MAT1372, Classwork3, Fall2025

1.3 Sampling principles and strategies (Conti.)

6. Observational data: Data where no treatment has been explicitly applied or withheld.

7. Confounding variable: It is a variable that is correlated with both the explanatory and response variables.

8. Examples of Confounding variable

confounding variable: sun exposure

(1) Suppose an observational study tracked sunscreen use and skin cancer, and it was found that the more sunscreen someone used, the more likely the person was to have skin cancer. Does this mean sunscreen causes skin cancer?

If someone is out in the sun all day, this individual is more likely to use sunscreen and more likely to get skin cancer

(2) Ice cream causes sunburns:

Confounding Variable : temperature

9. Observational Studies:

(1) Prospective study: It identifies cases in targeted population and collects information as events unfold.

Medical reachers identify and follow a group of patients over many years

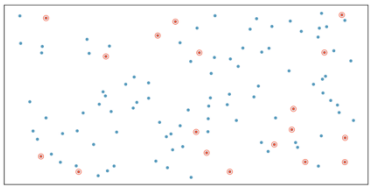
(2) Retrospective study: It collects data after events have taken place.

A survey after a concert ; A review of a purchase, etc.

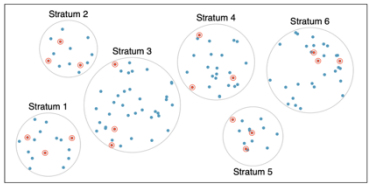
Some data set may contain both prospectively and retrospectively collected variables.

10. Four Sampling Methods.

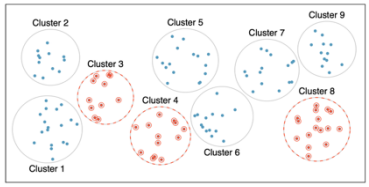
Almost all statistical methods are based on the notion of implied randomness



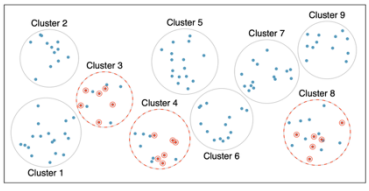
(1) Simple random sample: each case in population has an equal chance of being included in the final sample and knowing that a case included does not provide useful information about which other cases are included.



(2) Stratified sample: The population is divided into groups called Strata based on the similarity of cases and then Simple random sampling is used within each stratum to get a sample.



(3) cluster sample: The population is divided into groups called clusters such that the cases in each cluster are diverse, but clusters themselves do not look very different from one another. Then we sample a fixed number of clusters and include All the cases in the chosen clusters.



(4) Multistage sample: The population is divided into cluster, and we collected a random sample within each selected cluster.

1.4 Sampling principles and strategies

1. Randomized experiment: To show a causal connection between two variables, i.e. one variable is the direct cause of another, a randomized experiments will be used to study it which means that the researchers assign random treatments to cases.

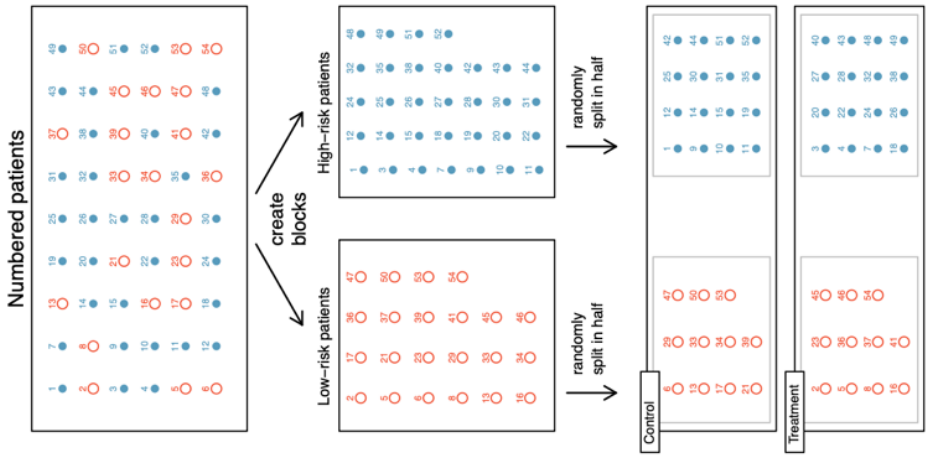
2. Principles of Randomized Experimental Design:

(1) Controlling : Researchers assign treatments to cases, and they control any other difference in the groups. For example, the amount of water taken daily.

(2) Randomization: Researchers randomize cases into treatment group to account for variables that cannot be controlled. For example, different dietary habits, etc.

(3) Replication: In a single study, researchers replicate by collecting a sufficiently large sample. Additionally, a group of scientists may replicate an entire study to verify an earlier finding.

(4) Blocking: When some variables may affect the results other than the treatment, researchers may first group cases based on this variable into blocks and then randomize cases within each block to the treatment group.



3. Blind study and the Placebo:

Randomized experiments are the **gold standard** for data collection, but they do not ensure an **unbiased perspective** into the cause and effect relationship in all cases. The bias could be from human aspects

- Blind study: When researchers keep the patients uninformed about their treatment, the study is said to be blind.
- Double-blind study: When researchers keep both doctors and patients uninformed about the treatment, the study is said to be double-blind
- Placebo : In order to prevent the cases in control group to know they are in control group because there is no treatment, researchers give fake treatment to patients in the control group. A fake treatment is called a Placebo , and an effective placebo is the key to making a study truly blind.
- Placebo effect. : Often times, a placebo results in a slight but real improvement in patients. This effect has been dubbed the placebo effect.