

BST 140.651

Problem Set 5

Due in the biostat main office on November 11th

1. In a study of the cariostatic properties of dentrifices, 423 children were given dentrifice A and 408 were given dentrifice D. After 3 years, 163 of the children on A and 119 of the children on D had withdrawn from the trial. The authors suggest that the main reason for withdrawal from the trial was because the children disliked the taste of dentrifices. Do these data indicate that one of the dentrifices is disliked more than the other?
 - a. Construct a confidence interval for the difference in withdrawal rates. (interpret)
 - b. Construct a confidence interval for the relative withdrawal rates. (interpret)
 - c. Construct a confidence interval comparing the odds of withdrawal between the two treatment arms. (interpret)
2. Read the article "Food borne Hepatitis A Infection: A Report of Two Urban Restaurant-Associated Outbreaks" by Denes, et al., in *The American Journal of Epidemiology*, **105**, no. 2 (1977), pages 156-162 and answer the following questions based on it.
 - a. The authors analyzed the results of Table 1 using a chi-square statistic. Is this a reasonable method of analysis to use for this table? If not, suggest an alternative method. Perform the analysis and check your results with the authors.
 - b. Student's t test with 40 d.f. was used to analyze the results in Table 2. Is this a reasonable method of analysis to use for this table? If not, suggest an alternative method.
3. Consider the hypothesis testing problem of comparing two binomial probabilities $H_0 : p_1 = p_2$. Show that the square of statistic $(\hat{p}_1 - \hat{p}_2)/SE_{\hat{p}_1 - \hat{p}_2}$ is the same as the χ^2 statistic. (Clearly define any notation you introduce.)
4. A study of the effectiveness of *streptokinase* in the treatment of patients who have been hospitalized after myocardial infarction involves a treated and control group. In the streptokinase group, 2 of 15 patients died within 12 months. In the control group, 4 of 19 died with 12 months.
 - a. Use Fisher's exact test to test for a difference in mortality rates. Do this by hand by writing down all possible tables with fixed marginal totals. You may confirm your results with a computer.
 - b. Compare your results using the test statistics based on the normal and χ^2 approximations.
 - c. Suppose we are designing a larger study. Based on our preliminary data we believe the 12 month mortality rate in the control group is about $p_1 = 20\%$. We wish to have 90% power to detect a difference in the mortality rates at $\alpha = .05$. Suppose the true mortality rate in the treated group is p_2 . Make a graph to show the relation between the total sample size required (from both groups assuming equal numbers in the two groups) as a function of p_2 . Make the same graph with $\alpha = .01$.

5. This problem considers the delta method.

a. Derive the asymptotic standard error for $\sqrt{\hat{p}}$ where \hat{p} is a binomial sample proportion.

b. Assume that $n = 200$ and $p = .5$. Implement a simulation study to verify that the delta method results in approximately normally distributed variables.