Observational Studies

Grinnell College

March 2026

Motivation: Final Project

A critical part of your final will be a "self-reflection" part where you discuss...

- describe the data collection method
- the limitations of your data collection method
- what, if anything, you'd like to change if it was redone

Data Collection Methods

Broadly there are two major ways to collect data

Experiments where the variables of interest are manipulated (hopefully intelligently)

- Handing a subject a bean or letting subject choose the bean
- Assigning different fields different new soybean hybrids

Observational studies is where the researcher does not intervene in/manipulate the scientific process

- Phone screen time generally and on their favorite app (retrospectively)
- Asking someone how long they can plank for and then recording their time (prospective)

Observational Studies

Broadly two types...

- Retrospective studies
  - Looks backwards
  - Usually considered "weaker"
  - Asking about nutrition as a child for studying adult heights
- Prospective studies
  - Looks forward
  - Continues to take measurements into the future
  - Stronger than retrospective studies but weaker than experiments
  - Medical studies where they follow people around for years....

Causation: Right out

No control over variables and random assignment; it just *is*

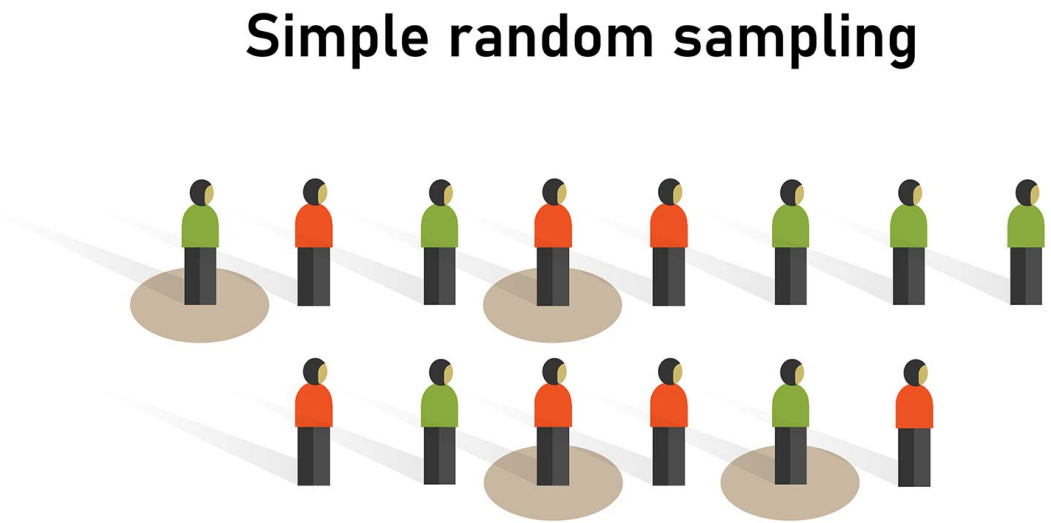
Better to talk about correlation

(Applies to experiments as well)

Survey Methods (the good ones)

Simple Random Sample: All population members have an equal chance of being chosen

- Most basic form
- Eg Grinnell sends an email survey to a random sample of students on LGBT acceptance/discrimination

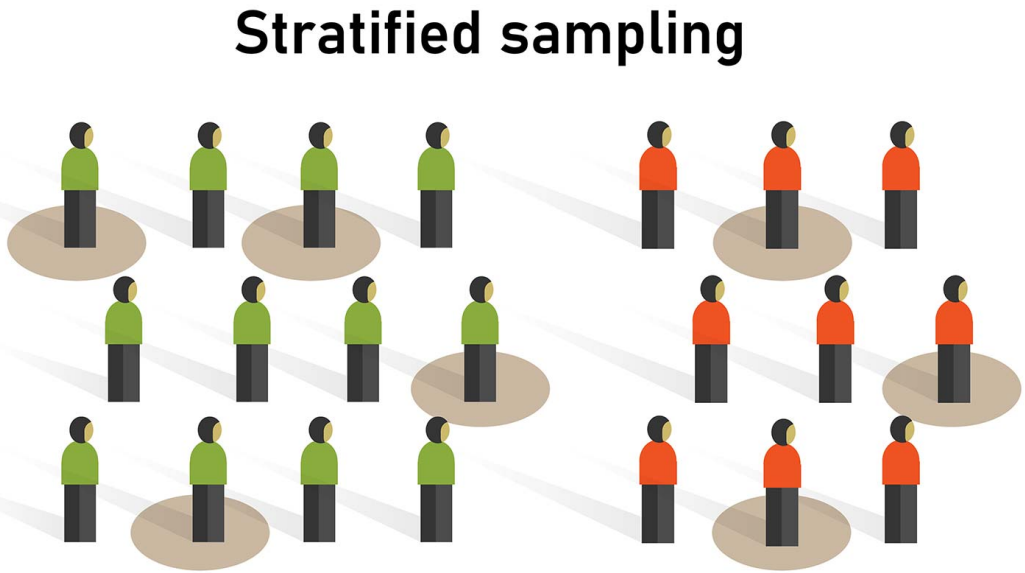


Survey Methods (the good ones)

