Present Scenario 1.

Sophia is playing baseball with her cousin Vinnie.

Vinnie is throwing the ball too hard and recklessly.

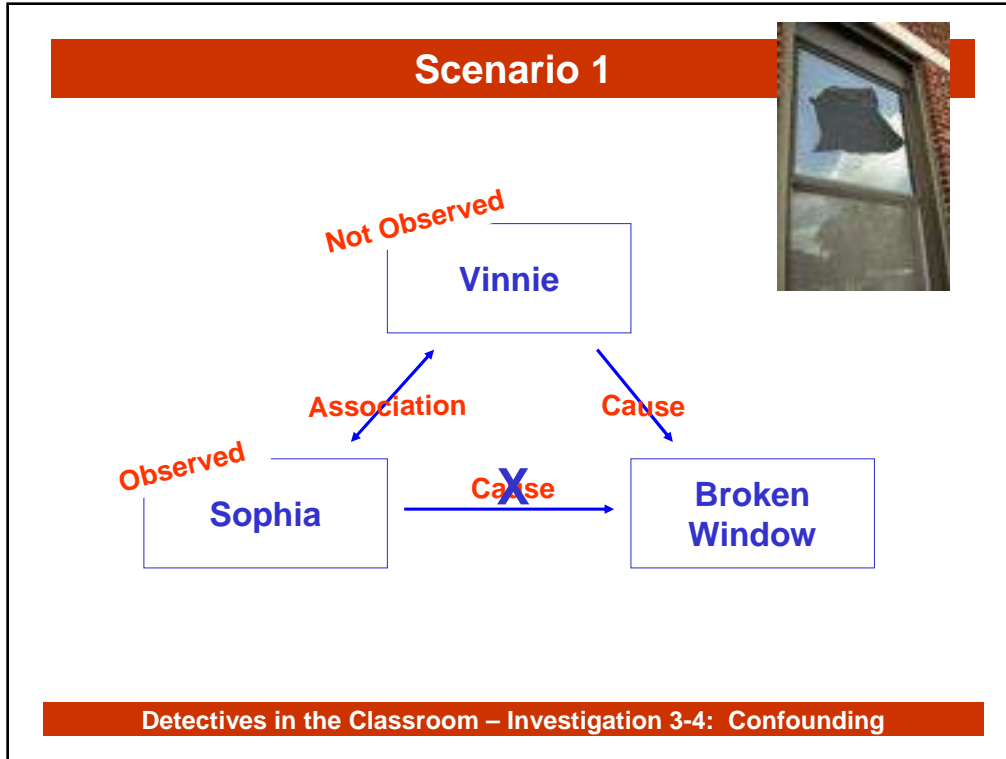
Sophia tells Vinnie to stop, but he does not listen and throws the ball again, hard and over Sophia's head, and breaks the window of Sophia's neighbor, Mr. Johnson.

When Vinnie hears the crash, he runs and hides.

Mr. Johnson, who has spoken to Sophia many times about not playing ball near his house, looks out the window and observes Sophia standing there. Without saying anything, Mr. Johnson calls Sophia's mother.

✧ Teacher Alert: Scenario 1 introduces the idea of confounding on a personal level that students should be able to relate to. Scenario 2 (starting in Slide 7) reinforces the concept of confounding using a "population" example—a hypothetical epidemiology study of the relationship between watching R-rated movies and teenage pregnancy.

Next Slide



Ask students:

- Who was blamed for breaking the window? (Sophia)
- Why was Sophia blamed for breaking the window? (When Mr. Johnson looked out the window, he observed that Sophia and the broken window turned up together.)
- Why didn't Mr. Johnson think that Vinnie broke the window? (When Mr. Johnson looked out the window, he did not observe Vinnie.)
- Who actually broke the window? (Vinnie)
- Why was Sophia, not Vinnie, blamed for breaking the window? (When Sophia and Vinnie were playing baseball, they were associated with each other. Sophia was guilty by association.)

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 3-4: Confounding

Remind students that when epidemiologists try to determine why two things turn up together, they observe what happens *in specified populations*.

Next Slide

Scenario 2



Detectives in the Classroom – Investigation 3-4: Confounding

Present Scenario 2.

Students are listening to the news, and they hear the anchorwoman say that “... the observational study showed that teenage girls who watch R-rated movies were more likely to become pregnant, that teenage girls who watched R-rated movies were 15 times more likely to become pregnant than teenage girls who did not watch R-rated movies.”

Next Slide

Scenario 2



	Teenage Pregnancy	No Teenage Pregnancy	Risks	Relative Risk
R-Rated Movies	a	b	/ or %	15
No R-Rated Movies	c	d	/ or %	

Detectives in the Classroom – Investigation 3-4: Confounding

Ask students:

- How would this evidence be presented in a 2 x 2 table?
- What is the exposure? (R-rated movies)
- What is the outcome? (Teenage pregnancy)
- What is the relative risk? (15)

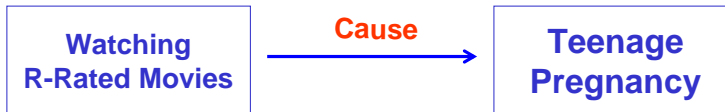
Next Slide

Scenario 2

“The study establishes a clear progression that begins with watching R-rated movies and leads to teenage pregnancy.”



