1.2 Observational Studies vs Designed Experiments MATH 241 THOMPSON

1) What is an observational study? What is a designed experiment? Which allows the researcher to claim causation between an explanatory variable and a response variable?

What is an observational study?

B. An observational study measures the value of the response variable without attempting to influence the value of either the response or explanatory variables.

What is a designed experiment?

B. A designed experiment is when a researcher assigns individuals to a certain group, intentionally changing the value of an explanatory variable, and then recording the value of the response variable for each group.

A designed experiment allows the researcher to claim causation between an explanatory variable and a response variable

2) Explain what is meant by confounding. What is a lurking variable? What is a confounding variable?

What is meant by confounding?

A. Confounding in a study occurs when the effects of two or more explanatory variables are not separated. Therefore, any relation that may exist between an explanatory variable and the response variable may be due to some other variable or variables not accounted for in the study.

What is a lurking variable?

C. A lurking variable is an explanatory variable that was not considered in a study, but that affects the value of the response variable in the study. In addition, lurking variables are typically related to explanatory variables in the study.

What is a confounding variable?

A. A confounding variable is an explanatory variable that was considered in a study whose effect cannot be distinguished from a second explanatory variable in the study.

3) What is a cross-sectional study? What is a case-control study? Which is the superior observational study? Why?

What is a cross-sectional study? Choose the correct answer below.

B. Cross-sectional studies are observational studies that collect information about individuals at a specific point in time or over a very short period of time.

What is a case-control study? Choose the correct answer below.

C. Case-control studies are observational studies that are retrospective, meaning that they require individuals to look back in time or require the researcher to look at existing records.

Which is the superior observational study? Why? Choose the correct answer below.

B. Neither study is always the superior to the other. Both have advantages and disadvantages that depend on the situation.

4) Determine whether the study depicts an observational study or an experiment.

Forty patients with skin cancer are divided into two groups. One group receives an experimental drug to fight cancer, the other a placebo. After two years, the spread of the cancer is measured.

Does the description correspond to an observational study or an experiment?

B. The study is an experiment because the researchers control one variable to determine the effect on the response variable.

5) Determine whether the study depicts an observational study or an experiment.

Eighth-grade students are randomly divided into two groups. One group is taught English using traditional techniques. The other is taught English using a reform method. After 1 year, each group is given an achievement test to compare its proficiency with that of the other group.

Choose the correct description of the study.

C. The study is an experiment because the researchers control one variable to determine the effect on the response variable.

6) Determine whether the study depicts an observational study or an experiment.

A poll is conducted by a school's math department in which eighth-grade students are asked if they prefer to be in their math class or their English class.

Choose the correct description of the study.

B. The study is an observational study because the study examines individuals in a sample, but does not try to influence the response variable.

7) Determine whether the study depicts an observational study or an experiment.

Twenty patients with leukemia are divided into two groups. One group is treated with an experimental drug. The other is not. After one month, both groups are questioned about their energy level.

Is the study an observational study or an experiment?

D. The study is an experiment because the researchers control one variable to determine the effect on the response variable.

8) Researchers wanted to determine if there was an association between the level of stress of an individual an their risk of lung cancer. The researchers studied 1972 people over the course of 9 years. During this 9-year period, they interviewed the individuals and asked questions about their daily lives and the hassles they face In addition, hypothetical scenarios were presented to determine how each individual would handle the situation. These interviews were videotaped and studied to assess the emotions of the individuals. The researchers also determined which individuals in the study experienced any type of lung cancer over the 9-year period. After their analysis, the researchers concluded that the stress-free individuals were less likely to experience lung cancer. Complete parts (a) through (c).

(a) What type of observational study was this? Explain.

This was a cohort study, because information was collected about a group of individuals by observing them over a long period of time.

(b) What is the response variable? What is the explanatory variable?

The response variable is whether or not lung cancer was contracted, because it is the variable of interest.

The explanatory variable is level of stress, because it affects the other variable.

The researchers may be concerned with confounding that occurs when the effects of two or more explanatory variables are not separated or when there are some explanatory variables that were not considered in a study, but that affect the value of the response variable.

9) Researchers wanted to determine if there was an association between daily kale consumption and the occurrence of heart disease. The researchers looked at 94,138 women and asked them to report their kale-eating habits. The researchers also determined which of the women had congestive heart failure. Aft their analysis, the researchers concluded that consumption of two or more servings of kale per day was associated with a reduction in congestive heart failure. Complete parts (a) through (c) below.

(a) What type of observational study was this? Explain.

