Chapter 1 Homework SOLUTIONS

There is a long standing controversy surrounding mass vaccination of military personnel with anthrax vaccine. In the 1950’s Brachman Study, workers at four goat hair mills were recruited into a trial of an anthrax vaccine. Several reports of this study claim that the anthrax vaccine studied was effective, since the rate of anthrax was statistically significantly higher in the group randomly allocated to take a shot with inert ingredients in it. It turns out that randomization was not done properly and that workers in the group receiving inert ingredients had much higher exposure to anthrax spores (that was not accounted for in the analysis). So, it cannot be determined whether the higher rate of anthrax in the group receiving the shot with inert ingredients was due to the lack of vaccination or the higher exposure to the anthrax spores.

1. Identify whether this study was an observational study or an experiment. Experiment

Identify each of the following:

2. Response Variable Contraction of anthrax
3. Explanatory Variable Vaccination (2 treatment groups – one receiving the proposed vaccine and one receiving the shot with inert ingredients)
4. Lurking Variable Level of exposure to anthrax spores (since higher exposure increases chances to contract anthrax but was not a variable accounted for in the study)

5. Fill in the blank. Since we cannot tell apart the effect of vaccination status from the effect of exposure to anthrax, we would say these variables are confounded.

6. Is there a control group in this study? If so, what is it? Yes. The group receiving the shot with inert ingredients serves as the control.

7. Is there a placebo group? If so, what is it? Yes. The control group in this study is receiving a shot with inert ingredients (a placebo), so the control group in this study is a placebo group.

Exercise 1.2.3

Suppose in a study on acupuncture, patients with headaches are randomly divided into two groups. One group is given acupuncture and the other group given aspirin. The acupuncturist evaluates the effectiveness of the acupuncture and compares it to the results of the aspirin group. Explain how lack of blinding biases the experiment and how/why.

Firstly, the acupuncturist is the response measurer and will likely be biased toward acupuncture working better than aspirin (so he/she may think there is more improvement in the group getting acupuncture). As far as response measurer bias, it is fairly easy to predict the direction of the bias here.

Secondly, the subjects also were not blinded. If they had a predisposed idea that the treatment they were getting was a more effective / less effective way to treat headaches, they may think they were better / worse than they actually were, biasing results in either direction. As far as subject bias, it is not as easy to predict the direction or strength of bias.
Exercise 1.3.1
Identify the sampling scheme (simple random sampling (SRS), random cluster sampling, stratified random sampling). Identify the clusters if cluster sampling was used. Identify the strata if stratified random sampling was used.

(a) All 257 leukemia patients from three randomly chosen pediatric clinics in the United States were enrolled in a clinical trial for a new drug. **Random cluster sampling, with “pediatric clinics” as the clusters**

(b) A total of twelve 10 g soil specimens were collected from random locations on a farm to study physical and chemical soil profiles. **Simple Random Sample (SRS)**

(c) In a pollution study, three 100 ml air specimens were collected at each of four specific altitudes (100, 500, 1000, and 2000 meters) for a total of twelve 100 ml specimens. **Stratified Random Sampling, with 4 strata – the four chosen altitudes**

(d) A total of 20 individual grapes were picked from random vines in a vineyard to evaluate readiness for harvest. **Simple Random Sampling (SRS)**