“If we can keep our teenagers from watching R-rated movies, then we can go a long way towards preventing teenage pregnancy.”



Detectives in the Classroom – Investigation 3-4: Confounding

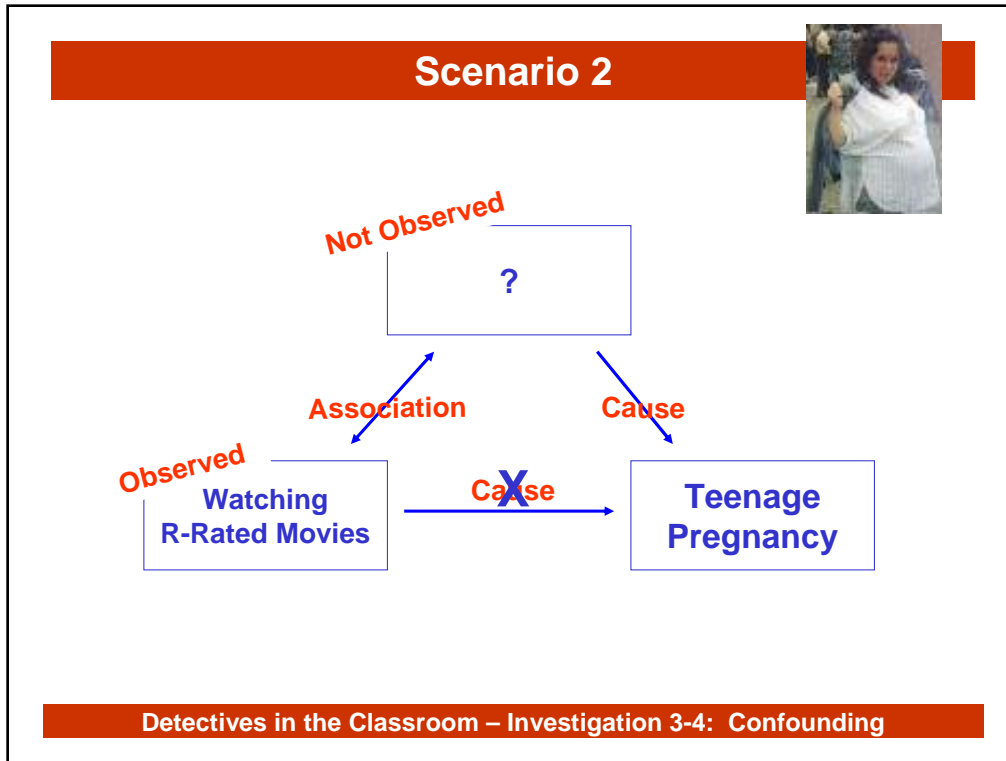
The anchorwoman then quoted the investigators: “The study establishes a clear progression that begins with watching R-rated movies and leads to teenage pregnancy.”

The anchorwoman said that the investigators concluded, “If we can keep our teenage girls from watching R-rated movies, then we can go a long way towards preventing teenage pregnancy.”

Ask students:

- On the basis of the above quotes, why does the investigator think the association between watching R-rated movies and teenage pregnancy was found? (Cause)

