

## **IMPORTANT NOTE**

The following is an open-book, open-note assignment. Collaboration is not allowed. Please show all your work, as no credit will be given for unsupported answers. Feel free to e-mail me with questions at [nega\\_ginge@yahoo.com](mailto:nega_ginge@yahoo.com). You can also call me at (225) 292-0475. You can either e-mail your solutions to me at the e-mail address above or send them by snail mail to

Stephen Looney  
11888 Longridge Ave.  
Apt. 1007  
Baton Rouge, LA 70816

If you do use snail mail, please make sure that your solution to Assignment 4 is post-marked by November 7, 2005.

Good luck!

### **Assignment 4 (Due Monday, November 7, 2005)**

1. Work Exercise 3.8, p. 68. Perform the CMH test by hand and test the hypothesis of conditional independence using the approximate  $\chi^2$  test. Interpret the results in the context of the applied problem. Please show all your work.
2. Consider Exercise 3.9, p. 68. Write the SAS code, including the DATA step, to perform the approximate CMH test and the approximate test for homogeneous association (with adjustment), and to calculate an approximate 95% CI for the true overall conditional odds ratio.
3. Use the SAS output below to answer the following questions. When giving the results for an hypothesis test, be sure to provide the value of the test statistic, the d.f. (if any), and the p-value. **Be sure to indicate on the printout where you obtained your answers.**
  - (a) Perform the exact version of the  $\chi^2$  test for independence and calculate an exact 95% CI(OR) for each of the conditional odds ratios.
  - (b) Does the use of the Cochran-Mantel-Haenszel methodology appear to be justified for these data? Why or why not?
  - (c) Perform the approximate version of the CMH test.

- (d) Perform the test for homogeneous association with adjustment.
- (e) Calculate the M-H estimate of the overall conditional OR, along with an approximate 95% CI. Interpret the results in the context of the applied problem.
- (f) Compare the results in parts (a) and (e) above. What benefit(s) does the M-H approach provide relative to the separate analyses in each layer?
- (g) The marginal analysis for this problem yielded  $\widehat{OR} = 0.72$ , with an exact 95% CI(OR) = (0.54, 0.95), and a p-value for the exact  $\chi^2$  test of independence = 0.018. Does it appear that “country” is a significant confounder in this study? Why or why not?

Statistics for Table 1 of passive by case  
Controlling for country=1

Pearson Chi-Square Test

Chi-Square	2.2159
DF	1
Asymptotic Pr > ChiSq	0.1366
Exact Pr >= ChiSq	0.1458

Odds Ratio (Case-Control Study)

Odds Ratio	0.6595
Asymptotic Conf Limits	
95% Lower Conf Limit	0.3804
95% Upper Conf Limit	1.1435
Exact Conf Limits	
95% Lower Conf Limit	0.3607
95% Upper Conf Limit	1.1721

Statistics for Table 2 of passive by case  
Controlling for country=2

Pearson Chi-Square Test		
Chi-Square		0.6534
DF		1
Asymptotic Pr > ChiSq		0.4189
Exact Pr >= ChiSq		0.5816

Odds Ratio (Case-Control Study)	
Odds Ratio	0.6250
Asymptotic Conf Limits	
95% Lower Conf Limit	0.1988
95% Upper Conf Limit	1.9646
Exact Conf Limits	
95% Lower Conf Limit	0.1560
95% Upper Conf Limit	2.1643

Statistics for Table 3 of passive by case  
Controlling for country=3

Pearson Chi-Square Test		
Chi-Square		2.8003
DF		1
Asymptotic Pr > ChiSq		0.0942
Exact Pr >= ChiSq		0.1003

**(NOTE: SAS output is continued on next page.)**

## Odds Ratio (Case-Control Study)

Odds Ratio	0.7555
Asymptotic Conf Limits	
95% Lower Conf Limit	0.5438
95% Upper Conf Limit	1.0497
Exact Conf Limits	
95% Lower Conf Limit	0.5351
95% Upper Conf Limit	1.0618

Summary Statistics for passive by case  
Controlling for country

## Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	5.4497	0.0196
2	Row Mean Scores Differ	1	5.4497	0.0196
3	General Association	1	5.4497	0.0196

## Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	Mantel-Haenszel	0.7218	0.5489	0.9492
	Logit	0.7226	0.5494	0.9504
Cohort (Col1 Risk)	Mantel-Haenszel	0.7825	0.6348	0.9647
	Logit	0.7837	0.6358	0.9661
Cohort (Col2 Risk)	Mantel-Haenszel	1.0840	1.0155	1.1572
	Logit	1.0843	1.0158	1.1574

(NOTE: SAS output is continued on next page.)

Breslow-Day-Tarone Test for  
Homogeneity of the Odds Ratios

---

Chi-Square	0.2381
DF	2
Pr > ChiSq	0.8878

- 3.7. For three-way contingency tables, when any pair of variables is conditionally independent, explain why there is homogenous association. When there is not homogeneous association, explain why no pair of variables can be conditionally independent.
- 3.8. Table 3.5 refers to the effect of passive smoking on lung cancer. It summarizes results of case-control studies from three countries among nonsmoking women married to smokers. Test the hypothesis that having lung cancer is independent of passive smoking, controlling for country. Report the P-value, and interpret. (Note: Weak associations in observational studies are suspect. With relatively small changes in the data, perhaps representing effects of misclassification or other bias, the association could disappear. See, for instance, R. L. Tweedie et al., Garbage in, garbage out, *Chance*, 7: no. 2, 20–27 (1994)).

Table 3.5

Country	Spouse Smoked	Cases	
		Cases	Controls
Japan	No	21	82
	Yes	73	188
Great Britain	No	5	16
	Yes	19	38
United States	No	71	249
	Yes	137	363

Source: Blot and Fraumeni, *J. Nat. Cancer Inst.*, 77: 993–1000 (1986).

- 3.9. Refer to the previous problem. Assume that the true odds ratio between passive smoking and lung cancer is the same for each study. Estimate its value, and use software to find a 95% confidence interval. Interpret. Analyze whether the odds ratios truly are identical.
- 3.10. Table 3.6 shows results of a three-center clinical trial designed to compare a drug to placebo for treating severe migraine headaches. At each center, subjects were randomly assigned to treatments.

Table 3.6

Center	Group	Response	
		Success	Failure
1	Drug	6	4
	Placebo	2	8
2	Drug	4	3
	Placebo	1	5
3	Drug	5	3
	Placebo	3	6

- a. Describe the associations in the partial tables. Are results similar among centers?