B. This was a cross-sectional study because all information about the individuals was collected at a specific point in time.

(b) What is the response variable in the study? Is the response variable qualitative or quantitative? What is the explanatory variable?

What is the response variable in the study? Is the response variable qualitative or quantitative?

B. The response variable is whether the woman has congestive heart failure or not. The response variable is qualitative.

What is the explanatory variable?

D. The explanatory variable is consumption of kale.

(c) In their report, the researchers stated that "After adjusting for various demographic and lifestyle variables, daily consumption of two or more servings was associated with a 30% reduced prevalence of congestive heart failure." Why was it important to adjust for these variables?

C. The researchers may be concerned with confounding that occurs when the effects of two or more explanatory variables are not separated or when there are some explanatory variables that were not considered in a study, but that affect the value of the response variable.

10) Researchers wanted to determine if having a DVD player in the bedroom is associated with obesity. The researchers administered a questionnaire to 370 twelve-year-old adolescents. After analyzing the results, the researchers determined that the body mass index of the adolescents who had a DVD player in their bedroom was significantly higher than that of the adolescents who did not have a DVD player in their bedroom. Complete parts (a) through (e) below.

A. The researchers intentionally changed an explanatory variable of the study.

B. The researchers administered a questionnaire to obtain their data without trying to influence an explanatory variable of the study.

C. The researchers observed the behavior of the individuals in the study without trying to influence an explanatory variable of the study.

D. The researchers tried to influence the outcome of the study.

What type of observational study is this?

Cross-sectional study

(b) What is the response variable in the study? Is the response variable qualitative or quantitative? What is the explanatory variable?

What is the response variable in the study? Is the response variable qualitative or quantitative?

A. The response variable is the body mass index of the adolescents. The response variable is quantitative.

(c) Can you think of any lurking variables that may affect the results of the study?

A. Yes. For example, a possible lurking variable might be the age of the individual.

B. No, there are no lurking variables in this study.

C. Yes. For example, possible lurking variables might be eating habits and the amount of exercise per week.

(d) In the report, the researchers stated, "These results remain significant after adjustment for socioeconomic status." What does this mean?

A. It means that when the results are separated by socioeconomic status, there are significant differences between each socioeconomic status.

B. The researchers made an effort to avoid confounding by accounting for potential lurking variables.

(e) Does a DVD player in the bedroom cause a higher body mass index? Explain.

D. No. It can only be said that a DVD player in the bedroom and obesity are associated because the body mass index of the adolescents who had a DVD player in their bedroom was significantly higher than that of the adolescents who did not have a DVD player in their bedroom.

Extra examples:

Determine whether the study depicts an observational study or an experiment.

Fifty patients with heart arrhythmias are divided into two groups. One group receives a new drug to regulate heart rhythm, the other a placebo. After one month, the presence of arrhythmias is measured.

Does the description correspond to an observational study or an experiment?

- A. The study is an experiment because the study examines individuals in a sample, but does not try to influence the variable of interest.
- B. The study is an observational study because the study examines individuals in a sample, but does not try to influence the response variable.
- C. The study is an experiment because the researchers control one variable to determine the effect on the response variable. ✔
- D. The study is an observational study because the researchers control one variable to determine the effect on the response variable.

Determine whether the study depicts an observational study or an experiment.

While shopping, 225 people are asked to perform a taste test in which they eat two randomly placed, unmarked cereals. They are then asked which cereal they prefer.

Choose the correct description of the study.

- A. The study is an observational study because the study examines individuals in a sample, but does not try to influence the variable of interest. ✔

Determine whether the study depicts an observational study or an experiment.

Forty people are divided into two groups. One group is exposed to atonal classical music. The other is not. After one month, both groups are questioned about their ability to remember random phrases.

Is the study an observational study or an experiment?

- A. The study is an experiment because the study examines individuals in a sample, but does not try to influence the variable of interest.
- B. The study is an observational study because the researchers control one variable to determine the effect on the response variable.
- C. The study is an observational study because the study examines individuals in a sample, but does not try to influence the response variable.
- D. The study is an experiment because the researchers control one variable to determine the effect on the response variable. ✔

Researchers wanted to determine if there was an association between the level of trauma of an individual and their risk of heart disease. The researchers studied 1699 people over the course of 11 years. During this 11-year period, they interviewed the individuals and asked questions about their daily lives and the hassles they face. In addition, hypothetical scenarios were presented to determine how each individual would handle the situation. These interviews were videotaped and studied to assess the emotions of the individuals. The researchers also determined which individuals in the study experienced any type of heart disease over the 11-year period. After their analysis, the researchers concluded that the trauma-free individuals were less likely to experience heart disease. Complete parts (a) through (c).