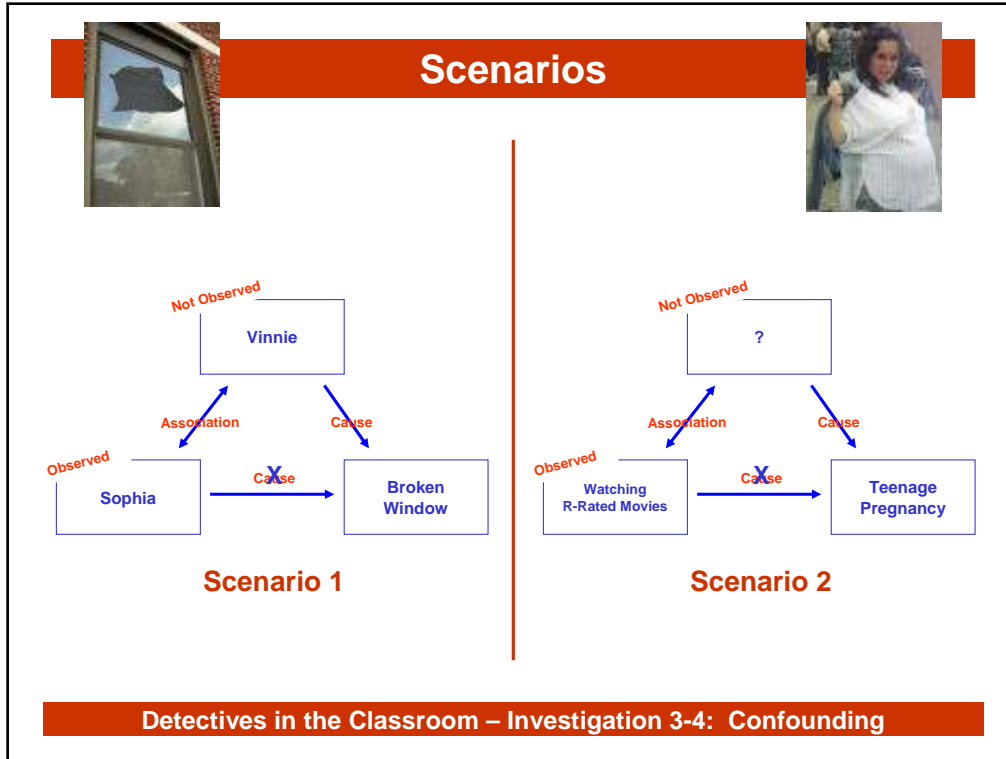
Next Slide



Ask students:

- What was blamed for teenage pregnancy? (Watching R-rated movies)
- Why was watching R-rated movies blamed for teenage pregnancy? (When the investigator looked at the evidence, he observed that watching R-rated movies and teenage pregnancy turned up together.)
- Why didn't the investigator think that something else caused teenage pregnancy? (When the investigator looked at the evidence, he did not observe anything else.)
- Is it possible that something else associated with watching R-rated movies was a cause of teenage pregnancy? (Yes)

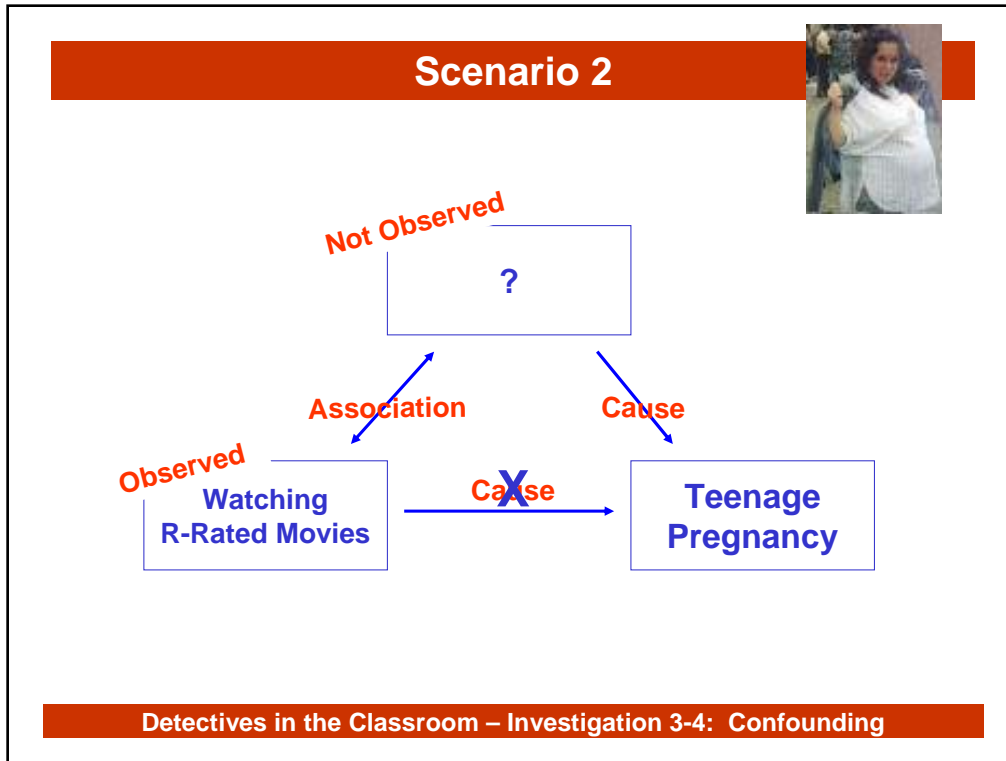
Next Slide



Ask students:

- Can you describe what is *similar* about Scenarios 1 and 2? (In both scenarios, two things turned up together. In both, the investigator concluded that the reason for this was that one thing caused the other.)
- Can you describe what is *dissimilar* about Scenarios 1 and 2? (In Scenario 1, Mr. Johnson’s conclusion, that Sophia broke the window, was wrong; Vinnie, who actually broke the window, was not blamed. In Scenario 2, we do not know whether the investigator’s conclusion, that watching R-rated movies is a cause of teenage pregnancy, is right or wrong.)

