

Experimental Design: Chapter 4

What to Study: To be successful on this section of the final, the student will

1. Sample Survey:

- Selects units randomly from the population of interest for inclusion in the study
- Certain outcomes are measured.
- Makes no random assignment of them to treatments.
- The results of a sample survey can be used to identify associations among variables for the populations from which the units were randomly selected-not just for the people in the study, as in an observational study.

2. Observational Study:

- A type of study in which individuals are observed or certain outcomes are measured. No attempt is made to affect the outcome (for example, no treatment is given).
- No treatments
- No random selection of units from the population
- No random assignments of those units to treatments.
- Observes the characteristics of a group of units from one or more existing populations.

3. Experiment

- Deliberately imposes some treatments on individuals in order to observe their responses.
- Assigns all units randomly to treatments or treatments to trials.
- May or may not select units at random from the population
- Allows researchers to draw cause-and-effect conclusions for either the study's units (if the experimental units were not randomly selected) or the population (if the experimental units were randomly selected).
- Three Principals of Experimental Design: control, randomize, and replicate

Vocabulary:

- | | | |
|------------------------------|-----------------------------|-------------------------------------|
| ▪ outcome | ▪ heterogeneous groups | ▪ participants |
| ▪ trial | ▪ stratified random sample | ▪ experimental units |
| ▪ population | ▪ cluster sampling | ▪ factors |
| ▪ sample | ▪ multistage sampling | ▪ levels |
| ▪ sample survey | ▪ systematic sampling | ▪ treatment |
| ▪ biased | ▪ respondents | ▪ block |
| ▪ randomization | ▪ voluntary response sample | ▪ completely randomized experiments |
| ▪ census | ▪ convince sampling | ▪ statistically significant |
| ▪ parameter | ▪ undercoverage | ▪ control |
| ▪ statistic | ▪ nonresponse bias | ▪ control group |
| ▪ simple random sample (SRS) | ▪ response bias | ▪ single-blind |
| ▪ sampling frame | ▪ observational study | ▪ double-blind |
| ▪ sampling variability | ▪ retrospective study | ▪ placebo |
| ▪ homogeneous groups | ▪ prospective study | ▪ placebo effect |
| | ▪ experiment | ▪ matching |
| | ▪ subjects | ▪ confounding |

Problems to Review:

11. Which of the following is not required in an experimental design?
- a. control
 - b. blocking
 - c. randomization
 - d. replication
 - e. All are required in an experimental design.
12. Which is not a critical part of designing a good experiment?
- a. Random selection of subjects.
 - b. Random assignment of subjects to treatments.
 - c. Control of known sources of variability.
 - d. Replication of the experiment on a sufficient number of subjects.
 - e. All of these are important.
13. Hoping to get information that would allow them to negotiate new rates with their advertisers, Natural Health magazine phoned a random sample of 600 subscribers. 64% of those polled said they use nutritional supplements. Which is true?
- I. The population of interest is the people who read this magazine.
 - II. "64%" is not a statistic; it's the parameter of interest.
 - III. This sampling design should provide the company with a reasonably accurate estimate of the percentage of all subscribers who use supplements.
- a. I and III only
 - b. I only
 - c. I and II only
 - d. I, II, and III
 - e. II and III only
14. Jennifer is a quality control inspector for a well-known computer modem manufacturer. Jennifer oversees five assembly lines, each assembly line produces the same number of modems per day. Jennifer randomly selects one assembly line each morning and performs further sampling and quality control procedures on that assembly line's modems for the rest of the day. This morning, Jennifer randomly selected the modems of assembly line #5 for quality control inspection. Furthermore, Jennifer will then perform systematic sampling on that assembly line's modems. What has been excluded from being in the sampling frame today?
- a. Some of the modems of assembly line #5
 - b. The modems of assembly lines #1, 2, 3, and 4
 - c. An unbiased sample for assembly line #5
 - d. A sampling method for assembly line #5
 - e. Nothing has been excluded from the sampling frame.

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15. Management at a post office is curious about its services in one particular zip code area. Every address within that zip code, including business and residential, is mailed a survey inquiring about the post office's quality of service. The post office does receive a respectable 19% response rate to the survey. What, if any, is the most noticeable bias for this survey?
- Nonresponse bias
 - Voluntary response bias
 - Undercoverage of the population
 - Response bias
 - There does not seem to be any bias.

A member of the City Council has proposed a resolution opposing construction of a new state prison there. The council members decide they want to assess public opinion before they vote on this resolution. Identify the method that is proposed to sample local residents to determine the level of public support for the resolution.

16. Place an announcement in the newspaper asking people to call their council representatives to register their opinions. Council members will tally the calls they receive.
- convenience
 - systematic
 - cluster
 - voluntary response
 - simple (SRS)
17. Randomly select several city blocks; interview all the adults living on each block.
- stratified
 - cluster
 - systematic
 - simple (SRS)
 - judgment
18. Call every 500th person in the phone book.
- convenience
 - cluster
 - simple (SRS)
 - systematic
 - stratified
19. An education researcher was interested in examining the effect of the teaching method and the effect of the particular teacher on students' scores on a reading test. In a study, there are four different teachers (Juliana, Felix, Sonia, and Helen) and three different teaching methods (A, B, and C). The number of students participating in the study is 258. Students are randomly assigned to a teaching method and teacher. After a four-month period, students take a reading test and are given a score out of 10. Identify the levels of the factor "teaching method".
- Method A, method B, method C
 - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
 - Teaching method and teacher
 - Score on reading test
 - Juliana, Felix, Sonia, and Helen

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20. Listening to popular music while driving is dangerous?

In a study of 7824 drivers from Chico, California, all who renewed their driver's license in 2009, it was found that of the 2113 who listen to popular music while driving, 4.0% had been in an accident or gotten a ticket in the last two years. On the other hand, of the 5711 who listened to talk radio or nothing at all, just 2.3% had been in an accident or gotten a ticket in the last two years.

a. Is this an observational study or an experiment? observational

If you said it is an observational study, answer questions b-h. If you said it is an experiment, answer questions i-o. Answer only one set of questions, leave the other set blank.

Questions for an observational study:

b. Is this a retrospective or prospective study?

retrospective

c. Explain your answer to part b).

Looking in the past

d. Who were the subjects studied, and how were they selected?

7824 drivers from Chico, California, who renewed their driver licence in 2009

e. What is the parameter(s) of interest?

Does what is listened to in a car

f. State a potential lurking variable or bias.

affect driving ability

g. Can cause-effect be determined based on this study?

Age

NO - only on experiences

h. Explain your answer to part g) ↗

Questions for an experiment:

i. What is the factor? What are the levels of the factor?

j. What is the response?

k. Who were the subjects studied, and how were they selected?

l. What is the parameter(s) of interest?

m. Is this study blind (or double blind)?

n. Can cause-effect be determined based on this study?

o. Explain your answer to part n).