

## Ch 1.4 Experimental Design and Ethics

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Types of statistical study:

1) Observational study: we observe and measure specific characteristic of the subjects. A survey study is an observational study. We don't attempt to modify the individuals being studied.

Types of observational study:

- a) Cross-sectional study – data are collected at one point in time, not over a period of time.
  - b) retrospective study – data are collected from a past time by going back in examination of records.
  - c) prospective study – data are collected in the future from cohort groups.
- 2) Experimental study: we apply treatments and proceed to observe its effect on individuals.

The purpose of an experiment is to investigate the relationship between two variables. When one variable causes change in another, we call the first variable the **explanatory variable**. The affected variable is called the response variable.

Observational study can demonstrate an association but no causal relationship. Controlled experiment can demonstrate a causal relationship.

### Feature of good of experimental design:

**Control:** Use a control group with placebo, blinding or double blinding to reduce placebo effect (also known as power of suggestion).

**Randomization:** subjects are randomly assigned to control and treatment groups. (**Completely Randomized Design**). Control and Treatment groups should be as similar as possible. **Matched-pair design** can be used.

**Replication:** use large sample size in both control and treatment group.

**Blinding:** subjects are unaware if they are in a control or treatment group.

**Double-blinding:** one in which both the subjects and the researchers involved with the subjects are blinded.

Ex1. Researchers want to investigate whether taking aspirin regularly reduces the risk of heart attack. Four hundred men between the ages of 50 and 84 are recruited as participants. The men are divided randomly into two groups: one group will take aspirin, and the other group will take a placebo. Each man takes one pill each day for three years, but he does not know whether he is taking aspirin or the placebo. At the end of the study, researchers count the number of men in each group who have had heart attacks.

Identify the following values for this study: population, sample, experimental units, explanatory variable, response variable, treatments.

population: \_\_\_\_ all men between the age of 50 and 84

sample: \_\_\_\_ the 400 men recruited

experimental units: \_\_\_\_ each of the 400 men

explanatory variable: \_\_\_\_ take or do not take aspirin

response variable: \_\_\_\_ have or not have heart attacks

treatments: \_\_\_\_ aspirin

Ex 2. A survey shows that students who eat breakfast have higher average GPA. The researcher conclude that breakfast can cause an increase in academic performance. Discuss if the conclusion is valid or not and explain.

Answer:

Since the study is a "survey" which is an observational study. The correlation between eating breakfast and higher average GPA are "association" only.

The conclusion of "cause" is not valid.

Ex 3. Classify if the study is an experiment or observational study:

<https://www.sciencedaily.com/releases/2008/07/080707081834.htm>

Make comment about the headline of the article:

*"PTSD Causes Early Death From Heart Disease, Study Suggests."*

Answer: The study is an observation study. Causation conclusion is not valid until experiments are conducted.

Ethics of statistic researcher

- Risks to participants must be minimized and reasonable with respect to projected benefits.
- Participants must give **informed consent**. This means that the risks of participation must be clearly explained to the subjects of the study. Subjects must consent in writing, and researchers are required to keep documentation of their consent.
- Data collected from individuals must be guarded carefully to protect their privacy

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