Week 1 Discussion: Studies

David Diez

Introductions ::

- Write up course information:
  - Stat 10. Professor: Davis. TA: David Diez.
  - Office: Boelter Hall 9407
  - Email: david@stat.ucla.edu (I check this every 1 hour or so during 7:30am-4pm, roughly)
- Have students pick groups of 4 people and have them introduce themselves to each other for 2-4 minutes.
- Office hours : Th 1-2 and T/Th: 10-10:35.
- Remind them to take the first quiz to check for problems. To do this, they will need to initiate their account at `moodle.stat.ucla.edu`.
- I will post additional items on `www.stat.ucla.edu/~david`

Studies :: discuss in the context of education and income, an observational study.

- There are two types of variables in studies: explanatory and response. The variables in either case may be quantitative or qualitative. Usually, we can *think* of these variables as a cause and effect (although, we cannot conclude there is a cause/effect unless we have an experiment, to be discussed shortly). We may believe the explanatory variable in some way explains changes in the response. Education (the explanatory variable) may be seen as a way to explain income level (the response).
- The study subjects are the people or objects that are being observed.
- Experiments and observational studies may be differentiated by how the study was conducted. If the researchers controlled the explanatory variable in the subjects (like in clinical trials when they randomly assign treatments to patients who sign up for the study), then it is an experiment. This is in contrast to cases when the subjects either self-select the explanatory variable (like how much income they have) or it is an inherent quality (like gender), which would correspond to an observational study.

When can we infer causation? In education and income, we find that more education is associated with higher income levels. But if we only have an observational study, does this mean we can infer causation? NO!

Sunscreen and skin cancer :: This example is made-up but actually plausible. We talk to a thousand people and ask them how many days a week they use sunscreen (explanatory variable) and if they have had any cases of skin cancer (response). We find that people who tend to use sunscreen on more days of a given week actually have *higher* rates of skin cancer (!). Does this mean sunscreen *causes* skin cancer? Definitely not. Take a step back. Who uses sunscreen a lot? People who tend to be in the sun a lot. So, there is another factor we are not taking into account – sun exposure – that is likely making us come to a bad conclusion. If we also considered this variable, we would find that after we account for sun exposure, sun screen actually *reduces* the skin cancer rate. This example points out how wrong an observational study can be and emphasizes that we cannot draw causation conclusions from an observational study.

Causation and experiments :: Unlike observational studies, the conclusions from experiments are important and powerful. The way experiments are conducted, researchers randomize some component of who receives what explanatory variable (sometimes called a *treatment* in experiments). This randomization helps reduce any effects unaccounted for, like sun exposure in the example above, which allows the researchers to make conclusions about causation.

Remark :: There are certainly ethical concerns that we don't get into in this course. It would be unethical to run an experiment where we told people who spend a lot of time in the sun to not use sunscreen, so such a study would likely be a very well-controlled inside a lab or an observational study that includes many variables, like sun exposure and genetic susceptibility.

Placebo effect :: Imagine a group of 30 individuals with chronic headaches. We give 15 of them a pill to take daily that contains a new drug and the rest we give nothing. Sure enough, we find that several people in the group who take the new drug improve while perhaps none in the group without any treatment improve. Does this mean the drug works? No. There is something that is *causing* these people to improve (since this is an experiment), however, it may not be the drug. The simple act of **being treated**, or receiving a pill in this case, can cause positive effects in some patients where they improve. This is called the *placebo effect*. Even if it only affects a fraction of patients, this can greatly affect results. So, we may have just observed that either the placebo effect or the drug (or some combination of the two) caused improvement in our patients. But which was it? Instead of giving the untreated group nothing, we could also cause a placebo effect in them: give them a **placebo**, a fake treatment (like a sugar pill). This means that they will also have a placebo effect. From here we can focus on finding the real different that is just due to the effectiveness of the drug in the patients.

Study and Experimental Studies ::

- Purpose :: What the researchers are trying to find out?
- Subjects :: Who/what were the objects of the study (often people, be fairly specific about the subjects)?
- Observational or experiment :: Was the treatment deliberately applied by the researchers? (If so, experiment. If not, observational.) Tip: if you see that a placebo was used in the study, odds are it was an experiment.

- Explanatory variable :: The treatment. Also often seen as the cause (although no causal relationship can be obtained from an observational study). Almost always occurs first chronologically.
- Response variable :: What was used to measure the effect of the explanatory variable (treatment). This almost always comes second chronologically.
- Conclusions :: What information did the researchers obtain from their experiment?

***You've had brain surgery ... just kidding* (the parts of the study)**

- Purpose :: to determine if dopamine neurons implanted in the brain improve symptoms in Parkinson's disease patients.
- Obs/Exp :: it is an experiments. The researchers applied a treatment where the patients had no choice in which treatment they received.
- Subjects :: 40 American and Canadian patients suffering from Parkinson's disease.
- Explanatory variable :: Human embryonic dopamine neurons or a "sham surgery".
- Response :: a wide range of scales, which included tremor and rigidity reported by the medical staff.
- Conclusions :: the dopamine neurons appears to improve tremor and rigidity.