

3.1 Introduction to Data Collection Part 3: Observational Studies & Experiments

A sample survey usually aims to gather information about a population without disturbing the population in the process. Sample surveys are one kind of **observational study**. Other observational studies watch the behavior of animals in the wild or track the medical history of patients to look for associations between variables such as diet, exercise, and heart disease.

In contrast to observational studies, **experiments** don't just observe individuals or ask them questions. They actively *impose* some treatment to measure the response. Experiments can answer questions like "Does aspirin reduce the chance of a heart attack?" and "Do plants grow better when classical music is playing?"

An **observational study** observes individuals & measures variables of interest, but does not attempt to influence the responses.

An **experiment** deliberately imposes some treatment on individuals to measure their responses.

The goal of an observational study can be to describe some group or situation, to compare groups, or to examine relationships between variables.

The purpose of an experiment is to determine if the treatment causes a change in the response.

An observational study, even one based on a random sample, is a poor way to gauge the effect that changes in one variable have on another variable.

To see the response to a change, researchers must impose the change.

When the goal is to understand cause and effect, experiments are the only source of fully convincing data.

For this reason, the distinction between observational study and experiment is one of the most important ideas in statistics.

Example: Determine if each of the following settings describe an observational study or an experiment. Explain your reasoning.

1.) Ninety residents of a retirement community were selected at random. Each member of the sample was asked a number of questions, including questions about exercise and blood pressure. Residents who exercised more often were less likely to have high blood pressure.

Observational study because
we had no influence on their
answers.

2.) Students in a statistics class were divided into two groups at random. Students in one group were given a set of words to memorize in a room with music playing. Students in the other group were given the same list of words to memorize, but in a quiet room. Students in the quiet room were able to remember more words, on average.

Experiment because we are
influencing with the music
in the groups.