Next Slide



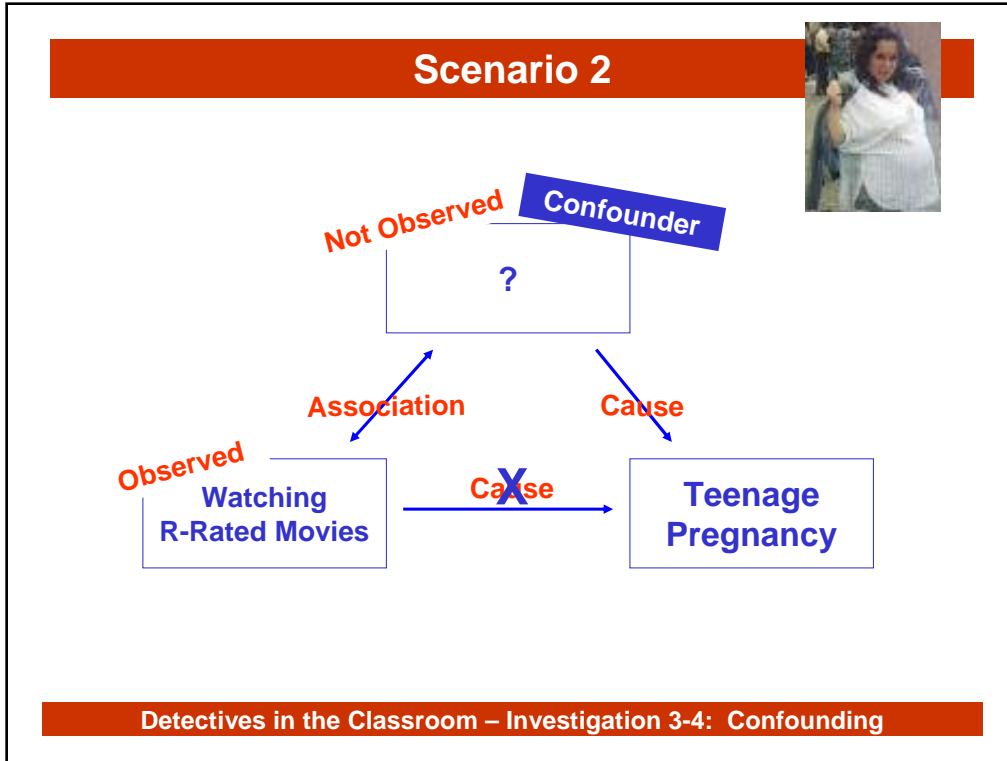
Students should consider the possibility that the investigator's conclusion was wrong. Although the *observed* exposure (watching R-rated movies) was associated with the outcome (teenage pregnancy), the association was found because there is something that was *not observed* that (1) is associated with watching R-rated movies and (2) is an actual cause of teenage pregnancy.

Ask students:

- Can you think of another exposure that (1) may be associated with watching R-rated movies and (2) might also be a cause of teenage pregnancy?

Discuss.

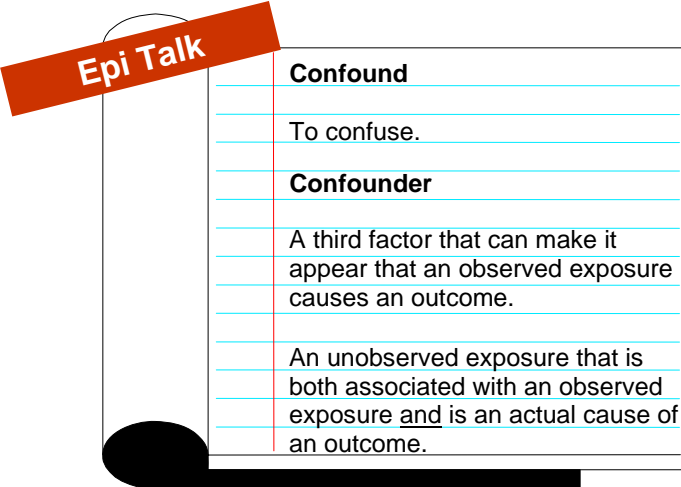
Next Slide



An unobserved exposure that is both associated with the observed exposure and is an actual cause of the outcome is called a confounder.

Next Slide

Epi Talk



Confound
To confuse.
Confounder
A third factor that can make it appear that an observed exposure causes an outcome.
An unobserved exposure that is both associated with an observed exposure <u>and</u> is an actual cause of an outcome.

