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Chapter 13

Day 2

Statistical "Blindness"

In some studies we don't want the person giving or getting the treatment to influence the results of the experiment.

- To avoid the effects of subject behavior
  - Subjects not given any medication are often given a placebo such as a sugar tablet
  - The subjects will not know which treatment they get
- To avoid the effects of administrator behavior
  - The administrators are not told which drug they are administering
- When both the subjects and the researchers do not know which treatment, this is called double-blind

Completely Randomized Design

- A completely randomized design is when each experimental unit is assigned to a treatment completely at random
- Examples:
  - Randomly assign 10 people to get the new drug and 10 people to get the old drug; compare results
  - A farmer wants to test the effects of a fertilizer; we choose a set of plants to receive the treatment; and we randomly assign plants to receive different levels of fertilizer
- This has similarities to completely random sampling

Randomized Design Example

- We control as many factors as we can
  - Amount of watering
  - Method of tilling
  - Soil acidity
- Randomization decreases the effects of uncontrolled factors
  - Rainfall
  - Sunlight
  - Temperature

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Matched-Pair Design

- A matched-pair design is when the experimental units are paired up and each of the pair is assigned to a different treatment
- A matched pair design requires
  - Units that are paired (twins, the same person before and after the treatment, ...)
  - Only two levels of treatment (one for each of the pair)
- Examples:
  - New sock on right foot and old sock on left foot; and the wear-time until a hole develops is recorded
  - A subject before receiving the medication and then the same subject after receiving the medication

Matched-Pair Design Example

- Test whether students learn better while listening to music or not
  - Match students by IQ and gender (to control those factors)
  - Randomly choose one of each pair (to decrease the effects of other uncontrolled factors
  - Assign that one to a quiet room and the other to a room with music (the treatment)
  - Administer the test and analyze the test scores

Problem in a Random Design Example

- We are testing the effects of treatments A, B, and C on soybean plants
- Assume that group 1 is treated with A and group 2 is treated with B
- Assume that Chemgro plants have higher yields than Pioneer plants
- Assume that group 1 has more Chemgro plants (happens because of randomization) than group 2

Confounding

- If group 1 (treatment A) has higher yields than group 2 (treatment B)
  - Is this because treatment A is more effective than B?
  - Is this because there are more Chemgro plants in group 1?
- It is not possible to distinguish
  - The effects of Treatment A versus B
  - The effects of Chemgro versus Pioneer
- When two effects cannot be distinguished, this is called confounding

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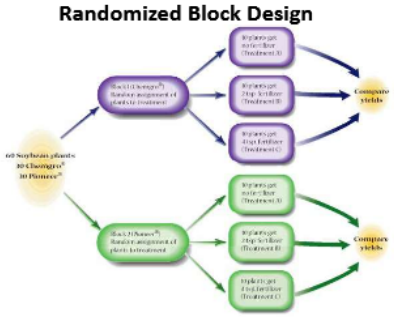
Randomized Block Design

- A randomized block design is when the experimental units are grouped and then each group is assigned a treatment at random
- The groups are called blocks
- This design will reduce confounding
- This has similarities to stratified sampling

Randomized Block Design

- In our soybean experiment
  - We apply treatment A to one third of the Chemgro plants, chosen at random
  - We apply treatment B to one third of the Chemgro plants, chosen at random
  - We apply Treatment C to one third of the Chemgro plants, chosen at random
- We apply the same method to the Pioneer plants
- With this randomized block design
  - Insures a balance of the treatments to the type of soybean plants
  - Plant type does not affect the value of our response variable
  - The effect of treatment A versus B and the effect of Chemgro versus Pioneer are no longer confounded
- This has similarities to stratified sampling

Randomized Block Design



Blocks should be homogenous: made up of the same attribute

Example 1

An agronomist wishes to compare the yield of five corn varieties. The field, in which the experiment will be carried out, increases in fertility from north to south. Outline an appropriate design for this experiment. Identify the explanatory and response variables, the experimental units, and the treatments. If it is a block design, identify the blocks.

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Example 1

Answers

Example 2

You are participating in the design of a medical experiment to investigate whether a calcium supplement in the diet will reduce the blood pressure of middle-aged men. Preliminary work suggests that calcium may be effective and that the effect may be greater for African-American men than for white or Hispanic men. Forty randomly selected men from each ethnic category are available for the study. Outline the design of an appropriate experiment. What kind of design is this? Can this experiment be blinded?

Example 2

Answers

Example 3

An educational psychologist wants to test two different memorization methods to compare their effectiveness to increase memorization skills. There are 120 subjects available ranging in age from 18 to 71. The psychologist is concerned that differences in memorization capacity due to age will mask (confound) the differences in the two methods. What would the design look like?

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Example 3

Answers

Example 4

Men and women experience different physiological differences among diseases. In a study of blood pressure three different methods (a drug, yoga, and meditation) will be tried on both men and women randomly selected from a large company to see which is most effective in reducing high blood pressure. Construct an appropriate design diagram. Would a control group be necessary? Explain. Can this experiment be blinded? What is the parameter of interest in this experiment? What is the population of interest in this problem?

Example 4

Answers