Stratified Sampling: Simple random sampling occurs within each subpopulation

- Ie The population is broken into groups and then each group gets sampled
- Members of a subpopulation of the same probability of being picked
- Members do not have the same probability of being picked across/between subpopulations
- Eg Grinnell sends an email survey on LGBT acceptance/discrimination to..
  - LGB Students
  - Trans/NB Students
  - Het-Cis Students
- Ensures all subpops are represented

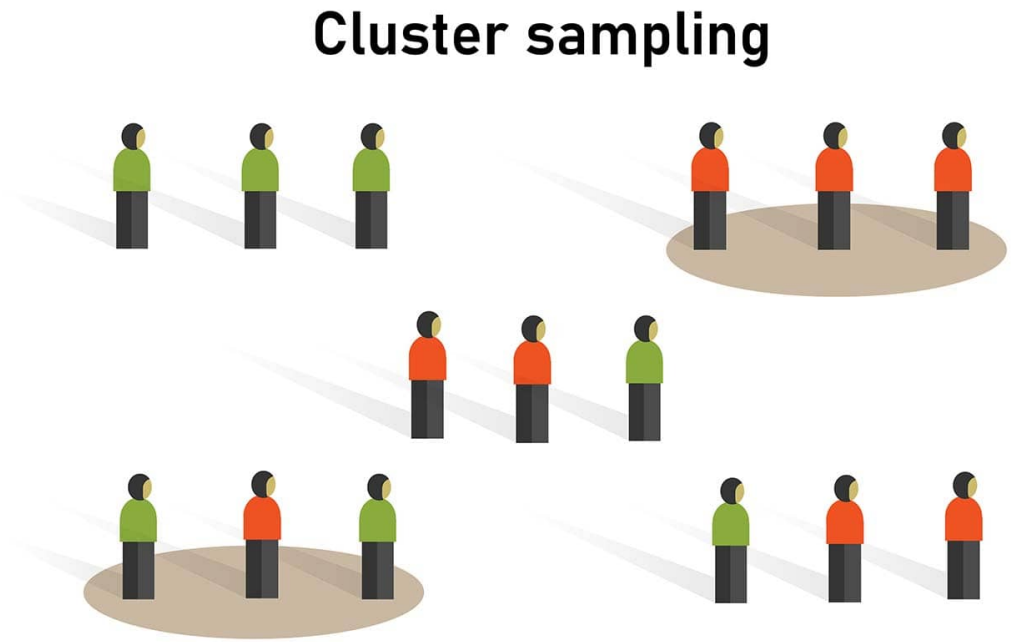
Survey Methods (the good ones)



Survey Methods (the good ones)

Cluster Sampling is where all members in a few random (usually tiny) subpopulation are studied

- Exaustive study of a few smal things
- Eg Grinnell surveys by physical paper 5 randomly selected classes, all students required to respond



Survey Methods (the good ones)

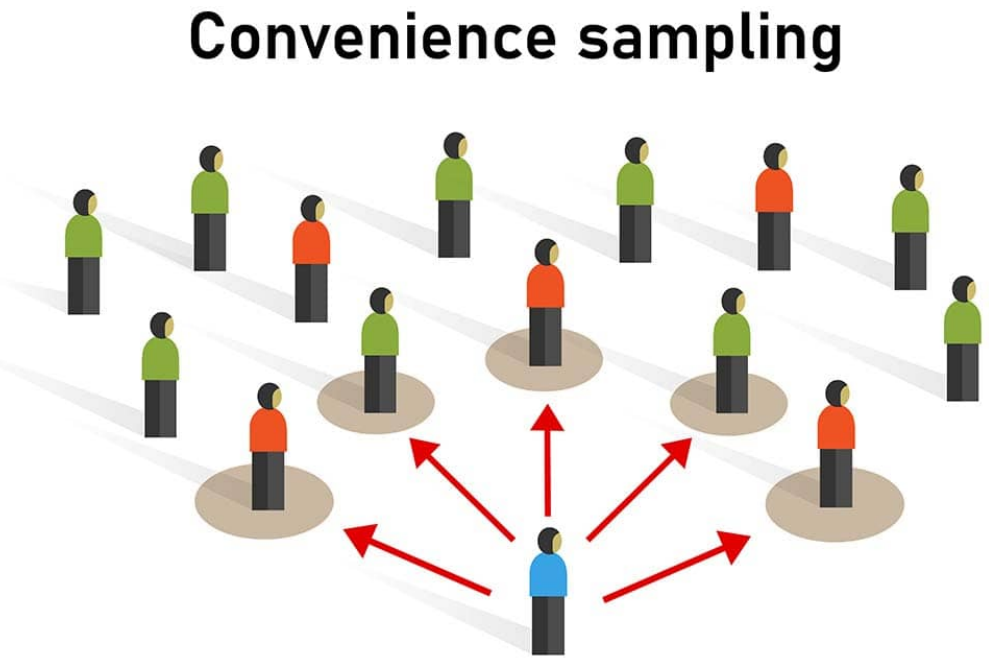
Multi-Stage Sampling uses combinations of the others to make it easier, done in stages

