

Assignment 3, due March 10, 2020 at beginning of class

(Out of 40 points)

1. (10 points) Prostate-specific antigen (PSA) is a tissue-specific tumor marker used by urologists and oncologists to monitor treatment responses, prognosis, and progression in patients with prostatic cancer. A high level of PSA in the blood is indicative of prostate cancer. Researchers have found that the sensitivity of the test is .80, and that there is a .25 probability of testing positive if you don't have prostate cancer. The prevalence of prostate in a particular population of males is 15%.
 - (a) What is the probability of False Negative of the test? (1)
 - (b) What is the probability of False Positive of the test? (1)
 - (c) What is the specificity of the test? (2)
 - (d) What is the probability of testing positive for prostate cancer? (2)
 - (e) What is the probability of a subject actually having prostate cancer if they have a positive result on the PSA test? (2)
 - (f) What is the probability that a subject does not have the disease if they have a negative PSA test? (2)

2. (7 points) The Physicians' Health Study was a randomized double-blind placebo- controlled trial of beta-carotene (50mg every other day). 22,071 male physicians age 40-84 were enrolled in 1982. The subjects were followed until December 1995, for the development of new cancers (malignant neoplasms). The group of size 11,036 receiving beta-carotene had 1273 new cancers, while the placebo group of size 11,035 had 1293 new cancers.
 - (a) What is the estimated relative risk for malignant neoplasms, in the beta-carotene treatment relative to the placebo group. (2)
 - (b) Calculate the 95% confidence interval for the relative risk. (5)

3. (8 points) A retrospective study on peptic ulcer and the use of nonsteroidal anti-inflammatory drugs (NSAIDs) obtained the following results in 168 patients admitted to hospital with perforated peptic ulcer and a set of matched controls.

	NSAID Use		Total
	Yes	No	
Cases	79	89	168
Controls	12	156	168

- (a) Calculate the odds ratio for the association between perforated peptic ulcer and NSAID use, in the Yes relative to the No group. (2)
- (b) Calculate the 95% confidence interval for the odds ratio. (4)
- (c) Based on this confidence interval, is there significant evidence against the null hypothesis of no association between NSAID use and peptic ulcers at the $\alpha = .05$ level of significance? Explain. (2)

4. (15 points) In a study on the effect of lansoprazole (15mg and 30 mg) and ranitidine on ulcer healing, Agrawal et al. obtained the numbers in the table below.

Healed	Therapy			Total
	R	L15	L30	
Yes	61	81	85	227
No	54	37	32	123
Total	115	118	117	350

Do an overall test to determine whether there are any differences among the therapies, in the following steps.

- (a) State the hypotheses. (2)
- (b) Calculate the expected counts, and present the results in a table of expected counts (2 rows, 3 columns as for observed counts). (4)
- (c) Calculate the contributions to the goodness of fit statistic, and present the results in a table (2 rows, 3 columns) (4)
- (d) Calculate the observed value of the test statistic. (2)
- (e) What is the degrees of freedom? (1)
- (f) Determine the P value as accurately as possible using the χ^2 table on the class web site. (2)