Lesson 2: Study Types

- Let's examine different kinds of studies.

2.1: What's Different About These Questions?

For each question, determine whether it is a statistical question. If it is a statistical question, determine whether an experimental study, observational study, or survey would be best at providing data to answer the question. Explain your reasoning.

1. Do dogs who eat only Brand A of dog food have more health problems than those who eat a variety of food brands?

2. Do people who sit for at least 8 hours per day have more health problems than those who sit for fewer than 8 hours per day?

3. Which brand of dog food has the most protein per serving?

4. Do people who eat a low-fat diet feel healthier than those who eat a variety of foods?

2.2: Study Type Matching

Take turns with your partner to determine whether a survey, observational study, or experimental study would be the best way to collect data to answer the question.

- For each study type that you match, explain to your partner why you think this is the best type of study.
- For each study that your partner matches, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.

1. Do smokers get in more car accidents than non-smokers?
2. What is the students' favorite type of sport at this school?
3. Do people who chew gum while studying do better on tests when they chew gum while taking the test than when they don't chew gum while taking the test?
4. How has the percentage of the world's wealth owned by the top 1% of individuals changed over the past 300 years?
5. Do strawberry plants produce more fruit when growing in a greenhouse or outside?
6. What are the most important issues for voters in a district at the moment?

2.3: Relaxing Television

A study of 1,000 people aged 20–30 asked how much television each person watches each night and how each person would rate their energy level in the evenings. The study showed that people who watch television for at least 2 hours every night have lower energy in the evening than people who do not watch as much television.

1. Is this study a survey, observational study, or experimental study? Explain your reasoning.

2. Does this mean that watching television for at least 2 hours every night lowers energy in the evening? Explain your reasoning.

3. If you were to do your own experiment to determine if watching television for at least 2 hours every night lowers energy in the evening, how would you set up the experiment?

Are you ready for more?

Sometimes it is not feasible or ethical for a researcher to directly influence factors as required for an experimental study. In those situations, a researcher may try to find what is called a natural experiment. While technically a form of observational study, in a natural experiment, the group's assignment to treatments seems random so that it resembles an experimental study.

For example, in Oregon in the early 2000s, the state did not not have enough money to fund a health insurance program for everyone who would have been eligible for it, so after people applied, they randomly selected who would be allowed to enroll. Researchers could not ethically have given some people health insurance and denied it to others, but they followed up on the state's actions to research the effect of having health insurance on a person's health and well-being.

What are some statistical questions that researchers may be interested in studying, that could be answered with an experimental study, but for which a natural experiment may be necessary? Explain why an experimental study wouldn't be feasible or ethical.

Lesson 2 Summary

Three of the best ways to collect data are through surveys, experimental studies, and observational studies. Each method has advantages and disadvantages depending on the question you are trying to answer.

A statistical study begins with a *research question*, which describes what you want to know clearly and simply. Most research questions are questions about characteristics of a population or about the effect of one variable on another.

Sometimes researchers have a question about a population, like: "What percentage of the fish in Lake Erie are toxic for humans to eat?" Sometimes they have a question about how two or more populations compare, like: "Which lake, Lake Erie or Lake Ontario, has a higher percentage of fish that are toxic for humans to eat?" And sometimes, researchers want to change one variable and see how a population responds. For example, "Does taking a fish oil supplement daily help older adults maintain brain function?" After the research question is created, the researcher needs to collect some data.

There are three methods for collecting data: *observational studies*, *surveys*, and *experimental studies*. In an experimental study, the researcher deliberately does something to one or more groups of individuals, such as giving them access to tutoring or giving them a vitamin, and then measures their responses in comparison to another group that does a different thing, such as not going to tutoring or taking a different type of vitamin. This is different from observational studies and surveys, in which the researcher collects data about individuals as they are.

In an observational study, the researcher records values for one or more variables, like ZIP code or height, for each individual participating in the study. These values can be obtained by observation, measurements, or taken from existing data that has already been collected (like the U.S. Census).

A researcher can also collect data with a survey, in which they ask each participant to answer one or more questions.

Each method comes with advantages and limitations that the researcher must understand before planning a study. The method used to collect data also affects what kind of conclusions can be drawn. Choosing the best method for a research question takes careful thought and practice.