

- Individuals: people, animals, or objects that are desired by data.
- Variables: Characteristics used to describe individuals.
- Treatment Group: Experiment group that receives treatment.
- Control Group: Experiment group that doesn't receive treatment that is used for comparison.

Convert from a Sample to Population Based on a sample, we use the results of a statistic to try to estimate the parameters of the population.

$$\frac{\text{Statistic}}{\text{Sample size}} = \frac{\text{estimated parameter}}{\text{population}}$$

Example 1: A car factory just manufactured a load of 6,000 cars. The quality control team randomly chooses 60 cars and tests the air conditioners. They discover that 2 of the air conditioners do not work.

Sample size

Statistic

How many of the manufactured cars do you expect to have broken air conditioners?

$$\frac{2}{60} \times \frac{x}{6000}$$

$$12000 = 60x$$

$$\boxed{200 = x}$$

Example 2: In a survey of 40 employees at a company, 18 said they were unhappy with their pay. The company has 180 employees.

How many employees do you expect are unhappy with their pay?

$$\frac{18}{40} \times \frac{x}{180}$$

$$3240 = 40x$$

$$\boxed{81 = x}$$

An Experiment or an Observational Study?

<p><u>Experiment</u> imposes a treatment on individuals to collect data on their responses.</p> <p>Ex: A researcher adds acetone to gasoline to measure its effect on fuel efficiency.</p>	<p><u>Observational Study</u> observes individuals & measures variables without controlling the individuals or their environment in anyway.</p> <p>Ex: A researcher wants to find out if poor nutrition affects eyesight, but it would be unethical to subject some individuals to poor nutrition.</p>
<p><u>Controlled experiment</u> two groups are studied under conditions that are identical except for one variable.</p> <p>Randomized controlled experiment</p> <pre> graph LR RCE[Randomized controlled experiment] --> TG[Treatment Group] RCE --> CG[Control Group] </pre>	<p><u>Randomized comparative experiment</u> is when subjects are randomly assigned to both treatments.</p> <p>Ex: We want to know which taste better, Coke or Pepsi? You got randomly assigned to taste Coke 1st & Pepsi 2nd. I got randomly assigned to taste Pepsi 1st & Coke 2nd. Both groups had both treatments, but the order was diff.</p>

Example 3: Explain whether each situation is an experiment or an observational study. A researcher wants to know if a soil additive makes a fern grow more quickly. He grows one specimen in treated soil and one in untreated soil.

Experiment

Example 4: Explain whether each situation is an experiment or an observational study. To find out whether car accidents are more likely on rainy days, a researcher records the weather conditions during 50 randomly selected accidents for the past year.

Observational Study

Example 5: Describe the treatment, the treatment group, and the control group. One hundred arthritis sufferers reported the severity of their symptoms daily for a month. Fifty of the subjects were given Epsom salt to bathe in at least every other day. At the end of the month, 30% of the subjects who used Epsom salt reported a decrease in severity of their symptoms, compared to 5% in the other group.

Treatment: Epsom Salt Treatment Group: 50 who received Epsom Salt Control Group: 50 who didn't receive Epsom Salt

Example 6: Decide whether the following research topic is best addressed through an experiment or an observational study. Does using the tanning beds at least twice a month affect the likelihood of developing skin diseases?

Observational Study

Example 7: Classify each method as a survey, experiment, or observational study.

Method A:	Method B:	Method C:
Choose 50 people who have at least one serving of soy a day and 50 who don't, and check their cholesterol levels.	Randomly choose 100 people. Ask how many servings of soy they have a week, and ask if their cholesterol levels are high.	Randomly choose 50 people to eat at least one serving of soy a day, and 50 people not to, and monitor their cholesterol levels.
Observational Study	Survey	Experiment