

For Real?

Sample Surveys, Observational Studies, and Experiments

LEARNING GOALS

In this lesson, you will:

- Identify characteristics of sample surveys, observational studies, and experiments.
- Differentiate between sample surveys, observational studies, and experiments.
- Identify possible confounds in the design of experiments.

KEY TERMS

- characteristic of interest
- sample survey
- random sample
- biased sample
- observational study
- experiment
- treatment
- experimental unit
- confounding

Have you taken medicine to treat an illness? Imagine that the medicine you took was not really medicine, but just a sugar pill. In medical studies, people who have unknowingly taken a sugar pill—called a placebo—have reported that the pill has had an effect similar to medicine, even though there was no medicine in the pill at all. This is an example of what is called the placebo effect.

Researchers must always be on the lookout for placebo effects. They may be to blame for successful or unsuccessful outcomes to experiments.

PROBLEM 1 Survey Says



You can use data to help answer questions about the world. The specific question that you are trying to answer or the specific information that you are trying to gather is called a **characteristic of interest**.

For example, you can use data to help determine which drug is most effective, teenagers' favorite television program, or how often doctors wash their hands.

One way of collecting data is by using a *sample survey*. A **sample survey** poses one or more questions of interest to obtain sample data from a population. Recall, a population represents all the possible data that are of interest in a survey, and a sample is a subset of data that is selected from the population.

A researcher wants to design a sample survey to determine the amount of time that U.S. teenagers between the ages of 16 to 18 spend online each day.



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1. Identify the characteristic of interest in the sample survey.
2. Identify the population that the researcher is trying to measure by using a sample survey.

3. Augie and Sandy were discussing the population of the survey.

Augie

The population is all 16- to 18-year-olds in the United States.

Sandy

The population is all teenagers in the United States.

Who is correct? Explain your reasoning.



4. Write a survey question or questions that the researcher could use to collect data from the participants in the survey.



When sample data are collected in order to describe a characteristic of interest, it is important that such a sample be as representative of the population as possible. One way to collect a representative sample is by using a *random sample*. A **random sample** is a sample that is selected from the population in such a way that every member of the population has the same chance of being selected. A **biased sample** is a sample that is collected in a way that makes it unrepresentative of the population.



5. Joanie and Richie were discussing strategies the researcher could use to select a representative sample of 16- to 18-year-olds.

 **Joanie**

The sample should include 16- to 18-year-olds from various states.

 **Richie**

Include 16- to 18-year-olds who live in various types of communities, like urban, suburban, and rural.

List some additional strategies the researcher should consider when selecting the sample.



6. Chereese suggested that the researcher could post the survey online and then distribute the link to the survey to students after school on Friday as they are leaving the building.

Will this method result in a biased sample? Explain your reasoning.

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PROBLEM 2 Confound It All!

In an **observational study**, data are gathered about a characteristic of the population by simply observing and describing events in their natural settings. Recording the number of children who use the swings at a local park would be an example of a simple observational study.



The results of an observational study state that approximately 70% of in-house day care centers in one U.S. state show as much as 2.5 hours of television to the children per day. The observational study examined 132 day care centers in one state.

1. Identify the population, the sample, and the characteristic of interest in the observational study.



2. List some similarities and differences between an observational study and a sample survey.



An **experiment** gathers data on the effect of one or more **treatments**, or experimental conditions, on the characteristic of interest. Members of a sample, also known as **experimental units**, are randomly assigned to a treatment group.

Researchers conducted an experiment to test the effectiveness of a new asthma drug. They collected data from a sample of 200 asthma patients. One hundred of the patients received a placebo treatment along with an inhaler. The other one hundred patients received the new drug along with an inhaler. Monthly blood and breathing tests were performed on all 200 patients to determine if the new drug was effective.

A placebo treatment is a treatment that is assumed to have no real effect on the characteristic of interest.



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3. Identify the population, the sample, and the characteristic of interest in the experiment.

4. What are the treatments in the experiment?

5. What are some ways the researchers could choose a biased sample for this experiment?

Confounding occurs when there are other possible reasons, called confounds, for the results to have occurred that were not identified prior to the study.



6. Suppose one of the treatment groups was given the new drug with an inhaler and the other group was given a placebo with no inhaler. Describe how this design of the experiment introduces a confound.

3. A medical researcher wants to learn whether or not there is a link between the amount of TV children watch each day and childhood obesity in a particular school district. She gathers data from the records of 15 local pediatricians.



4. In a particular school district, a researcher wants to learn whether or not there is a link between a child's daily amount of physical activity and their overall energy level. During lunch at a school, she distributed a short questionnaire to students in the cafeteria.