Solution *Section* 1.2 – Observational Studies vs Designed Experiments

Exercise

Researchers wanted to know if there is a link between proximity to high-tension wires and the rate of leukemia in children. To conduct the study, researchers compared the rate of leukemia for children who lived within ½ mile of high-tension wires to the rate of leukemia for children who did not live within ½ mile of high-tension wires. Determine whether the study depicts an observational study or an experiment.

Solution

This is an observational study because the researchers merely observed existing data. There was no attempt by the researchers to manipulate or influence the variable(s) of interest.

Exercise

Rats with cancer are divided into two groups. One group receives 5 milligrams (mg) of a medication that is thought to fight cancer, and the other receives 10 mg. After 2 years, the spread of the cancer is measured. Determine whether the study depicts an observational study or an experiment.

Solution

This is an experiment because the researchers intentionally changes the value of the explanatory variable (medication dose) to observe a potential effect on the response variable (cancer growth).

Exercise

Seventh-grade students are randomly divided into two groups. One group is taught math using traditional techniques; the other is taught math using a reform method. After 1 year, each group is given an achievement test to compare proficiency. Determine whether the study depicts an observational study or an experiment.

Solution

This is an experiment because the explanatory variable (teaching method) was intentionally varied to see how is affected the response variable (score on proficiency test).

Exercise

A poll is conducted in which 500 people are asked whom they plan to vote for in the upcoming election. Determine whether the study depicts an observational study or an experiment.

Solution

This is an observational study because no attempt was made to influence the variable of interest. Voting choices were merely observed.

Exercise

A survey is conducted asking 400 people. “Do you prefer Coke or Pepsi?” Determine whether the study depicts an observational study or an experiment.

Solution

This is an observational study because the survey only observed preference of Coke or Pepsi. No attempt was made to manipulate or influence the variable of interest.

Exercise

A Gallup poll surveyed 1018 adults by telephone, and 22% of them reported that they smoked cigarettes within the past year. Determine whether the description corresponds to an observation study or an experiment.

Solution

Observational study, since the poll involves collecting data from unmodified subjects.

Exercise

In a morally and criminally wrong study, 399 black men with syphilis were not given a treatment that could have cured them. The intent was to learn about the effects of syphilis on black men, The subjects were initially treated with small amounts of bismuth, neoarsphenamine, and mercury, but those treatments were replaced with aspirin. Determine whether the description corresponds to an observation study or an experiment.

Solution

Experiment, since the effect of an applied treatment (in this case a zero dose of the appropriate medicine) was measured.

Exercise

While shopping, 200 people are asked to perform a taste test in which they drink from two randomly placed, unmarked cups. They are then asked which drink they prefer. Determine whether the description corresponds to an observation study or an experiment.

Solution

This is an experiment because the researcher intentionally imposed treatments on individuals in a controlled setting.

Exercise

Conservation agents netted 250 large-mouth bass in a lake and determined how many were carrying parasites. Determine whether the description corresponds to an observation study or an experiment.

Solution

This is an observation study because the conservation agents merely observed the fish to determine which were carrying parasites. No attempt was made to manipulate or influence any variable of interest.

Exercise

Researchers wanted to determine if there was an association between the level of happiness of an individual and their risk of heart disease. The researchers studied 1739 people over the course of 10 years. During this 10-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 10-year period. After their analysis, the researchers concluded that the happy individuals were less likely to experience heart disease.

a) What type of observational study is this? Explain.
b) What is the response variable?
c) What is the explanatory variable?
d) 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." Use the language introduced on this section to explain what this sentence means.

Solution

a) This is a cohort study because the researchers observed a group of people over a period of time.
b) The response variable is whether the individual has heart disease or not.
c) The explanatory variable is whether the individual is happy or not.
d) There may be confounding due to lurking variables. For example, happy people may be more likely to exercise, which could affect whether they will have heart disease or not.

Exercise

Researchers wanted to determine if there was an association between daily coffee consumption and the occurrence of skin cancer. The researchers looked at 93,676 women enrolled in the Women's Health Initiative Observation Study 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

a) What type of observational study is this? Explain.
b) What is the response variable?

c) What is the explanatory variable?

d) 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?

Solution

a) This is a cross-sectional study because the researchers collected information about the individuals at a specific point in time.

b) The response variable is whether the woman has nonmelanoma skin cancer or not.

c) The explanatory variable is the daily amount of caffeinated coffee consumed.

d) It was necessary to account for these variables to avoid confounding due to lurking variables.

Exercise

Researcher Penny Gordon-Larson and her associate wanted to determine whether young couples who marry or cohabitate are more likely to gain weight than those who stay single. The researchers followed 8000 men and women for 7 years as they matured from teens to young adults. When the study began, none of the participants were married or living with a romantic partner. By the end of the study, 14% of the participants were married and 16% were living with a romantic partner. The researchers found that married or cohabiting women gained, on average, 9 pounds more than single.

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

b) What is the response variable in the study?

c) What is the explanatory variable?

d) Identify some potential lurking variables in this study.

e) Can we conclude that getting married or cohabiting causes one to gain weight? Explain.

Solution

a) This is an observational study because the researchers merely observed the individuals included in the study. No attempt was made to manipulate or influence any variable of interest. This is a cohort study because the researchers identified the individuals to be included in the study, then followed them for a period of time (7 years).

b) The response variable is weight gain.

c) The explanatory variable is whether the individual is married/cohabitating or not.

d) Answers may vary. Some potential lurking variables are eating habits, exercise routine, and whether the individual has children.

e) No since this is an observational study, we can only say that being married or cohabitating is associated with weight gain.