

Chapter 4 Homework

1. List the four leading causes of death in developed and developing countries for the following age groups:
 - a. Ages 0-4
 - b. Ages 15-44
 - c. Ages 45-59
 - d. Compare the differences in causes of mortality in these settings. What is responsible for the differences?
 - e. Compare the leading causes of morbidity to the leading causes of mortality in each case. What differences do you note?

2. Road traffic accidents are a leading cause of death for young people.
 - a. How do motorcycle helmets work to save lives?
 - b. Why do factors which slow driver reaction time lead to increased crash frequency and crash severity? Name three factors which slow driver reaction times.
 - c. Compare trends in motor vehicle related mortality rates in developed and developing countries over the past ten years. What factors do you think contribute to these differences?

3. Cholera can produce severe diarrhea. The associated fluid loss can lead to dehydration and death if untreated.
 - a. How does cholera produce such severe fluid loss?
 - b. What is oral rehydration therapy and how does it prevent dehydration associated with severe diarrhea?

4. The AIDS pandemic is a worldwide problem. An estimated 40 million people are living with HIV/AIDS and over 20 million deaths have been associated with this disease.
 - a. Which component of the immune system is selectively targeted and destroyed by HIV?
 - b. Sketch a plot showing (1) the viral load and (2) blood count of the cell type specified in part (a), over the time course of the disease. On the plot identify the acute phase of the infection, the latent period, and full-blown AIDS.
 - c. What is the approximate length of the latent period? Can HIV be transmitted during this time?
 - d. Draw a diagram which indicates the process of retrovirus replication inside a human cell.
 - e. Combination drug therapies have been successful in suppressing viral levels. What is the name of the current treatment strategy and why is it so effective?
 - f. There are several potential strategies for preventing retrovirus replication. On your diagram for part d, draw arrows to indicate the three stages targeted in current combination therapies. Name the type of each type of inhibition.
 - g. Discuss the WHO 3x5 initiative and comment on the current progress and challenges associated with this effort.

5. Download "Drug Resistance and Malaria" by Peter Bloland, published by the WHO: <http://www.who.int/csr/resources/publications/drugresist/malaria.pdf>. Using this reference as your guide, answer the following questions.
 - a. According to the report, which species of *Plasmodium* parasites have developed drug resistance
 - b. Which region of the world is experiencing the most significant problem with drug

resistance?

- c. What would be the yearly cost of treating every malaria infection on earth with the least expensive single-agent antimalarial? (Note: use the WHO's low-end estimate of global incidence, and assume that one treatment per patient will suffice)
- d. What is the yearly cost for the least expensive combination therapy?
- e. In one sentence each, describe three strategies to prevent anti-malarial drug resistance.

6. The use of combinations of antiretroviral drugs has proven remarkably effective in controlling the progression of human immunodeficiency virus (HIV) disease and prolonging survival, but these benefits can be compromised by the development of drug resistance. Resistance is the consequence of mutations that emerge in the viral proteins targeted by antiretroviral agents. In the United States, as many as 50 percent of patients receiving antiretroviral therapy are infected with viruses that express resistance to at least one of the available antiretroviral drugs. [*NEJM* 350:1023-35, 2004]. One new technology developed to decrease the development of resistance is described in the following NPR report:

<http://www.npr.org/templates/story/story.php?storyId=5554167>. How might this particular development reduce the risk of drug resistance in the developing and developed world?

7. Access the following CDC Weekly Report: Emergence of *Mycobacterium tuberculosis* with Extensive Resistance to Second-Line Drugs --- Worldwide, 2000—2004
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5511a2.htm>. Answer the questions that follow.

- a. Define MDR and XDR tuberculosis.
- b. In 2004, which two regions of the world had the highest percentage of TB isolates classified as Multi-Drug Resistant?
- c. In 2004, which countries had more MDR isolates classified as XDR than any other?
- d. How does one attempt to treat MDR-TB? (Hint: Refer to the Weekly Report's Editorial Note).

8. The Framingham Heart Study was a monumental project not only for cardiovascular disease, but for all of science, health, and medicine. Answers to the following questions may be found at the study's website: <http://www.nhlbi.nih.gov/about/framingham/>.

- a. What was the initial purpose of the Framingham study?
- b. List 5 definite risk factors for heart disease, and the year in which they were found to be associated with an increased risk.

9. Complete the interactive tutorial on Coronary Artery Bypass Graft (CABG) surgery:

<http://www.nlm.nih.gov/medlineplus/tutorials/coronaryarterybypassgraft/htm/index.htm>

- a. What non-surgical therapies are alternatives to CABG?
- b. What vessels are used to form the "bypass"? What are the specific side effects associated with harvesting these vessels?

10. Cancer is the second leading cause of death in the United States and annually costs the health care system more than 100 billion dollars.

- a. What type of cancer is responsible for the greatest number of deaths worldwide?
- b. Why is the mortality rate so high for this type of cancer?
- c. Describe the stages of malignant tumor formation and metastasis.