2019Fall STAT5107 Assignment 2

Department of Statistics, The Chinese University of Hong Kong

Due 9:30pm, Thursday, October 17, 2019

1. Consider the following two studies reported in the *New York Times*.

   a. A British study reported (Dec. 3, 1998) that of smokers who get lung cancer, "women were 1.7 times more vulnerable than men to get small-cell lung cancer." Is 1.7 the odds ratio or the relative risk?

   b. A National Cancer Institute study about tamoxifen and breast cancer reported (Apr. 7, 1998) that the women taking the drug were 45 % less likely to experience invasive breast cancer than women were taking placebo. Find the relative risk for (i) those taking the drug compared to those taking placebo, and (ii) those taking placebo compared to those taking the drug.

2. For a diagnostic test of a certain disease, π_1 denotes the probability that the diagnosis is positive given that a subject has the disease, and π_2 denotes the probability that the diagnosis is positive given that a subject does not have it. Let ρ denote the probability that a subject does have the disease. Given that the diagnosis is positive, show that the probability that a subject does have the disease is

$$\pi_1\rho/[\pi_1\rho + \pi_2(1-\rho)]$$

3. Table below is based on records of accidents in 1988 compiled by the Department of Highway Safety and Motor Vehicles in Florida. Identify the response variable, and find and interpret the difference of proportions, relative risk, and odds ratio. Why are the relative risk and odds ratio approximately equal?

Safety Equipment in Use	Injury	
	Fatal	Nonfatal
None	1601	162,527
Seat belt	510	412,368

Source: Florida Department of Highway Safety and Motor Vehicles.

4. Table below is based on a Swedish study of the association between aspirin use and myocardial infarction which reports the number of deaths due to myocardial infarction during a follow-up period of about 3 years. The study randomly assigned 1360 patients who had already suffered a stroke to an aspirin treatment (one low-dose tablet a day) or to a placebo treatment.

	Myocardial Infarction		
	Yes	No	Total
Placebo	28	656	684
Aspirin	18	658	676

Source: Based on results described in *Lancet* **338**: 1345–1349 (1991).

a. Give an estimate of sample odds ratio θ, calculate the standard error of $log\hat{\theta}$ and give a 95% confidence interval for $log\theta$ and θ. Based on the CI for θ, is it plausible that the true odds of death due to myocardial infarction are equal for aspirin and placebo?

b. Give an 95% confidence interval for difference of proportions.

c. Give an estimates of sample relative risk and a 95% confidence interval for the log relative risk and relative risk.

5. Table below cross-classifies the degree of fundamentalism of subjects' religious beliefs by their highest degree of education. The table also contains the estimated expected frequencies for H_0 : *independence*. For instance, $\hat{\mu}_{11} = n_{1+}n_{+1}/n = (424 \times 886)/2726 = 137.8$. Specify the degree of freedom, calculate the χ^2 statistic and give the corresponding P-value. Is the statistic provide strong evidence of an association?

	Religious Beliefs			
Highest Degree	Fundamentalist	Moderate	Liberal	Total
Less than high school	178 (137.8)[1]	138 (161.5)	108 (124.7)	424
High school or junior college	570 (539.5)	648 (632.1)	442 (488.4)	1660
Bachelor or graduate	138 (208.7)	252 (244.5)	252 (188.9)	642
Total	886	1038	802	2726

Source: 1996 General Social Survey, National Opinion Research Center.

[1]Estimated expected frequencies for testing independence;