Chapter 10 Homework

1. In the U.S., what is the most prevalent cancer in (a) men and (b) women? Worldwide, what is the most prevalent cancer in (c) men and (d) women?

2. Cancer screening:
- o What four types of cancer are routinely screened for in the United States? For each, describe the screening test that is used.
- o Do most people in the US adhere to screening recommendations? What factors cause people not to be screened?
- o Discuss whether these screening tests are used throughout the rest of the world.

3. Lung cancer is the leading cause of cancer death for both men and women in the United States. More people die of lung cancer than of colon, breast, and prostate cancers combined. Lung cancer is fairly rare in people under the age of 40. The average age of people found to have lung cancer is 60. In 2004 there will be about 173,770 new cases of lung cancer in the United States. About 160,440 people will die of this disease. The population of the United States in 2004 is 292,287,454.
- o Calculate the annual incidence rate of lung cancer in the US in 2004.
- o Calculate the mortality rate of lung cancer in the US in 2004.
- o Why is the mortality rate of lung cancer so high?

4. Describe in your own words, ***WITHOUT*** using equations or other mathematical expressions or the words "true", "false", "positive", or "negative" the following terms with regard to a screening test for ovarian cancer:
    True Positive
    False Positive
    False Negative
    True Negative
    PPV
    NPV

5. A diagnostic test is 92% sensitive and 94% specific. A test group is comprised of 500 people known to have the disease and 500 people known to be free of the disease. How many of the known positives would actually test positive? How many of the known negatives would actually test negative?

6. A screening test for a particular disease has a sensitivity of 96% and a specificity of 92%. You plan to screen a population in which the prevalence of the disease is 0.2%. How many false positives will be found by this screening procedure for each true positive that is found?

7. A clinical trial of a new automated mammography system was carried out in 50,000 women known to have breast cancer. If 37,500 women received a positive test result, what would the specificity of the new test be?

8. Based on all the information currently available, you estimate that the patient in your office has a one in four chance of having a serious disease. You order a diagnostic test with sensitivity of 95% what would be the chance your patient really has the disease?

9. A test with 99.9% sensitivity and 99% specificity is used to screen a population for a disease with 1% prevalence. What would be the proportion of test positives in the screen who

actually have the disease?

10. The American Disease X Foundation reports that 6% of the population over 50 years of age has Disease X. You inquire as to the source of their information, and they cite disease population screening data in the literature which reports that 6% of that population was positive when screened. Referring to the literature, you discover that the screening test used had sensitivity of 95% and specificity of 98%. What proportion of the population over 50 years of age do you think really has the disease?

11. A recent study examined the expression of p53 (a protein found in many transformed cell lines derived from tumors) as a marker for ovarian cancer. The sensitivity and specificity of p53 as a marker for the diagnosis of ovarian cancer in this study were 82% and 93% respectively. Forty-seven patients with no family history of breast or ovarian cancer were included in the study. Fourteen of the 17 patients with ovarian cancer had p53 overexpression. Fifteen of the 47 patients had never given birth.
- o If p53 overexpression was used as a test for ovarian cancer, how many patients in this study received a false positive test result?
- o If p53 overexpression was used as a test for ovarian cancer, how many patients in this study received a false negative test result?
- o How much better are these results for a screening test than CA-125?

12. You are a physician for Mr. Jones, a 65 year old African American man who presents to you with complaints of difficulty urinating. Specifically, he has trouble starting urine flow and has an intermittent stream. He says he noticed this problem some time ago, and that it has slowly been getting worse. Mr. Jones says he has always been healthy and has not seen a doctor in thirty years. He was adopted and does not know his family history.
- What disease discussed in Chapter 10 might explain Mr. Jones' symptoms?
- What three risk factors for this disease does Mr. Jones have?
- What initial tests are available that might aid your diagnosis of Mr. Jones?
- If the initial tests are positive, what would be the next step in diagnosis?
- Mr. Jones does indeed have the disease you suspected, and you recommend surgical intervention. Any surgical procedure has the risks of pain, bleeding, and infection. What are two specific risks associated with this particular surgery?
- List two reasons why the tests listed in part c are controversial for use as screening tools.
- In American males, prostate cancer is the most common, non-skin cancer (accounting for 33% of all new cancers), but is less deadly than might be expected, ranking behind both lung and colon cancer as the third leading cause of cancer death (9%). By contrast, ovarian cancer is the eighth most common new non-skin cancer in American women (3% of new diagnoses), but accounts for a surprising number of deaths; it ranks as the fifth leading cause of cancer death in this population (6%). Give three reasons for the discrepancy between the incidence and death rates for these two cancer types.

13. A patient comes to your office complaining of abdominal fullness and a change in bowel habits. She reports a family history of breast cancer and ovarian cancer. You suspect she may have ovarian cancer and order a serum CA125 test. The sensitivity of this test is 35% and the specificity is 98.5%. The incidence of ovarian cancer in this population is 0.1%. The test comes back positive.

If you gave this test to 1,000,000 women, how many patients would have a true positive (TP) result, a false positive (FP) result, a true negative (TN) result and a false negative (FN)

result?Given her positive test result, what is the likelihood that your patient really has ovarian cancer? What test would you recommend that your patient undergo next?

14. A company called BioCurex recently announced results of a clinical trial for a new test to detect lung cancer (see story below).

RANCHO SANTA MARGARITA, Calif.--(BUSINESS WIRE)--April 5, 2004--BioCurex Inc. announces results for lung cancer detection using its proprietary Serum-RECAF(TM) blood test. The results confirm 90% sensitivity with 95% specificity. The findings further substantiate the use of RECAF(TM) as a universal cancer marker with a potential market size of $2 billion per year for all cancers. The study included 32 lung cancer patients and 103 normal donors with statistical verification.

[http://www.biospace.com/ccis/news_story.cfm?StoryID=15650520&full=1]
  o   Calculate the number of patients with true negative (TN), true positive (TP), false positive (FP) and false negative (FN) test results in this trial.
  o   What is the positive predictive value in this trial?
  o   Do you think the PPV you calculated in part b is an accurate estimate of what to expect if the test is used to screen the general population for lung cancer? Why or why not?

15. Suppose we have two new screening tests for ovarian cancer – Test A and Test B. When tested in a large population, we find the sensitivity and specificity values for the two tests listed in the table below. Your mother knows that you have taken BME301. She is worried about her risk of ovarian cancer because both her mother and sister died of ovarian cancer at a young age. She asks your advice about which screening test to undergo. Which test would you recommend that she take? Why?

Test	Se	Sp
Test A	60%	95%
Test B	95%	60%

16. Consider the development of a new proteomics based screening test for ovarian cancer described in this chapter. Apply the five steps of technology assessment to this new technology. Does this assessment support the use of the technology?