

Introduction to Biostatistics (BIOS:4120)
Breheny

Assignment 1

Due: Tuesday, February 4

1. One study on slavery in America estimated that “11.9% of slaves were skilled craftsmen.” This estimate was based on the records of thirty plantations in Plaquemines Parish, Louisiana. The study is making a generalization about a population based on a sample.
 - (a) In this study, what is the population of interest?
 - (b) In this study, what does the sample consist of?
 - (c) Could the study’s generalization be biased? If so, what type of bias would this be?
2. A Dutch study of rheumatoid arthritis found that patients who experienced more pain were more likely to respond to a health survey. In their questionnaire, 2% of respondents said that they experience no pain associated with their condition.
 - (a) Is the “2%” number an estimate or a parameter of interest?
 - (b) Is the “2%” number a biased estimate? If so, what type of bias is present?
 - (c) Is the true percentage of individuals with rheumatoid arthritis who suffer no pain likely to be less than 2%, greater than 2%, or equal to 2%?
3. In 1975, The National Institutes of Health conducted a randomized controlled double-blind experiment to determine whether vitamin C is effective at treating the common cold. Subjects who developed a cold were prescribed capsules, to be taken six per day for the first five days of the cold. The subjects were randomly assigned to receive either vitamin C capsules or a placebo. Almost all participants adhered to the protocol: 99% took at least four capsules per day.
 - (a) The average duration of cold for the vitamin C group was 6.5 days, while the average duration in the placebo group was 7.1 days. Does this provide evidence that vitamin C is effective at treating colds?
 - (b) Could the results described in part (a) be affected by confounding?
 - (c) Investigators later discovered that the blinding of subjects failed in this study (vitamin C has a characteristic sour taste that the placebo lacked; this was noticed by 42% of subjects). How does this new information affect your conclusion from part (a)?
 - (d) If we restrict analysis only to those patients who remained blinded, the average duration of cold for the vitamin C group was 6.7 days, while the average duration in the placebo group was 6.3 days. Does this analysis provide evidence that vitamin C is effective at treating colds?
 - (e) Are there any potential problems with the analysis in part (d), in which we exclude certain subjects from the analysis after they have been randomized to a group?
 - (f) Based on all of the information you have been provided with in this question, do you think this experiment provides evidence that vitamin C is effective at treating colds? Or do you think that the study is inconclusive?

4. This question involves an article by Abramowicz *et al.* (2008) on the epidemiology of ultrasound [[Link](#)]. Read the section on the second page titled “Low Birth Weight.”
 - (a) The authors discuss the use of animal studies to make inferences about humans. What sampling concept that we discussed in class does this violate?
 - (b) Multiple observational studies indicated that ultrasound exposure may be linked to low birth weight. Were these findings replicated in controlled experiments?
 - (c) It is not explicitly stated in the article, but were the controlled experiments randomized controlled, double-blind experiments?
5. A 1979 randomized trial was performed comparing a surgical treatment for angina pectoris (chest pains due to obstruction of the coronary arteries) to a placebo (non-surgical medical management). In the study, 6 of the patients randomized to receive surgery died before they could be operated on. There was a subsequent debate over how best to analyze the data. Some favored approach A, in which all patients were analyzed as they were randomized. Others favored approach B, in which those 6 patients were excluded on the grounds that they never actually received the surgical treatment that they were randomized to. Which approach do you think is better? Why?
6. In both the polio and clofibrate studies, some subjects did not want the treatment assigned to them. In the polio study, we were able to sidestep the problem of non-compliance by only studying the compliant group. Why is this not an option in the clofibrate study?
7. A study of sexual bias in admissions was conducted by the Graduate Division at the University of California, Berkeley. Admissions results from the six largest majors are listed below (university policy does not allow the departments to be identified by name):

Major	Men		Women	
	Applicants	Admitted	Applicants	Admitted
A	825	512	108	89
B	560	353	25	17
C	325	120	593	202
D	417	138	375	131
E	191	53	393	94
F	373	22	341	24

- (a) From the table above, calculate the overall percentage of men and the overall percentage of women who were admitted.
- (b) Does your answer from part (a) suggest sexual bias? If so, against whom?
- (c) Create a table listing the percentage of men and women who were admitted, broken down by department.
- (d) Does the table you made in part (c) indicate sexual bias? If so, against whom?
- (e) Construct a weighted average of the percentage of male and female applicants who were admitted, controlling for the effect of department (*i.e.*, report one number for men and one number for women).
- (f) Does your answer from part (e) indicate sexual bias? If so, against whom?
- (g) The purpose of the study was to answer the question, “Were admissions biased on the basis of sex?” The analyses above indicate different answers to this question. Which of the analyses in (b), (d), and (f) do you feel best answers this question? Why?