1.3 Designs of Experiments

⊛ Experiments and Observational Studies

Def: An experimental unit are the individuals that are being studied.

ex people, animals, plants - living things that could be studied.

mechanical parts - non-living things that could be studied (measured).

⊛ Treatments

Def: A "treatment" in an experiment is a stimulus given to an experimental unit to set-up a potential response

Def: An outcome (response) is what is measured on each experimental unit once the stimulus is applied

⊛ Investigations fall into two categories (2)

I Randomized experiments are a study in which the investigator designs the treatments, applies the treatments and observes the response.

II Studies

a. Observational Studies: The treatments are not made by the investigator
" observe ppl eating fast food - then asking them to participate in a blood test"

b. Historical Studies: this is a study where the investigator dives into existing data to answer questions about a stimulus - response topic.

I Randomized Experiments

- Randomly selected individuals are assigned to a treatment
  - Some receive the "active" treatment
  - preferably some will receive a "placebo" treatment

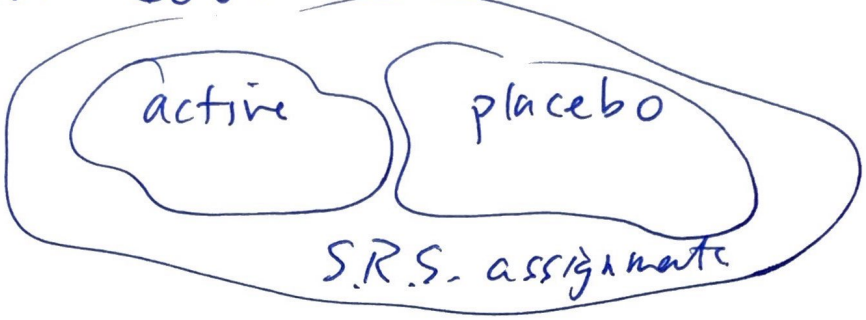
Def: Placebo is a treatment in name only - an inert treatment is applied.

- **Double-Blind** process: both the subject receiving the treatment as well as the administrator of the treatment do not know if the treatment is active or is a placebo.
- **single-blind**: receiver does not know if the treatment is a active or is a placebo, but the administrator of the treatment does know.

Note: A certain portion of a human population will show improvements with even a placebo {assuming the recipient remains unaware that their treatment is not active - just placebo}

- shear human will to survive

proceedures for double-blind.

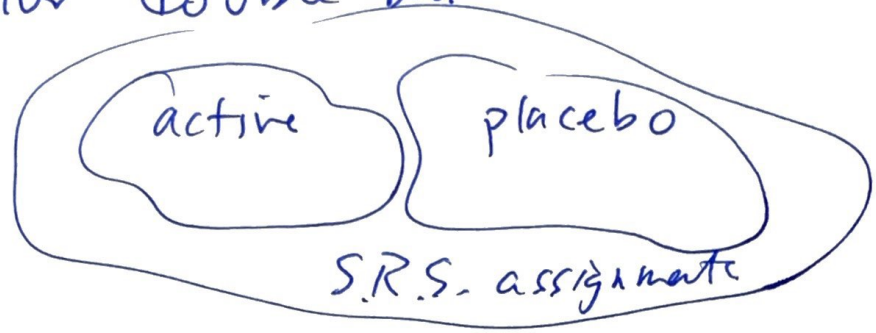


- Frame (a list) use random.org to seperate into active vs placebo.
- Record treatments in a database but Not notify the nurse as to which treatment is being administered.
- After a specified length the analysis is deemed "successful" or "failure" {we need strict definitions for both}
- The effectiveness of the treatment as a whole needs to be defined... "maybe if 10% more subjects improve = success"

Note: A certain portion of a human population will show improvements with even a placebo {assuming the recipient remains unaware that their treatment is not active - just placebo}

- shear human will to survive

proceedures for double-blind.



- Frame (a list) use random.org to seperate into active vs placebo.
- Record treatments in a database but Not notify the nurse as to which treatment is being administered.
- After a specified length the analysis is deemed "successful" or "failure" {we need strict definitions for both}
- The effectiveness of the treatment as a whole needs to be defined... "maybe if 1% more subjects i = success"

* Randomized Block Experiments (strata Polling) (5)

Normally in a completely randomized experiment all aspects of the study are applied randomly

→ In some situations we may want to apply the experiment in a strata.

ex A "method to improve reading skills in lower-ase elementary education students It would be more natural to apply the treatments per grade level. 2nd grade seperate from 3rd grade

→ The placebo in this example might be an existing reading method.

→ Randomize schools and classrooms within the school. If the readers are broken into smaller portions then randomly apply the "new" treatment.

II Observational Studies

- We call through existing data vs. design an experiment. In most observational studies the subjects choose their own treatments:

Ex Bad Cholesteral (aka. potential heart failure)
Potential heart attack patients have selected in their diet the level of bad cholesteral.

- Confounding variables

ex A study in bad cholesteral levels needs to account for smoking, exercise & stress.
Confounding vars.

→ women who smoke will smoke less than men who smoke ⇒ gender also is a confounding variable ⇒ strata observational study.

⊗ **Confounding variables**: we ask

"Is there something else effecting the outcomes?"

Ex In the Neverlands ppl noticed that there were more storks nesting in communities where the birth rate was higher!

→ real reason: younger couples expanding into new communities w/ homes that have more fireplaces

- Common confounding variables

  gender, age, health habits

- we can "block" out the confounding variable by using a stratified or block study

Ex Alcoholism : Bar Attendees

Q: How many drinks are ppl consuming?

	M	F
Smokers	61	43
Non-Smokers	42	21

After a few weeks - approach them and ask confidently "Have you experience heart issues?

⊛ Cohort Studies

When groups of people with common backgrounds or traits are studied we call such a "Cohort Study"

{Birds of a Feather}

- Prospective Cohort Studies

  Subjects are followed over time {into the future} under constant or regular examination

- Retrospective Cohort Studies

  We look back in time and study the responses to treatments.

EX Back when ppl received plaster casts vs. Fiberglass casts. Did healing time change under each of these treatments.

- # Cross-Sectional Studies

we take "snapshots" of all parameters of subjects at different times or locations

EX Route 66 trip: Inquire about the owners of various hotels/motels.

EX Drill out a 30 ft ice core in antartica and sample the air bubbles in the ice V to measure CO_2 @every 10 ft levels.

EX Obtain once a decade soda cans and measure the thickness of the liner of "plastic" in the can. {Thickness, measure content of "Bisphenol A"

- Case-Controlled Studies

These studies will look into the past as well as follow subjects into the future.

Ex A study sampled 201 children under the age of 10 who were diagnosed with brain cancer. Also the stud sampled 285 children who did not have a history of brain cancer.

The two groups had the parents interviewed to determine the extent that the children were exposed to common pesticides "such a RAID"

Summary

Cohort Study	Pros	Cons
prospective (into the future)	Thourogh controllable	expensive time consuming
retrospective (into the past)	less-expensive quick	No Control of subjects/treatments
Cross-sectional (past & future)	—	difficult to determine the desired timing of events in the past that correspond to the future.