BME 301   **Name:**_____

Practice Exam 1

February 2, 2004

The exam consists of 10 questions. Show all work to receive credit. Clearly organize your work and draw a box around your final answers. NEATNESS COUNTS! Good Luck!

Problem 1 (5):   _____

Problem 2 (5):   _____

Problem 3 (10):   _____

Problem 4 (20):   _____

Problem 5 (5):   _____

Problem 6 (5):   _____

Problem 7 (5):   _____

Problem 8 (10):   _____

Problem 9: (20):   _____

Problem 10 (15):   _____

Total (100):   _____

1. Explain the difference between *incidence* and *prevalence* of a disease.

2. What is a QALY? How much is our society willing to spend to gain one QALY?

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.

   a. Calculate the annual incidence rate of lung cancer in the US in 2004.

   b. Calculate the mortality rate of lung cancer in the US in 2004.

   c. Why is the mortality rate of lung cancer so high?

4. You have developed a new technology that could detect pre-cancerous cells in the sputum. This technology can enable much earlier detection of lung cancer, reducing the fraction of lung cancer patients that die of their disease from 90% to 15%. Your test costs $100 to perform. Assume that on average, 18 years of life are lost when a person dies of lung cancer. There are 292 million Americans, 140 million of whom are over age 40. There are 173,770 new cases of lung cancer in the United States each year.

    a. How much money would we spend annually if all adults over age 40 were screened with this new test?

    b. Calculate the mortality rate of lung cancer without the use of the new test. Compare this to the expected mortality rate of lung cancer with the use of the new test.

    c. If the new test was used, how many years of life would be gained?

    d. If this test was administered annually to all adults over age 40, how many $ would we spend per year of life gained?

    e. Based on your answer to part d and our discussions in class, do you think this test would be adopted in the developed world? In the developing world? Explain your reasoning.
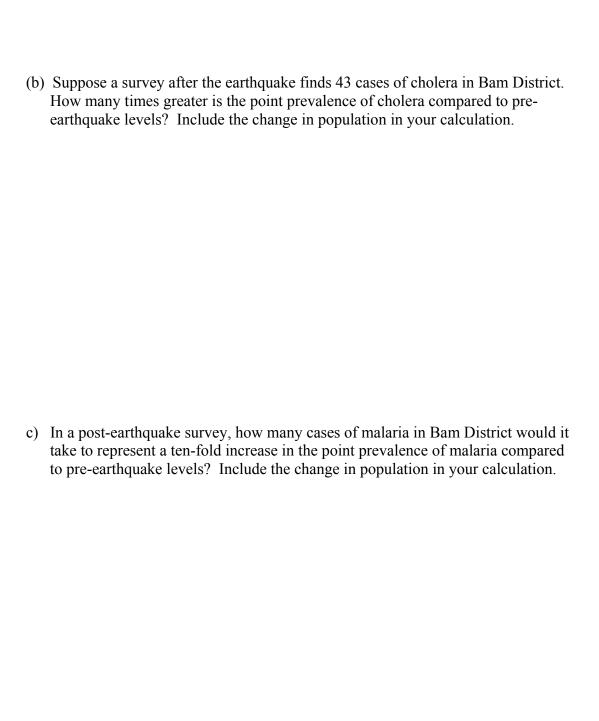
5. For ages 15-44 what are the 3 leading causes of death:

   a) in the developing world:

   b) in the developed world:

6. For ages 45-60 what are the 3 leading causes of death:

   a. in the developing world:

   b. in the developed world:

7. How do air bags work to save lives? How did our demonstration with the egg illustrate this?

8. In the developing and the developed world, heart disease is the leading cause of mortality for persons aged 45-60. Describe the differences in the type of heart disease, its cause and treatments in these two settings.

    a. Type of heart disease

    b. Cause

    c. Treatments

9. The following information is from a World Health Organization report on the reconstruction of health services in Bam, Iran, after the December 2003 earthquake.

    "On Friday 26th of December 2003 at 5:27 a.m. an earthquake with the magnitude of 6.7 on the Richter scale hit the city of Bam. To date more than 31,000 people have been buried, 22,000 are injured, 7,400 seriously injured. In total, the earthquake has destroyed approximately 20,000 homes … Damages to the health facilities are almost total … According to the Ministry of Health's information 50% of the health personnel are dead." The "danger of outbreak of endemic diseases such as cholera, typhoid fever, malaria and leishmaniasis" is listed as a critical current priority.

    The report states that before the earthquake, the total population of Bam District was 240,000. The point prevalence of cholera was 3 in 100,000 population. The point prevalence of malaria was 109.1 in 100,000 population.

    (a) Calculate the approximate number of cases of cholera and malaria in Bam District before the earthquake.

(b) Suppose a survey after the earthquake finds 43 cases of cholera in Bam District. How many times greater is the point prevalence of cholera compared to pre-earthquake levels? Include the change in population in your calculation.

c) In a post-earthquake survey, how many cases of malaria in Bam District would it take to represent a ten-fold increase in the point prevalence of malaria compared to pre-earthquake levels? Include the change in population in your calculation.

10. Use the data in the chart to answer the following questions.

Country	GDP per capita	Life expectancy at birth for males	Total health expenditures per capita	Total health expenditures as % of GDP
United States	$34,637	74.3	$4,499	13%
Canada	$27,956	76.6 years	$2,534	9.1%
India	$1461	60 years	$71	4.9%
Angola	$1457	34.1 years	$52	3.6%

a) Make a graph that shows the <u>life expectancy at birth for males</u> vs. the <u>total health expenditures as a percentage of the GDP</u> for these four countries. Include a title and axis labels.

b) List three reasons that life expectancy is lower in Angola than in Canada and the US.

c) HAART is a highly effective treatment for HIV infection. Do you think that a poor citizen living in each of these four countries would have access to HAART? Why or why not?

EXTRA CREDIT:

1. Is the fish tank in Dr. Richards-Kortum's office a fresh or salt-water tank?

2. What are our TAs' names?

3. What was one of the books that Dr. Richards-Kortum recommended in week 1 Notes from Home?