Chapter 5
Correlation and Causation:

Birth Control by the Toaster Method

Toasters & Birth Control

- Study of factors related to the use of contraceptives
- Collected data on a wide range of behavioral and environmental variables
- Variable most strongly related to contraceptive use was the number of electrical appliances in the home
- So . . . Should we start passing out free toasters in high schools?

No, because. . .

- It is not the **strength** but the **nature** of the relationship that is relevant.
- Although there is correlation, toasters don't **cause** people to use contraceptives.
- Two variables may be associated without having a causal relationship.
- There may be a mediating variable/third variable involved. (In this case Socioeconomic Status)

The Third Variable Problem: Goldberger and Pellagra

- 1990s disease in the South
- Evidence pointed towards causal relationship of inside plumbing/good sewarage vs. bad sewarage
- Goldberger thought the correlation to came to be, because families with good plumbing were likely to be economically advantaged.
- He thought their economic status could be reflected in their diets
- His causal inference was a poor/low protein diet let to Pellagra

Goldberger's Tests

- To prove Pellagra was not contagious and not transmitted through bodily fluids (like the bad sewarage claim)
- Goldberger, his assistants and his wife ate victims of Pellagra's feces and urine
- Goldberger was injected with victims of Pellagra's blood
- Inserted their nose and throat secretions into his mouth.
- None of them got Pellagra, backing his claim.

Goldberger's Tests

- He then tested his own causal mechanism.
- One group given high carbohydrate, low protein diet
  - Pellagra occurred
- One group given balanced diet
  - No Pellagra present

Why was Goldberger's Causal Inference better?

- **Controlled manipulation**
  Instead of the investigator observing correlations they actually manipulate the critical variable.
- Goldberger created the conditions necessary for the infectious transmission of the disease, and nothing happened.
- He considered that even though there was a correlation with the first causal information there wasn't enough evidence to back it up so he tested a third related variable.

Spurious Correlations

"Correlations that arise not because a causal link exists between the two variables that are measured, but because both variables are related to a third variable."

The Directionality Problem

- Problems of determining the direction of causation.
- "Before immediately concluding that a correlation between variable A and variable B is due to changes in A causing changes in B, we must first recognize that the direction of causation may be the opposite, that is, from B to A."
- Eye movement example
- Self esteem example

Selection Bias

- "Tempting correlation evidence combined with a preexisting bias may deceive even the best of minds."

Mississippi – Higher average SAT scores and lower paid teachers

California – Lower average SAT scores and higher paid teachers

In taking a closer look…

Only 4% of Mississippi students took the SAT

Whereas 47% of California students took the SAT

"Scientists often have to use incomplete knowledge to solve problems. The important thing is that we approach correlational evidence with a certain skepticism."

Summary

- Correlation does not imply causation.
- Two problems in interpreting correlational relationships
  - The third-variable problem
    - Correlation between two variables may not indicate a direct causal path between them, but may be present in a third related variable.
  - The directionality problem
    - Even if two variables have a direct causal relationship, the direction may not be indicated by the mere presence of the correlation.
- Selection Bias
  - "the only way to ensure that selection bias is not operating is to conduct a true experiment in which the variables are manipulated."