- Common for complicated situations
- Tedious?
- Eg Grinnell randomly samples 3 classes from each of the Humanities, STEM, Social Sciences. All students required to respond.
- Stratified (Humanities, STEM, Social Sciences)
- Clustered (entire classes)

Survey Methods (the bad ones)

Convenience Sampling is where a sample is taken because it is convenient/easy

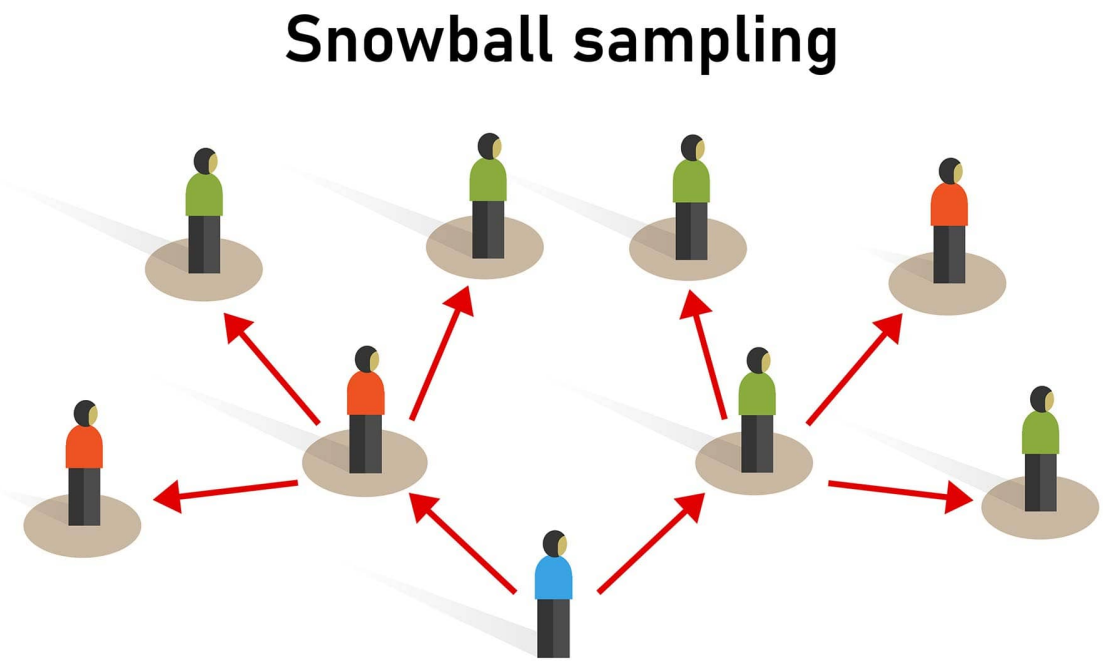
- Eg I texted my friends and we all agreed that X
- **Undercoverage** is where members of the population cannot be sampled or are sampled disproportionately low
- Eg Asking people how long they can plank *only* at the gym doesn't give you a sense for the student body as a whole (pun)



Survey Methods (the bad ones)

Snowball Sampling is where we use the first subjects to find the next few subjects

- Often useful (unfortunately) when populations are hard to reach/interact with
- Examples were early studies of homosexuals
- Problem is independence between respondents....



Other Biases

Several things can cause biases in your sample

- **Wording of the Questions**
  - wording is so charged people are "pushed" one way or the other
  - Also applies if it's so complicated/technical/run on as to be confusing
- **Response Bias**
  - Why did this weirdo take time out of their day to fill out my survey?
- **Non-Response Bias**
  - Why did this weirdo not take time out of their day to fill out my survey?

Do's and Don't's

Biggest issue with sampling is talking about who you were *actually* able to sample from. That becomes your de facto population even if you wanted to say something more broadly.

- Eg if you sampled only Grinnell students you can't say anything beyond Grinnell
- Eg A study of crapie in the upper end of the Mississippi River can only talk about crapie populations in the upper end of the Mississippi River
- Once the more limited population is identified it's easier to avoid undercoverage bias