

Chapter 2

Epidemiology

Learning Objectives

1. Describe the field of epidemiology and define key terms.
2. Identify major events and influences in the development of epidemiology.
3. Explain how the level of development of a nation is linked to its predominant diseases.
4. Illustrate the complexity of most issues studied by epidemiologists.
5. Explain why pandemics pose serious problems for both epidemiologists and populations.

Chapter Outline

Introduction: What Is Epidemiology?

Epidemiological Measures

The Development of Epidemiology

Disease and Modernization

The Complexity of Modern Ills: Heart Disease

Diet

Exercise

Obesity

Pandemics: HIV/AIDS and Influenza

HIV/AIDS

United States

Worldwide

Influenza

Summary

New to this Edition

- Updated infant mortality rates for the U.S.
- Section on obesity and heart disease.
- Discussion of pandemics.
- Updated data on HIV/AIDS prevalence for U.S. and worldwide.
- Section on influenza as a potential pandemic.

Chapter Summary

Introduction

1. Epidemiology is a multi-disciplinary field that studies the origin and distribution of health problems, whether infectious diseases, chronic ailments, or problems resulting from unhealthy behaviors.

Epidemiological Measures

1. Several analytic concepts aid the study of health problems:
 - a. Case: An episode of a disorder, illness, or injury involving a person.

b. **Prevalence:** The total number of cases of a health disorder that exists at any given time. It includes new cases as well as all previously existing cases. Prevalence rates are sometimes expressed as point prevalence (the number of cases at a certain point in time, usually a particular day or week), period prevalence (the total number of cases during a specified period of time, usually a month or year), or lifetime prevalence (the number of people who have had the health problem at least once during their lifetime).

c. **Incidence:** Refers to the number of new cases of a specific health disorder occurring within a given population during a stated period of time. Distinguished from prevalence as the rate at which cases first appear, while prevalence is the rate at which all cases exist.

d. **Crude rate:** The number of persons (cases) who have the characteristics being measured during a specific unit of time. Typical types of crude rates are birth rates and mortality rates.

e. **Age-adjusted rate:** This is a more specific measure than crude rates and shows differences by age in the distribution of health problems. The infant mortality rate, a measure of the deaths of all infants in a geographical area under the age of one year, is a common age-specific rate in epidemiology and often used as an approximate indicator of a society's standard of living. Similar rates can be constructed to examine the effects of other specific variables or social characteristics within a population such as sex, race, occupation, or any other measure of significant social differences.

The Development of Epidemiology

1. Epidemics only began to affect human populations as trade between regions increased and as humans began moving in greater proportion into cities, which were initially crowded and unsanitary.

2. Bubonic plague, which affected Europe between 1340 and 1750, was one of the worst epidemics in human history and killed approximately one-third of the European population. At the time, transmission of the disease was not well understood but some individuals did observe that fewer of the wealthy class died from it (evidence of social patterning in the distribution of disease).

3. John Snow's famous investigations into cholera outbreaks in London are usually treated as providing the foundation of modern epidemiological methods. He systematically mapped out cases of infection, interviewed victims, and traced their daily activities to a common source: contaminated water pumps.

4. Today diseases are understood to be caused by several classes of agents: (1) biological agents, such as bacteria, viruses, or insects; (2) nutritional agents, such as fats and carbohydrates as producers of cholesterol; (3) chemical agents, such as gases and toxic chemicals that pollute the air, water, and land; (4) physical agents, such as climate or vegetation; and (5) social agents, such as occupation, social class, location of residence, or lifestyle.

5. The term *social environment* in epidemiological research refers to actual living conditions, such as poverty or crowding, and also the norms, values, and attitudes that reflect a particular social and cultural context of living. What a person does, who a person is, and where a person lives can specify what health hazards are most likely to exist in that individual's life.
6. The field of epidemiology has passed through three stages and is entering a fourth:
 - a. *Sanitary era* (early 19th century) - focus was largely on sewage and drainage systems, and the major preventive measure was the introduction of sanitation programs.
 - b. *Infectious disease era* (late 19th to mid-20th century) - principal preventive approach was to break the chain of transmission between the agent and the host.
 - c. *Chronic disease era* (mid- to late 20th century) - focus was on controlling risk factors by modifying lifestyles, agents, or the environment.
 - d. *Eco-epidemiology* (21st century) - preventive measures are multidisciplinary as scientists from many fields use their techniques to deal with a variety of health problems at the molecular, social behavioral, population, and global levels.

Disease and Modernization

1. The health profiles of industrialized societies are different from those of developing countries. As a country modernizes, it is typically accompanied by: (1) a fall in mortality from infectious diseases and parasitic disorders; (2) declines in other diseases of the digestive and respiratory systems with a communicable component; (3) increases in life expectancy and declines in infant mortality; and (4) increases in mortality from heart disease, cancer, and other physical ailments associated with modern living.

The Complexity of Modern Ills: Heart Disease

1. Heart disease represents an example of the complexity of modern health problems as multiple factors contribute to the risk of developing heart disease by pathways not yet fully understood.
2. Sex (specifically male), advancing age, high blood pressure, cigarette smoking, diabetes, and obesity constitute significant risk factors in whether a person develops heart disease. Studies suggest that not smoking; consuming diets low in saturated fat and cholesterol; receiving adequate, moderately vigorous, leisure-time physical activity; and maintaining a healthy weight are important to lowering risk of heart disease.