(a) What type of observational study was this? Explain.

This was a cohort study, because information was collected about a group of individuals by observing them over a long period of time.

(b) What is the response variable? What is the explanatory variable?

The response variable is whether or not heart disease was contracted, because it is the variable of interest.
The explanatory variable is level of trauma, because it affects the other variable.

(c) In the report, the researchers stated that "the research team also hasn't ruled out that a common factor like genetics could be causing both the emotions and the heart disease." Explain what this sentence means. Choose the correct answer below.

- A. The researchers may be concerned with confounding that occurs when the effects of two or more explanatory variables are not separated or when there are some explanatory variables that were not considered in a study, but that affect the value of the response variable.

Researchers wanted to determine if there was an association between daily coffee consumption and the occurrence of skin cancer. The researchers looked at 94,580 women and asked them to report their coffee-drinking habits. The researchers also determined which of the women had nonmelanoma skin cancer. After their analysis, the researchers concluded that consumption of six or more cups of caffeinated coffee per day was associated with a reduction in nonmelanoma skin cancer. Complete parts (a) through (c).

(a) What type of observational study was this? Explain.

- A. This was a case-control study because individuals that had a certain characteristic were matched with those that did not.
- B. This was a cross-sectional study because all information about the individuals was collected at a specific point in time.
- C. This was a cohort study because it identified a group of individuals to participate in the study and observed the group over a period of time.

(b) What is the response variable in the study? What is the explanatory variable?

What is the response variable in the study?

- A. The response variable is whether the woman has nonmelanoma skin cancer or not.
- B. The response variable is the number of individuals that participate in the study.
- C. The response variable is consumption of caffeinated coffee.

What is the explanatory variable?

- A. The explanatory variable is consumption of caffeinated coffee.
- B. The explanatory variable is the number of individuals that participate in the study.
- C. The explanatory variable is whether the woman has nonmelanoma skin cancer or not.

(c) In their report, the researchers stated that "After adjusting for various demographic and lifestyle variables, daily consumption of six or more cups was associated with a 30% reduced prevalence of nonmelanoma skin cancer." Why was it important to adjust for these variables?

- A. The researchers may be concerned with confounding that occurs when the effects of two or more explanatory variables are not separated or when there are some explanatory variables that were not considered in a study, but that affect the value of the response variable.

Researchers wanted to determine if having a television (TV) in the bedroom is associated with obesity. The researchers administered a questionnaire to 360 twelve-year-old adolescents. After analyzing the results, the researchers determined that the body mass index of the adolescents who had a TV in their bedroom was significantly higher than that of the adolescents who did not have a TV in their bedroom. Complete parts (a) through (e).

(a) Why is this an observational study? What type of observational study is this?

Why is this an observational study?

- A. This is an observational study because the researchers try to influence the outcome of the study.
- B. It is not an observational study.
- C. This is an observational study because the researchers observe the behavior of the individuals in the study without trying to influence an explanatory variable of the study.

What type of observational study is this?

- A. Case-control study
- B. Cohort study
- C. Cross-sectional study

(b) What is the response variable in the study? What is the explanatory variable?

What is the response variable in the study?

- A. The response variable is whether the adolescent has a TV in the bedroom or not.
- B. The response variable is the number of the adolescents that participate in the study.
- C. The response variable is the body mass index of the adolescents.

What is the explanatory variable?

- A. The explanatory variable is the body mass index of the adolescents.
- B. The explanatory variable is the number of the adolescents that participate in the study.
- C. The explanatory variable is whether the adolescent has a TV in the bedroom or not.

(c) Can you think of any lurking variables that may affect the results of the study?

- A. No, there are no lurking variables in this study.
- B. There is not enough information to answer this question.
- C. Yes. For example, possible lurking variables might be eating habits and the amount of exercise per week.

(d) In the report, the researchers stated, "These results remain significant after adjustment for socioeconomic status." What does this mean?

- A. The researchers made an effort to avoid confounding by accounting for potential lurking variables.
- B. It means that socioeconomic status is not an explanatory variable and that including this variable in the study does not change the results of the study.
- C. It means that socioeconomic status is an explanatory variable and that including this variable in the study changes the results of the study.

(e) Does a television in the bedroom cause a higher body mass index? Explain.

- C. No, a television in the bedroom and obesity are associated because the body mass index of the adolescents who had a TV in their bedroom was significantly higher than that of the adolescents who did not have a TV in their bedroom.