Detectives in the Classroom – Investigation 3-4: Confounding

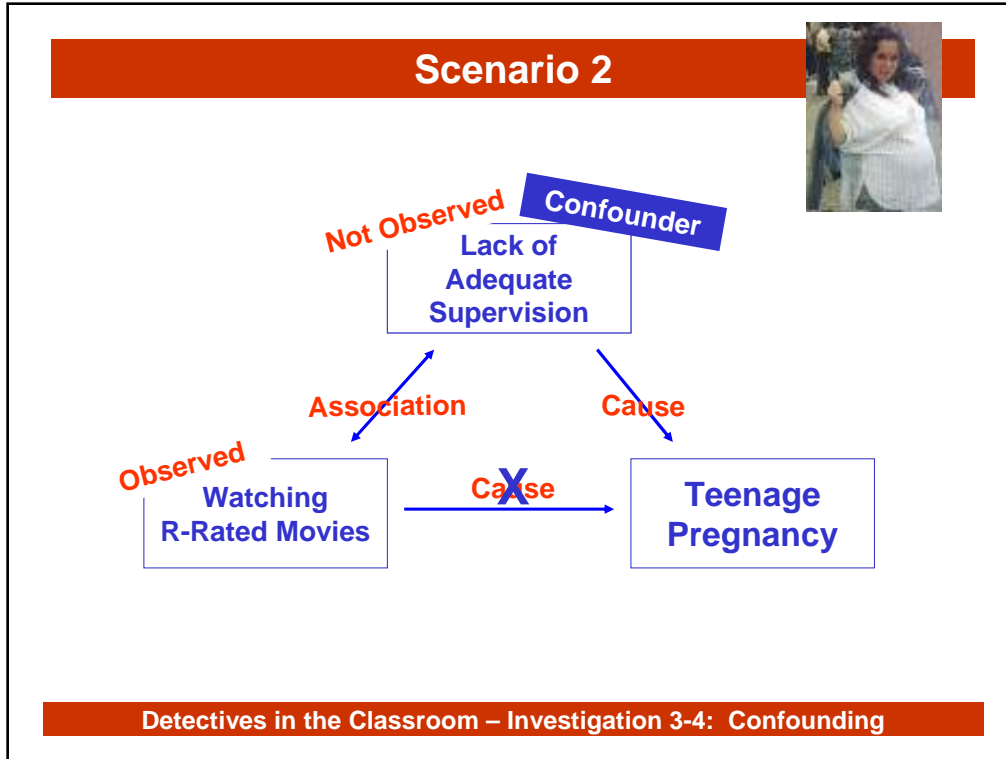
Ask students to find “Confound” in the **Epi Talk** list.

Review its definition.

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

Review its definition.

Next Slide



Ask students:

- Could a *lack of adequate supervision* be a confounder? (Yes)
- Could a *lack of adequate supervision* be something that is associated with watching R-rated movies? (Yes)
- And is a *lack of adequate supervision* something that could be a cause of teenage pregnancy? (Yes)

Next Slide

Epi Log Worksheet

Detectives in the Classroom Name: _____
Investigation 3-4: Epi Log Worksheet Date: ____/____/____
Explanations for Finding an Association: Confounding

1.

2.

3.

Detectives in the Classroom – Investigation 3-4: Confounding

Give each student an **Investigation 3-4: Epi Log Worksheet**.

Next Slide

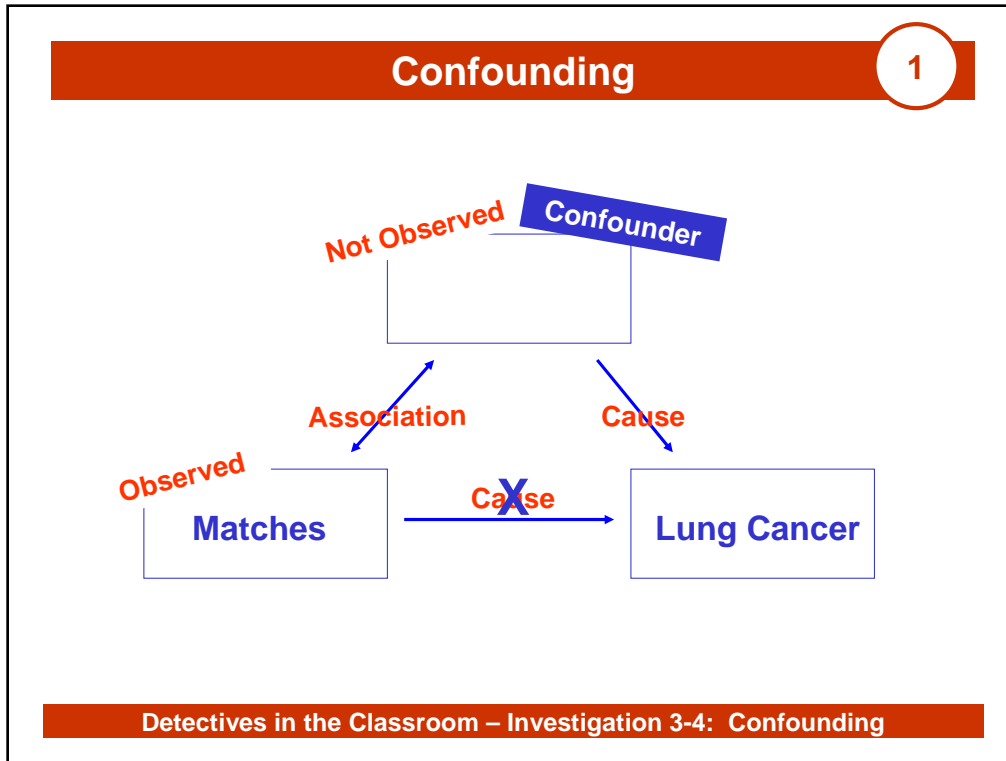
Epi Teams



Detectives in the Classroom – Investigation 3-4: Confounding

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

Next Slide



Now show students several associations between an observed exposure and an outcome. For each association, ask them to think of another exposure that could be a confounder.

Remind students that a confounder is a factor that can make it appear that an observed exposure causes an outcome. It is an unobserved exposure that (1) is associated with an observed exposure and (2) is an actual cause of the outcome.

