Module 5: Relating Data and Decisions

TOPIC 2: MAKING INFERENCES AND JUSTIFYING CONCLUSIONS

Students focus on methods of collecting data to analyze a question or characteristic of interest, specific sampling methods, and the significance of randomization. They then determine how to draw samples that most closely represent a population and contrast a simple random sample with 3 types of biased samples—convenience, subjective, and volunteer. Students use data from samples to estimate population means and proportions, and determine whether results are statistically significant. Throughout the topic, they work on a culminating project.

Where have we been?

Students are very familiar with measures of center and spread and have used them to compare data sets. In the previous topic, they dealt with frequency distributions and how they relate to the normal curve. Students learned the Empirical Rule for Normal Distributions and now relate this rule to margin of error, confidence interval, and statistical significance.

Where are we going?

As students consider all of the data that they have access to in this technological age, including advertisements, news reports, propaganda, and political polling, they need tools to analyze the data and determine whether the information is meaningful, significant, and/or useful in decision-making. Most importantly, any student pursuing a research-based career will use and build upon these skills extensively.

Statistical Significance

A result that is very unlikely to have occurred by chance, typically more than 2 standard deviations from the mean, or outside a 95% confidence interval, is considered statistically significant.

Percent of People Voting for Mayor's Re-election
Standard Deviation (s)
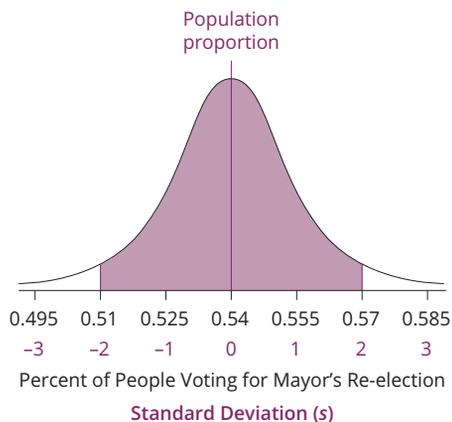
- There is a 95% confidence interval, the percent of values that lie between $-2s$ and $2s$.
- The confidence interval is 51% to 57%, the values that correspond to $-2s$ and $2s$.
- The margin of error is ±3%, $0.57 - 0.54$ or $0.54 - 0.51$.

The Placebo Effect

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.

Talking Points

Confidence intervals and margin of error can be important topics to know about for college admissions tests.

Here is an example of a sample question:

Researchers estimate that a population of chimpanzees is 1336. They determine that at a 95% confidence level, their margin of error for the population of chimpanzees is 10.1. If the actual population is within the confidence interval, what is the lowest possible population of chimpanzees?

This involves simple subtraction. If the actual population was within the confidence interval, then the lowest population could be is 1336 − 10.1, or 1325.9. Since this must be a whole number, round up to 1326.

Key Terms

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

convenience sample
A convenience sample is a sample whose data is based on what is convenient for the person choosing the sample.

confidence interval
An estimated range of values that will likely include the population proportion or population mean is called a confidence interval.