STAT 107 – Fall 2020

Statistical Study Designs

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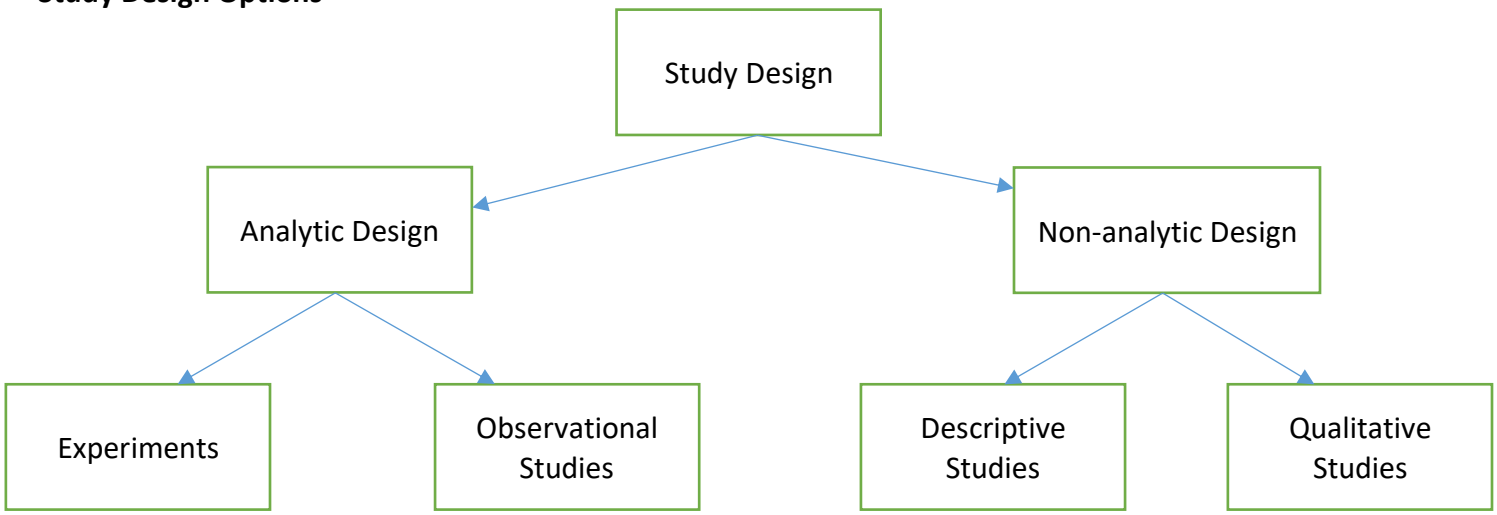
Study Design Options



Components of an Experiment

- **Treatment:** The variable I am selecting as a possible "cause." It is the intervening agent that I suspect might cause something. *Note that the term "treatment" doesn't necessarily mean it's a good thing. It's simply the cause. It could be an agent of good change or an agent of bad change!*
- **Response:** An outcome I'm trying to learn more about. I want to know if this is the "effect" from the "cause" identified above.
    - Example: A new medication → Improved Wellbeing
    - Example: Smoking → Lung cancer
- **Treatment group**: The observational units that receive/partake in the treatment/intervening agent. *Note: an experiment may have one or multiple different treatment groups each trying different treatment factors.*
- **Control group**: A group that doesn't receive/partake in the treatment. This group becomes a comparison group for the treatment group. *Note: some experiments may have two or three control groups (perhaps each with different placebos, or a non-affected group).*
- **Placebos** are typically used to mimic the psychological effect of the treatment without the supposed, unseen benefits of the treatment. Administering a placebo to the control group helps diminish any group differences based on a placebo effect.

Types of Experiments

- **Randomized Control Trial**
  - In this design, participants/units are randomly assigned to **two** *or more* **groups**. Typically, there will be *at least* one treatment group and at least one control group as well.
  - **Random Assignment** means that the researchers sort participants randomly, rather than intentionally creating groups or letting participants choose their group.

- **Matched Pairs Design**
  - There are two types of matched pairs designs.
  - The first type would have ***participants serve as their own control*** by making measurements before and after treatment. This particular variation would be known as a **Pre-Post Design** (sometimes also called a "Cross-over" Design).
    - This is usually accomplished by having participants complete a pre-test or examination, followed by the treatment, and finally concluding with a post-test.
    - *Example*: Treatment for arthritis by measuring participants' discomfort before and after a particular treatment.
  - Matched pairs studies might also be used in studies with identical twins or with carefully matched counterparts (e.g., people matched by age or diet).

- **Randomized Block Design**
  - This design does not use pure random assignment, but instead attempts to create relatively equal and representative groups by noting relevant demographic/medical characteristics of each participant (age, sex, family history of heart disease, etc.)
  - The researchers may split up participants into blocks, and then randomly assign each block to a group to ensure proportional blocks in each group.

- **Non-Randomized Controlled Experiment**
  - This design implies there is some sort of group comparison, but treatment groups are not blocked or randomized and are highly susceptible to unbalanced groups.

Practice: Identify which design is being used in each of these studies

Lunesta is a drug designed to treat insomnia. In a clinical trial of Lunesta, amounts of sleep each night are measured before participants begin taking Lunesta and again after participants have been treated with the drug. The researchers compare the average amount of sleep each participant was getting before and after starting Lunesta.

A vaccine is being tested that would potentially prevent West Nile virus infection. A study is designed in which 4,800 volunteers in one particular city would agree to receive the vaccine. The incidence rate of West Nile Virus would be recorded for those 4,800 participants and compared to the incidence rate of the city at large.

A small experiment is done to consider various treatments options for patients with glaucoma. 48 patients with varying levels of severity are split across three groups. The patients are divided in such a way that each group has approximately proportional numbers of severe, moderate, and mild cases.

To assess the effectiveness of a new energy supplement, researchers pay 300 people to volunteer to be in the study. 150 are randomly assigned to take the supplement while the other 150 receive a placebo supplement. The researchers then check back in 3 weeks to have them rate their energy levels.

To-do:

- Finish Lab 2, commit and push the lab using git commands!
- Get started with HW 1 on Prairie Learn!