Working in their Epi Teams, students should complete Part 1 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 1 with a possible confounder that might have been responsible for finding the association between matches and lung cancer.

Ask students what possible confounders they identified.

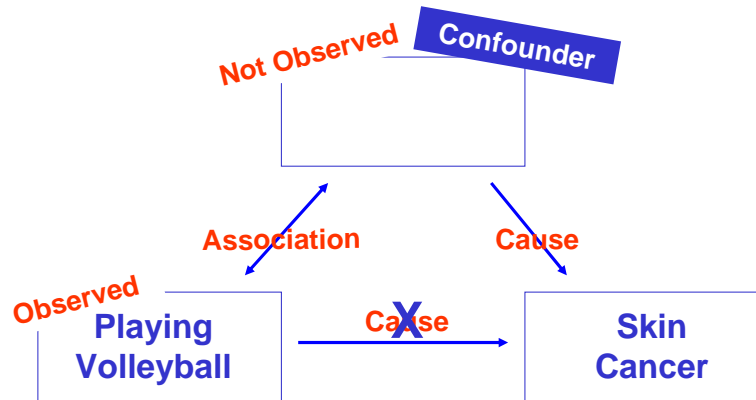
Probe.

(Possible confounders include *smoking* and *working with a blow torch*, but students' responses should not be limited to these suggestions. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Confounding

2



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 2 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 2 with a possible confounder that might have been responsible for finding the association between playing volleyball and skin cancer.

Ask students what possible confounders they identified.

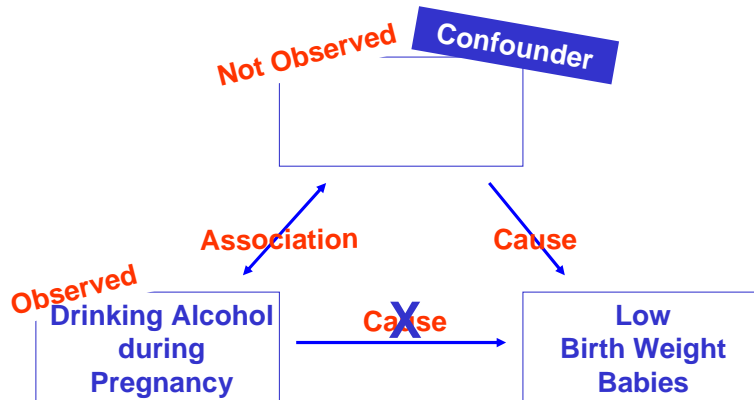
Probe.

(Because volleyball is often played on the beach, possible confounders include *sun* and *suntan lotion*. However, students' responses should not be limited to these suggestions. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Confounding

3



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 3 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 3 with a possible confounder that might have been responsible for finding the association between drinking alcohol during pregnancy and low birth weight babies.

Ask students what possible confounders they identified.

Probe.

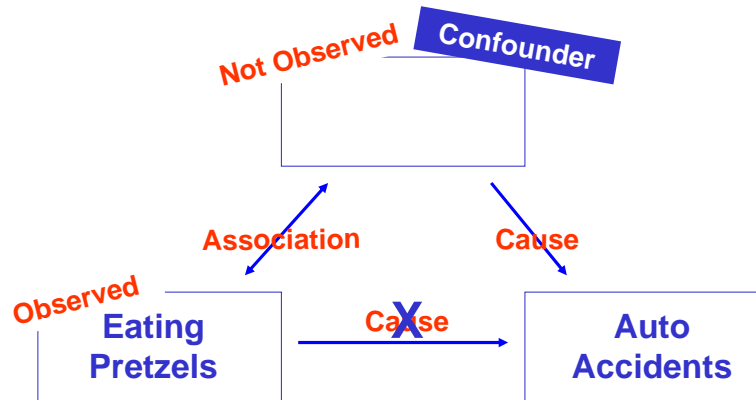
(Because pregnant women who drink during pregnancy may subject their fetuses to other harmful exposures, possible confounders include *cigarette smoking*, *other drug use*, and a *poor diet*. However, students' responses should not be limited to these suggestions. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

⚠ **Teacher Alert:** Although alcohol consumption is not believed to be a cause of low birth weight babies, it is harmful to the fetus. The damage that is done is called fetal alcohol syndrome. Be careful not to imply that alcohol is not harmful to the fetus.

Next Slide

Confounding

4



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 4 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 4 with a possible confounder that might have been responsible for finding the association between eating pretzels and auto accidents.

Ask students what possible confounders they identified.

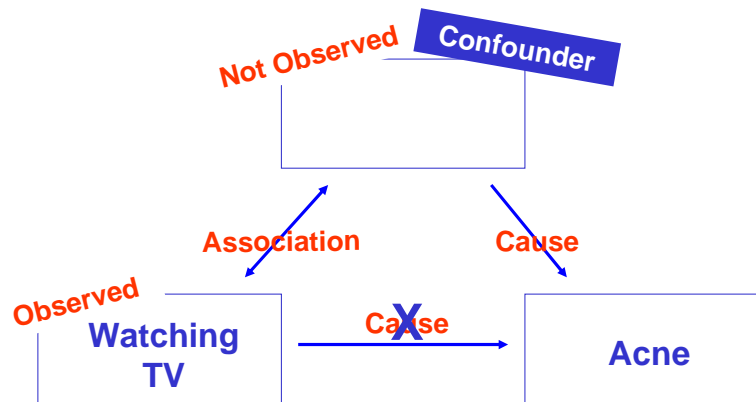
Probe.