Pandemics: HIV/AIDS and Influenza

1. Pandemics are distinguished from epidemics by their widespread nature, affecting not only the countries of one region but multiple regions and continents in the world.
2. HIV/AIDS is an especially lethal pandemic that has killed millions in the approximately 30 years since its appearance. The disease carries widespread social implications, since transmission is firmly rooted in social behaviors and has influenced changing norms, values, sex habits, and lifestyles throughout the world.
3. Its appearance in the U.S. in 1979 represented a significant epidemiological puzzle: first in determining what the new disease was, then in how it was transmitted and where it originated.

4. In the United States, CDC data for adult and adolescent males living with HIV/AIDS at the end of 2007 show that 64 percent of all cases reported were homosexual and bisexual men, 16 percent were IV drug users, and 7 percent were homosexuals and IV drug users. Of the remaining male HIV/AIDS cases, 12 percent resulted from heterosexual contacts and 1 percent from other causes like blood transfusions. For adult and adolescent females, the majority of HIV/AIDS cases—some 72 percent—are from heterosexual contact with infected males. Another 26 percent of females are infected from IV drug use and 2 percent from other sources.
5. Between 1984 and 2007, the total number of AIDS cases in the United States rose from nearly 5,000 to 1,051,875. Some 60 percent died. However, 1995 was the peak year for AIDS mortality as the number of deaths fell from 49,895 that year to 37,221 in 1996, dropped even further to 14,215 in 1999, and stood at 14,561 in 2007. See Table 2-2 (page 39) for the mortality rates for AIDS by gender and race for three selected years: 1987, 1995, and 2006.
6. Africa (estimated 33.4 million cases), especially south of the Sahara, has been hard-hit by AIDS. High rates in countries such as Swaziland have resulted in drastically declining life expectancy. The predominant mode of transmission is very different from North America and Europe, occurring mostly through heterosexual relations, with a system of migrant labor that spreads disease from urban areas to rural playing a major role. The reduced social power of women creates a vulnerable population, with women accounting for 60% of cases.
7. Western Europe (850,000 cases) and Eastern Europe (1.5 million cases) follow similar patterns of transmission as North America.
8. Asia (South/Southeast Asia, 3.8 million cases; East Asia and China, 850,000 cases) follows similar patterns of transmission as Africa, with migrant labor populations, long-distance transportation, and prostitution serving as the primary pathway in places such as Thailand and India. AIDS first appeared in China among IV-drug users.
9. In Latin America (2.0 million cases) and the Caribbean (230,000 cases), AIDS was originally spread through homosexual activity and drug use, but now bisexual activity by men is spreading the disease to women.
10. The sociological implications of the AIDS epidemic are enormous and involve not only the widespread modification of sexual behavior but also the deeply discrediting stigma attached to AIDS victims, the social rejection of AIDS patients, the subjective distress associated with becoming an AIDS patient, and the moral and religious debate centering on AIDS as a punishment for a deviant lifestyle.
11. Influenza represents the threat of a pandemic. Past outbreaks, such as 1918 “Spanish flu,” have killed millions worldwide. Recent outbreaks of H1N1 (“swine flu”) and H5N1 (“avian flu”) have the potential to become especially serious pandemics if the virus mutates to enable it to spread more easily. Predicting outbreaks of influenza and controlling the spread of infection remain challenging for epidemiologists.

Key Terms

Epidemiology – The study of both the origin and distribution of health problems (whether infectious, chronic, or resulting from unhealthy behaviors) in a population, through the collection of data from many different sources.

Case – An episode of a disorder, illness, or injury involving a person.

Prevalence – The total number of cases of a health disorder that exists at any given time.

Point prevalence – The number of cases at a certain point in time, usually a particular day or week.

Period prevalence – The total number of cases during a specified period of time, usually a month or year.

Lifetime prevalence – The number of people who have had the health problem at least once during their lifetime.

Incidence – The number of new cases of a specific health disorder occurring within a given population during a stated period of time.

Crude rate – The number of persons (cases) who have the characteristics being measured during a specific unit of time.

Mortality rate – A measure, usually annual, computed by using the number of deaths in that year as the numerator and the total number of residents in a specific population as the denominator.

Age-specific rates – A type of rate used to show differences by age. Age-specific rates are computed in the same way as crude rates, except the numerator and the denominator are confined to a specific age group.

Infant mortality rate – A measure of the deaths of all infants in a geographical area under the age of one year. It is traditionally used as an approximate indicator of a society's standard of living and quality of health care delivery.

Causal agents – One of several types of substances or conditions, which contact with may lead to infection. The five types are: (1) biological agents; (2) nutritional agents; (3) chemical agents; (4) physical agents; and (5) social agents.

Social environment – Refers to actual living conditions, such as poverty or crowding, and also the norms, values, and attitudes that reflect a particular social and cultural context of living

Pandemic – An epidemic that has spread across multiple regions and continents in the world.

Discussion Questions

1. John Snow's investigations set the stage for modern epidemiology. What did he do and how was it different from previous approaches to understanding diseases?
2. How does the transition from infectious diseases to chronic ailments change epidemiological investigations? Use the examples of heart disease and HIV/AIDS to illustrate.
3. What are the primary modes of transmission of HIV/AIDS around the world? Discuss the social factors influencing how this disease is spread.