Introduction to Biostatistics (BIOS:4120)
Breheny

Assignment 10
Due: Tuesday, April 9

Note: This is a fairly long assignment if you choose to do every χ^2 test by hand. You should do at least one by hand to make sure you know how, but feel free to use R to automate the work once you've got the hang of it.

1. The Current Population Survey is a monthly survey conducted by the Census Bureau. Among many other questions, the participants are asked about their sex and marital status. The following table contains the survey responses to these two questions for persons age 25-29 living in the state of Wyoming. The data come from the March 1988 Current Population Survey.

	Marital status	
	Married	Never Married
Men	20	21
Women	39	9

   (a) Is this a prospective, retrospective, or cross-sectional study?

   (b) What percent of men are married? What percent of women are married?

   (c) If the proportion of men in the population who are married is the same as the proportion of women who are married, what are the chances that we would see a difference as large as the one you observed in part (b) just by random chance? (The χ^2 test statistic is 10.4. If you would like practice on χ^2 tests, feel free to compute this statistic from the data, but you do not have to)

   (d) How would you interpret the result of your hypothesis test in part (c)? Does your result make sense? These data are not made up and same-sex marriage was not legal in Wyoming in 1988.

2. In our first week of class, we discussed the Salk vaccine trial. In the randomized controlled, double-blind portion of the trial, the results were as follows:

	Size of group	Polio cases per 100,000 children
Treatment	200,000	28
Control	200,000	71

   (a) Is the above table a contingency table? If not, create one from the data above.

   (b) Under the null hypothesis that the vaccine has no effect on the likelihood that a child will contract polio, create a table listing the expected number of children who will fall into each category.

   (c) Perform a χ^2-test of the null hypothesis described in part (b).

   (d) Calculate the risk difference comparing the vaccinated and unvaccinated groups.

   (e) Calculate the relative risk for the unvaccinated group compared to the vaccinated group.

(f) Calculate the odds ratio of the association between vaccination and risk of polio. Use this number to describe the results of this study in a sentence that doesn't contain the phrase "odds ratio."

(g) Calculate a 95% confidence interval for the odds ratio.

(h) Provide a one-sentence summary of this study in terms of what it tells the Public Health Service about the Salk polio vaccine.

(i) Is it safe to conclude that the vaccine is causing a reduction in polio, or could there be hidden confounders?

3. ⌨ In our fourth lecture (slides 31-32), we discussed the clinical trial of Nexium. The results of the trial were that 2,430/2,624 individuals who took Nexium were healed from erosive esophagitis, compared with 2,324/2,617 individuals who took Prilosec.

(a) Is Nexium more effective than Prilosec at treating erosive esophagitis, or could the results of this trial be explained by chance variability?

(b) If you performed an approximate test in part (a), perform an exact test (and vice versa). Comment on whether or not there is any substantial difference between the tests.

(c) Calculate a 95% confidence interval for the odds of healing for Nexium divided by the odds of healing for Prilosec.

(d) Provide a one-sentence summary of this study.

4. ⌨ / ✎ Millions of American women underwent breast augmentation/reconstruction surgery since the procedure was pioneered in the early 1960s. In response to case reports of connective tissue and autoimmune diseases following the surgery, the FDA issued a moratorium on these procedures in 1992 (this moratorium is no longer in effect). To investigate whether these anecdotes were statistically significant, researchers at the Mayo clinic conducted a retrospective study and obtained the following results:

	Connective Tissue Disease	
	Yes	No
Augmentation	5	744
No augmentation	10	1488

(a) Conduct an appropriate hypothesis test of the null hypothesis that breast augmentation / reconstruction surgery has no impact on connective tissue disease. What is your conclusion?

(b) Is the following statement true or false: "Based on my results in part (a), there is a high probability that the null hypothesis is true."

(c) Calculate a 95% confidence interval for the relative odds of developing connective tissue disease for women who received this surgery compared to women who did not.

(d) Write a one-sentence summary of this study.

5. Consider the data and your analysis of it in problems 3 and 4. Which of the following statements is more consistent with the data: (a) Nexium increases the odds of healing for erosive esophagitis by a factor of 2 (b) Breast augmentation increases the odds of connective tissue disease by a factor of 2. Briefly, support your answer.