(Because pretzels and other salty foods are often consumed when drinking alcohol, a possible confounder is *drinking alcohol*. However, students' responses should not be limited to this suggestion. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Confounding

5



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 5 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 5 with a possible confounder that might have been responsible for finding the association between watching TV and acne.

Ask students what possible confounders they identified.

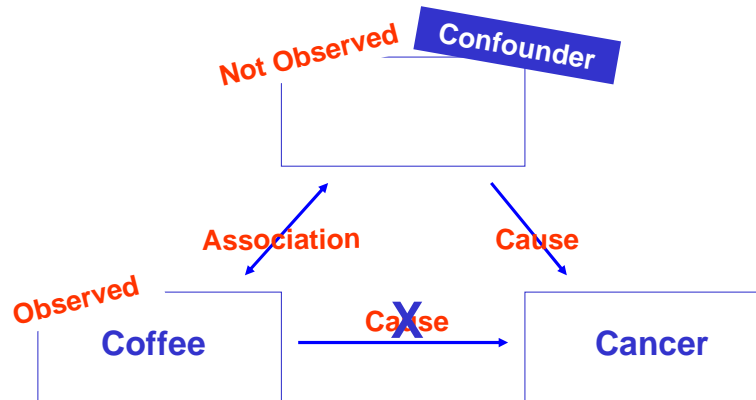
Probe.

(Because watching TV is often associated with eating junk food, *junk food* is a possible confounder. However, students' responses should not be limited to this suggestion. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Confounding

6



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 6 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 6 with a possible confounder that might have been responsible for finding the association between drinking coffee and cancer.

Ask students what possible confounders they identified.

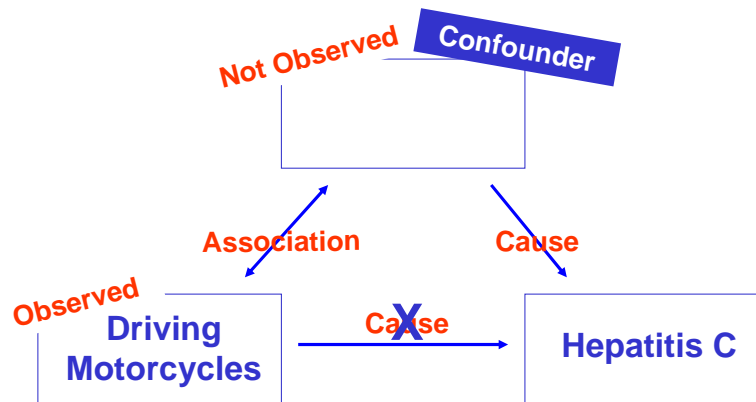
Probe.

(Because coffee drinking is often accompanied by other exposures, possible confounders include a *sweetener*, *newspapers*, *donuts*, and *Styrofoam cups*, but students' responses should not be limited to these suggestions. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being studied and is an actual cause of the outcome.)

Next Slide

Confounding

7



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 7 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 7 with a possible confounder that might have been responsible for finding the association between driving motorcycles and hepatitis C.

Ask students what possible confounders they identified.

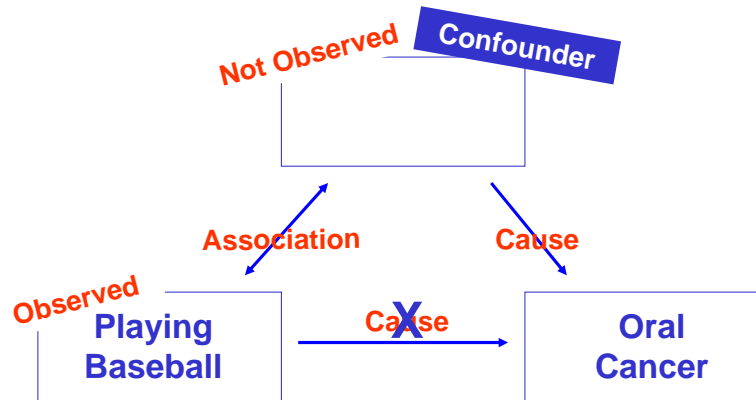
Probe.

(Because driving motorcycles is associated with having tattoos and tattoos can be drawn with dirty needles, a possible confounder is *dirty needles*. However, students' responses should not be limited to this suggestion. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Confounding

8



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 8 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 8 with a possible confounder that might have been responsible for finding the association between playing baseball and oral cancer.

Ask students what possible confounders they identified.

