Lecture 1: Introduction

Collecting Data

* What is the difference between an observational study and an experiment?

Observational Study

* Data collection is passive.
* You simply observe what is happening or has happened.

Experiment

* Data collection is active.
* You actively manipulate a factor to create treatments.
* You assign treatments to experimental units.

Example

* Is there a relationship between the amount of sodium in a diet and blood pressure?

Observational Study

* Recruit participants.
* Observe amount of sodium in the diet and seated systolic blood pressure.

Retrospective

* Look back to get the data.
* Measure blood pressure.
* Ask participants to recall what they ate during the last week.
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Prospective

- Look to the future to get the data.
- Ask participants to keep a diet diary for the next month.
- At the end of the month measure blood pressure.

Observational Study

- Enroll participants
- Future Data
- Past Data
- Retrospective
- Prospective

Diet and Blood Pressure

- Group participants by the amount of sodium in their diets.
- Group 1: 50 mmol (3 g) sodium per day.
- Group 2: 200 mmol (12 g) sodium per day.

Statistical Analysis

- Two-sample t-test
- Suppose that the difference in average blood pressure for the two groups is statistically significant and the high sodium group had a higher average blood pressure.

Conclusion

- Can we conclude that the higher sodium in the diet caused the higher average blood pressure?

Alternative Analysis

- Simple linear regression of blood pressure on sodium in diet.
- Suppose there is a positive linear relationship that is statistically significant.
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**Conclusion**

*Can we conclude that increasing sodium in the diet will cause an increase in the blood pressure?

**Observational Studies**

*Correlation is not causation.
*There could be many other confounding variables that could be causing the changes in blood pressure.

**Experiment**

*Manipulate the sodium in the diet to create treatments.
*Treatment 1: 50 mmol Na/day
*Treatment 2: 200 mmol Na/day

**Experiment**

*Assign treatments to participants.
*Each participant gets one diet.

**Experiment**

*In an experiment we try to isolate the effect of the treatment.
*If the treatment is the only thing that changes, then cause and effect can be inferred.

**Good Experiment**

*Three principles of a good experiment
*Control
*Replication
*Randomization