CHAPTER 1

Introduction to Epidemiology

LEARNING OBJECTIVES

Upon completion of this chapter, the student will be able to:

- Describe three basic uses of epidemiology.
- Explain how a scientific hypothesis is developed.
- Name the key elements of the scientific method.
- List four basic ethical elements present when conducting research among human populations.
- Describe three major issues relating to research misconduct.

KEY TERMS

- **Agent**: capable of causing an illness
- **Chronic disease**: refers to a disease that is long lasting
- **Determinants**: physical, biological, social, cultural, and behaviors that influence health
- **Distribution**: refers to time, place, and types of persons affected by a particular disease or condition (demographics)
- **Endemic**: the normal occurrence of a disease or condition common to persons within a localized area
- **Epidemic**: refers to a disease or condition that affects a greater than expected (normal) number of individuals within a population, community, or region at the same time
- **Epidemic threshold**: upper end of the normal endemic level of infections
- **Epidemiology**: the study of the distribution (who has the problem) and determinants (things that influence the problem) of health-related conditions in human populations and the application of this method to the control of health problems
- **Etiology**: the biological cause of a problem or disease
- **Health-related states or conditions**: diseases or events that cause illness, death or disability; examples are heart attacks or car accidents that can cause death, illness or disability; conditions that may not cause death, but are important because they cause disability, include autism or arthritis
- **Human subject**: any person that is observed for purposes of research
- **Hypothesis**: a tentative explanation for a scientific problem that can be tested by further investigation
- **Infectious disease**: refers to a contagious or transmissible disease
- **Informed consent**: the subject understands the scope of the study and can make an informed decision to participate
- **Modifiable risk factors**: those that can be changed or eradicated with lifestyle changes
- **Natural history**: the course of a disease if left untreated

- **Null hypothesis**: stated as if there is no relationship between the study factors and the disease
- **Non-modifiable risk factors**: those that cannot be changed or eradicated
- **Pandemic**: an epidemic that has become geographically widespread
- **Plagiarism**: using ideas of others as your own
- **Risk factors**: characteristics associated with disease development

CHAPTER OUTLINE

I. Introduction

II. Uses of Epidemiology
- A. Specialties in Epidemiology

III. Epidemiology and Research
- A. Scientific Method
- B. Hypothesis

IV. Epidemics

V. Historical Milestones in Epidemiology

VI. Ethics in Epidemiology
- A. History
- B. Requirements for Training
- C. Ethical and Practical Obligations
- D. Confidentiality
- E. Research Misconduct

VII. Summary

VIII. *A Closer Look: The Tuskegee Study*

IX. Review Questions

X. Website Resources

XI. References

OVERVIEW

- Learning Outcome 1: Describe three basic uses of epidemiology.
    - *Covered in Uses of Epidemiology*

The three basic uses of epidemiology are to describe disease occurrence, identify the causes of disease, and find factors that increase a person's risk of disease. Epidemiology is also used to describe the extent of disease in a population and the natural history and characteristics of a disease, as well as to evaluate preventive measures and guide policy decisions.

- Learning Outcome 2: Explain how a scientific hypothesis is developed.
    - *Covered in Epidemiology and Research – Hypothesis*

A scientific hypothesis is a tentative explanation for a problem that can be tested by further investigation. Once a scientific hypothesis is developed, there are several steps that are typically completed to conduct the study. First, there is a descriptive analysis of the problem. Then a study is conducted using an appropriate design to test the scientific hypothesis. The approach may vary depending on whether the health problem under study is an acute problem or a chronic problem.

- Learning Outcome 3: Name the key elements of the scientific method.
    - *Covered in Epidemiology and Research – Scientific Method*

The key elements of the scientific method are:
- Determine the primary agent.
- Understand causation.
- Determine the characteristics of the agent.
- Determine the mode of transmission.
- Determine the contributing factors.
- Assess geographic patterns.
- Define natural history.
- Determine the control measures.
- Determine the prevention measures.
- Plan health services.
- Determine the hypothesis (or tentative explanation).

- Learning Outcome 4: List four basic ethical elements present when conducting research among human populations.
    - *Covered in Ethics in Epidemiology – History*

The four basic ethical elements present when conducting research among human populations are:
- Informed consent.
- Respect for persons: autonomy or protection for those with diminished autonomy.
- Beneficence: maximize benefits while minimizing harm.

- Justice: those who receive the benefits of research should share its burden.

- Learning Outcome 5: Describe three major issues relating to research misconduct.
  - *Covered in Ethics in Epidemiology – Research Misconduct*

The three major issues relating to research misconduct are fabrication or falsification of data, plagiarism of other people's ideas, and bias in conducting research or in reviewing the research of other scientists.

ANSWER TO REVIEW QUESTIONS

Correct answers are **bolded**.

1. In one sentence, define epidemiology: **The study of the distribution (who has the problem) and determinants (things that influence the problem) of health-related conditions in human populations and the application of this method to the control of health problems.**

2. Analysis of disease by time, place, and demographics is known as:
   a. **Distribution**
   b. Determinants

3. Physical, biological, social, cultural, and behavior factors that influence health are:
   a. Distribution
   b. **Determinants**

4. Who was the first epidemiologist? **Hippocrates**

5. (T/F) All epidemiologists have the same training and can cover the same content areas, if needed. **False.**

6. Which of the following are examples of plagiarism? (choose all that apply)
   a. **Using a paragraph, word-for-word, from a paper you had previously written and submitted**
   b. **Using a paragraph, word-for-word, from a paper you had previously written and submitted, but cited to the source (although it may be okay if quotes are used)**
   c. Writing new material based on several published sources, with appropriate citations
   d. **Copying a "methods section" from a published source because you are using the same data set and there is no other way to describe it**

7. (T/F) Modifying study results can sometimes be justified if the end product provides benefits for society. **False.**

8. Which of the following ethical guidelines for the protection of human subjects did the Tuskegee study violate?
    a. Voluntary consent.
    b. The degree of risk never outweighs the benefit.
    c. Scientists must always be willing and able to end a study.
    d. **All of the above.**

9. (T/F) An important step in conducting epidemiologic research includes developing a testable hypothesis. **True**.

10. Discuss each of the following situations, describe if the situation requires Human Subjects Review, and note why or why not:
    a. A clinical trial comparing two experimental drugs. **(Yes)**
    b. A retrospective review of medical charts. **(Yes)**
    c. A simple "no risk" questionnaire (e.g., student attitudes toward lectures vs. small group learning). **(Yes)**
    d. Secondary analysis of aggregate census or health data published by a federal agency. **(No)**

11. For Deeper Thought: Three students are working on a group project for a class in criminology. One of the students has previously done work in this area and suggests that the group use a portion of his previous project for the current group project. Because only 75% of the project is new, and the other 25% was originally done for another project, one student thinks the practice is plagiarism while the other two do not. Explain if this is considered plagiarism or not. **Answers will vary, but this is most likely considered plagiarism.**