Select Reading Question Responses (8/31/2021)

> How can you tell if variation within a study is due to natural variation or is a piece of statistically significant data?

> [I]s there a numerical threshold to determine whether data or results form a study are usable or due to chance?

There are quantitative ways of answering questions like these, and this will be what we talk about for much of the course! ☺

> [H]ow do you account for non-response bias?

> [A]re there ways to estimate what kinds of people are more likely to respond to your survey and can you quantitatively take that change into account?

There are quantitative ways of taking non-response bias into account when conducting data analysis. My understanding is that pollsters have started doing this kind of thing much more actively after seeing that polls they took prior to some recent elections were not very reliable. This won't be something we'll be discussing in class, though it could very well be something you decide to look into for your final project.

> In the study of statistics do statisticians prefer the reliability of a prospective study or a retrospective study? Are they thought of in two different ways? Or compared?

Prospective studies are probably "better" in that their results might be more reliable, but they might also be prohibitive in terms of resources. For example, you'll probably have to pay the participants in a prospective study over the course of the entire study, while you might only need to pay participants in a retrospective study once. Maybe you only have the budget to do a retrospective study. Or maybe you might decide to do a retrospective study first and use that to decide if it's worth doing a more expensive prospective study.

> What are examples of biases that would be incorporated in simple random sampling?

Suppose, for example, that you're interested in understanding household income in the United States. You could take a simple random sample of 100 households and calculate the mean income of your sample; that would be a decent stand-in for the actual mean income of US households.

But, since Native Americans constitute roughly 1% of the US population, there's quite a large chance that a simple random sample of 100 US households completely misses Native American households. That means that, even though the mean of your sample might be a good stand-in for the actual mean of US household incomes, the simple random sample would be quite likely to be biased in the sense that it completely misses Native American households.

So, if you think you might ultimately be interested in understanding median income in various US subpopulations (such as racial/ethnic subpopulations) and you only have resources to study 100 households, it may be better to use a different sampling strategy that guarantees representation from each subpopulation (ie, stratified sampling).

> Referring to the principles of experimental design in section 1.4.1, I'm curious as to what parameters make for a "sufficiently large sample" described under the Replication principle. There was an example of examining mercury content in the population of swordfish in the Atlantic, where they examined a sample population of only 60 swordfish. In pertinence to all experiments though, how would you go about determining what a "sufficient sample" size is?

This is a great question, and one we'll be able to come back to later after we've developed a bit of mathematical machinery. For the time being, we can say the following: if you start off by quantifying "how strong" you want the evidence provided by your study to be, it's possible to figure out quantitatively how big a sample size you would need to get evidence that's that "strong."

> Regarding the ethics of experiments, how are medical trials and experiments still allowed and social experiments not? I am very familiar with the Stanford prison experiment, but I read that the main argument has to do with considering the benefit of future patients, and I feel like a similar argument could be made for social experiments. So why is one seen as more ethical than the other?

Another great question, and one I don't really have an answer to. It would be very interesting to know what ethics philosophers have to say about this!