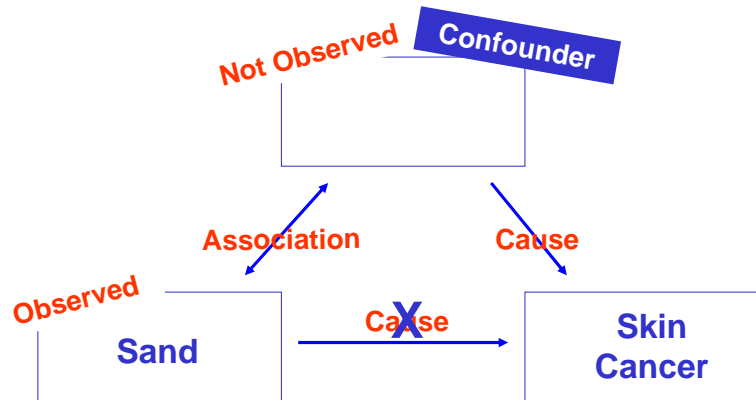
Probe.

(Because baseball players often *chew tobacco* or *eat sunflower seeds*, these exposures are possible confounders. However, students' responses should not be limited to these suggestions. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Confounding

9



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 9 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 9 with a possible confounder that might have been responsible for finding the association between being exposed to sand and skin cancer.

Ask students what possible confounders they identified.

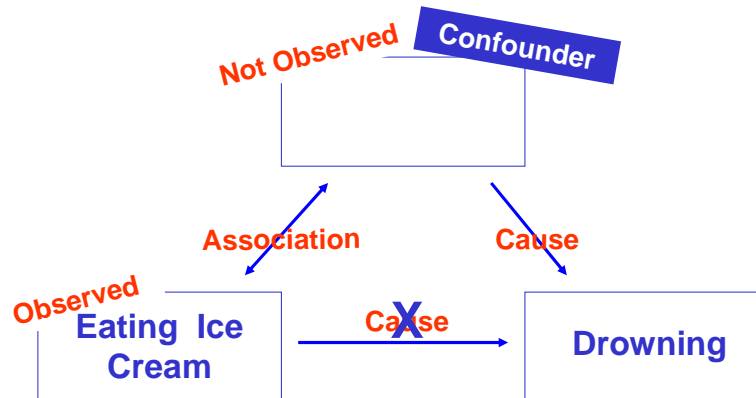
Probe.

(Because people who go to the beach are not only being exposed to sand but also to the sun, the *sun* is a possible confounder. However, students' responses should not be limited to these suggestions. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Confounding

10



Detectives in the Classroom – Investigation 3-4: Confounding

Students should complete Part 10 on their **Investigation 3-4: Epi Log Worksheets** by completing Confounding Diagram 10 with a possible confounder that might have been responsible for finding the association between eating ice cream and drowning.

Ask students what possible confounders they identified.

Probe.

(Because eating ice cream is associated with hot weather and hot weather is associated with swimming, *swimming* is a possible confounder. However, students' responses should not be limited to this suggestion. Keep in mind the definition of a confounder: an exposure that both is associated with the exposure being observed and is an actual cause of the outcome.)

Next Slide

Explanations for Finding an Association

1. Cause
2. Chance
3. Confounding
- 4.
- 5.

Study Finds Possible Link Of Cancer and Power Lines
Studies Link AIDS Virus Directly to Cancer and Dementia
Study Links Intelligence And Myopia
Chemical Tie to Cancer Hinted
Mist in Grocery's Produce Section Is Linked to Legionnaires' Disease
Coffee linked to heart disease
Dairy Sugar Linked to Ovarian Cancer
Report Links Snoring to Impaired Thinking
GUN CURBS LINKED TO HOMICIDE RATE
Children's Height Linked to Test Scores
China's Search for Nutrient Link to Cancer Proves Elusive
Study Links Eating M&M's To Decreased Risk of Flu



Why would an exposure and an outcome turn up together?

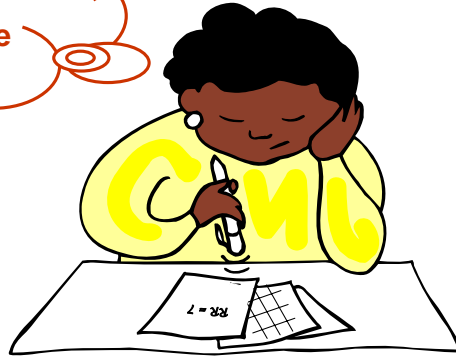
Detectives in the Classroom – Investigation 3-4: Confounding

Students now know from **Investigation 3-4: Confounding** that confounding is one of the reasons why epidemiologists can find an association between an exposure and an outcome.

Next Slide

Explanations for Finding an Association

Could the association have been found because of confounding?



Detectives in the Classroom – Investigation 3-4: Confounding

Tell students that when they find, read, or hear about an association, they should think carefully about it. Even if it appears to make sense, a good detective will not jump to the conclusion that the association is causal and will consider the possibility that the association was found as a result of confounding. Remember to ask, “Could it be something else?”

Next Slide

Confounding



Detectives in the Classroom – Investigation 3-4: Confounding

This concludes **Investigation 3-4: Confounding** and students can now put away their Epi Logs.