Observational Studies

April 11, 2012

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- Smoking versus lung cancer
- Minimizing the effect of lurking variables

1.0 Experiments Vs. Observational Studies

- Experiments are ACTIVE data collection.
- Observational studies are PASSIVE data collection.
- In both, the interest is on the relationship between one (or more) variable (explanatory) and another variable (response).

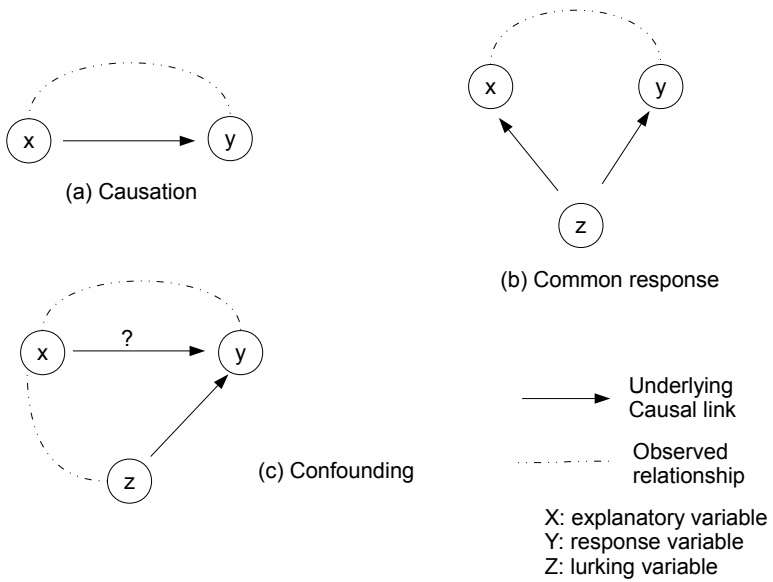
1.0 Practicing Identifying Type of Study

- A study of young children found that those with more body fat tended to have more "controlling" mothers. (Parents of Fat Kids Should Lighten Up)
- Observational or Experiment?
- Observational Units?
- Response Variable?
- Explanatory Variable?

1.0 Practicing Identifying Type of Study

- To measure the effect of exercise on heart disease, investigators compared the incidence of this disease for two large groups of London Authority busmen — drivers and conductors. The conductors got a lot more exercise as they walked around collecting fares.
- Observational or Experiment?
- Observational Units?
- Response Variable?
- Explanatory Variable?

1.1 Why Relationships Occur



1.1 Why Relationships Occur

- Nations with many T.V. sets (x) have higher life expectancies (y). Does television extend life? common response
- The S.A.T.s are associated with performance in college. Do high scores on the S.A.T. cause high scores in college? common response
- Childrens' shoe sizes are highly associated with their reading ability. Can we improve reading ability by making kids wear larger shoes? common response

1.1 Why Relationships Occur

- Some studies have found an association between smoking and liver cancer. This could mean:
  - smoking causes liver cancer, or
  - Drinking is ASSOCIATED with smoking, and alcohol CAUSES liver cancer.
- The effect of drinking is CONFOUNDED or MIXED UP with the effect of smoking.

1.2 Practicing Deciphering Relationships

- A study of young children found that those with more body fat tended to have more "controlling" mothers. (Parents of Fat Kids Should Lighten Up)
- Does the study find an association between mother's behavior and her child's level of body fat?
- If controlling behavior by the mother causes children to eat more, would that explain an association between controlling behavior by the mother and her child's level of body fat?
- Suppose there is a gene that causes obesity. Would that explain the association?
- Can you think of another way to explain the association?

2.0 Some Vocabulary

Lurking Variable

A LURKING variable is a variable that has an important effect on the relationship among the variables in the study, but is not one of the explanatory variables studied.

Confounding

Two variables are CONFOUNDED when their effects on a response variable cannot be distinguished from each other. The confounded variables may be either explanatory variables or lurking variables.

In a comparative design, CONFOUNDING occurs when the two groups differ by some variable (other than the treatment) that influences the response being studied.

2.0 Practicing Vocabulary

- According to a study done at Kaiser Permanente in C.A., users of oral contraceptives have a higher rate of cervical cancer than non-users. Investigators concluded that the pill causes cervical cancer.
- Is this an experiment or an observational study?
- What are the observational units, response variable, treatment and explanatory variable?
- What are some lurking variables that could affect the response?
- Were the conclusions of the study justified by the data?

2.0 Practicing Spotting Confounding Variables

- The Public Health Service studied the effects of smoking on health, in a large sample of representative households. For men and women in each age group, those who had never smoked were on average somewhat healthier than the current smokers, but the current smokers were on average much healthier than those who had recently stopped smoking.

- Why did they study men and women and the different age groups separately?

- The lesson seems to be that you shouldn't start smoking, but once you have started, don't stop. True/false?

3.0 The Problem with Observational Studies

- When we simply observe people's choices, the effect of their choice is CONFOUNDED with characteristics that might have led them to make those choices.
- For this reason, observational studies of the effect of one variable on another often fail.
- Well designed experiments take steps to prevent confounding.

4.0 Smoking Vs. Lung Cancer

- Early attempts to link smoking and lung cancer were based on observational data collected from patients admitted to hospitals.
- Investigators MATCHED each lung cancer patient with a person of the same gender and age group who did not have lung cancer.
- They then asked them questions about their smoking histories.
- The results showed that the group with lung cancer had more smokers, longer smoking histories and heavier smokers.
- These studies were replicated in the U.S. and the U.K.
- Two criticisms:
  - Biological plausibility?
  - Confounding variable: genetics.

4.0 Smoking Vs. Lung Cancer

- The criticisms were met by observational studies that attempted to follow a cohort (or group) of healthy subjects.
- Smoking habits for each member of the cohort was recorded at the beginning of the study.
- They were then followed for a period of time to see who developed lung cancer.
- These results showed that smokers were more likely to develop lung cancer.

4.1 Establishing Causation with Observational Studies

- The relationship is strong.
- The relationship is consistent.
- Higher doses correlate with stronger responses.
- The alleged cause precedes the effect in time.
- The alleged cause is biologically plausible.

5.0 Minimizing the Effect of Lurking Variables

- Combine comparison with matching to create the control group.
- Make comparisons in smaller, more homogeneous sub-groups, rather than over the whole.
- Use statistical techniques to ADJUST for confounding variables.