

# Unit 16: Census and Sampling

## SUMMARY OF VIDEO

There are some questions for which an experiment can't help us find the answer. For example, suppose we wanted to know what percentage of Americans smoke cigarettes, or what percentage of supermarket chicken is contaminated with salmonella bacteria. There is no experiment that can be done to answer these types of questions. We could test every chicken on the market, or ask every person if they smoke. This is a census, a count of each and every item in a population. It seems like a census would be a straightforward way to get the most accurate, thorough information. But taking an accurate census is more difficult than you might think.

The U.S. Constitution requires a census of the U.S population every ten years. In 2010, more than 308 million Americans were counted. However, the Census Bureau knows that some people are not included in this count. Undercounting certain segments of the population is a problem that can affect the representation given to a certain region as well as the federal funds it receives. What is particularly problematic is that not all groups are undercounted at the same rate. For example, the 2010 census had a hard time trying to reach renters.

The first step in the U.S. Census is mailing a questionnaire to every household in the country. In 2010 about three quarters of the questionnaires were returned before the deadline. A census taker visits those households that do not respond by mail, but still not everyone is reached. Some experts favor adjusting the census to correct the undercount using information gathered by smaller but more intense samples.

There is an alternative to a census, and that is a sample. While a census is an attempt to gather information about every member of the population, sampling gathers information only about a part, the sample, to represent the whole. Because a sample is only part of the population, we can study it more extensively than we can all of the members of the population. Then we can use the sample data to draw conclusions about the entire population. However, for those conclusions to be valid, the sample must be representative of the population. To make sure that it is, statisticians often rely on what is called simple random sampling. That means the sample is chosen in such a way that each individual has an equal chance to be selected. This helps eliminate bias in the study design, which occurs if certain outcomes are systematically favored.

Sampling is widely used in a variety of areas such as industry, manufacturing, agriculture, and medical studies, to name just a few. For example, consider food manufacturing with a look at processes Frito-Lay uses in making potato chips. Here's just some of what happens. A truck carrying 45,000 pounds of raw potatoes arrives at the plant, but is not allowed to unload until a sample of its potatoes has been carefully tested. First, a 150-pound sample of potatoes is taken from different locations in the truck (some from the front, middle and back). Next, an inspector selects 40 pounds of those potatoes and punches a hole through the core. Those holes make it easy to spot the samples when they undergo a cooking test. In other potatoes, the inspector searches for internal defects, green edges, rot, and other flaws. Each defective potato is weighed, and if the sample percentage is too large, the whole load must be rejected. The cooking sample is peeled and tossed directly into the slicing machine. Then the sample chips with their telltale holes are plucked out and go to a mini laboratory for further testing. Once everything in the sample is found to be up to specifications, Frito-Lay will accept the multi-ton shipment, based on the 150-pound sample.

All along the production line, workers continue taking samples to ensure the chip-making process stays on track. Sample chips are measured for thickness, color, and salt content. Even the finished bags are sampled to check their weight, both before and after being packed into cartons. If Frito-Lay waited until the end of the line to inspect the finished product, problems that were minor to begin with could be greatly compounded. Instead, sampling at key points catches problems early, before they get out of hand.