Lesson: Cause-and-Effect Relationship

5 different types and degrees of causal relationship between variables:

1) Cause-and-Effect Relationship
   A change in x produces a change in y

2) Common-Cause Factors
   External variables causes two variables to change in the same way

3) Reverse Cause-and-Effect Relationship
   The dependent and independent variables are reversed in the process of establishing causality

4) Accidental Relationship
   A correlation exists without any causal relationship between variables that happens by random chance

5) Presumed Relationship
   A correlation does not seem to be accidental even though no cause-and-effect relationship or co mmon cause factor is apparent.

Try This… Classify the relationships in the following situations.

a) The rate of a chemical reaction increases with temperature
   Cause and ~~Effect~~.

b) Leadership ability has a positive correlation with academic achievement
   Presumed

c) The price of butter and motorcycles have a strong positive correlation over many years
   Common Cause → inflation

d) Sales of cellular telephones had a strong negative correlation with ozone levels in the atmosphere over the last decade
   Accidental

e) Traffic congestion has a strong correlation with the number of urban expressways
   Reverse Cause and ~~Effect~~.

More……..

Extraneous Variables

- Variables that affect or obscure the relationship between an independent and a dependent variable

Experimental Group

- The group for which the independent variable is changed in an experiment or statistical study

Control Group

- The group for which the independent variable is held constant in an experiment or statistical study

Example 1:A medical researcher wants to test a new drug believed to help smokers overcome the addictive effects of nicotine.
• One hundred people who want to quit smoking volunteer for the study.
• The researcher carefully divides the volunteers into two groups, each with an equal number of moderate and heavy smokers.
•One group is given the nicotine patches with the new drug, while the second group uses ordinary nicotine patches.
• Twenty-eight people in the first group quit smoking completely, as do eighteen people in the second group.

a) Identify the experimental and control groups.

The experimental group in this study is the people who are given the nicotine patches with the new drug because the group receives the variable being tested in an experiment.
The control group in this study is the people who are using ordinary nicotine patches because this group doesn't receive the variable for testing.

EVALUATING STATISTICAL CLAIMS:

Factors leading to Erroneous Conclusions

- Bias in the survey
- Outliers in the data
- Failing to account for extraneous variables
- Failing to detect hidden variables
- Assuming a strong correlation proves the existence of a cause-and-effect relationship

Assessing methods of collecting and analyzing data

- Is the sample process free from bias?
- Could outliers or extraneous variables influence the results?
- Are there any unusual patterns that suggest presence of hidden variables?
- Has causality been inferred with only correlation evidence?