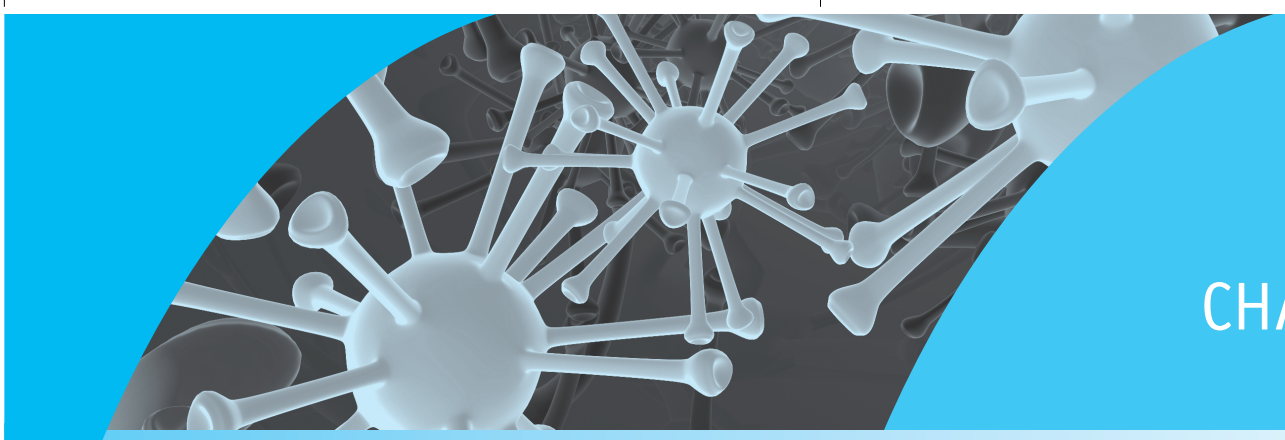


CHAPTER 4

Descriptive Epidemiology: Patterns of Disease—Person, Place, Time

Learning Objectives

By the end of this chapter you will be able to:

- Define the term **descriptive epidemiology**
- Discuss types of descriptive epidemiologic studies and their uses
- Describe the process of epidemiologic inference in the context of descriptive epidemiology
- Give two examples each of person, place, and time variables and describe how they relate to the distribution of health outcomes

CHAPTER OUTLINE

INTRODUCTION

Human health and disease are unequally distributed throughout populations. This generalization applies to differences among population groups subdivided according to age and other demographic characteristics, among different countries, within a single country, and over time. When specific diseases, adverse health outcomes, or other health characteristics are more prevalent among one group than among another, or more prevalent in one country than in another, the logical question that follows is "Why?" To answer the question "Why," one must consider "three Ws"—Who was affected? Where did the event occur? When did the event occur?

TABLE 4-1 List of Important Terms Used in This Chapter

Descriptive epidemiology	Major descriptive epidemiologic variables		
Study design terms	**Person**	**Place**	**Time**
Cross-sectional study	Age	International	Cyclic fluctuation
Descriptive epidemiologic study	Race	Localized/spatial clustering	Point epidemic
Descriptive epidemiology	Sex	Urban-rural	Secular trends
Hypothesis	Socioeconomic status	Within country	Temporal clustering

The field of **descriptive epidemiology** classifies the occurrence of disease according to the variables of person (who is affected), place (where the condition occurs), and time (when and over what time period the condition has occurred). A **descriptive epidemiologic study** is one that is "... concerned with characterizing the amount and distribution of health and disease within a population."[1(p654)] Descriptive epidemiology provides valuable information for the prevention of disease, design of interventions, and conduct of additional research. Descriptive epidemiologic studies set the stage for more focused investigations into questions raised. Such investigations include evaluating observed trends, planning for needed services, and launching more complex research. This chapter covers the three major descriptive variables and then explores how they are used in descriptive epidemiologic studies. Table 4-1 lists the terms related to descriptive epidemiology and subcategories of variables that make up person, place, and time.

Consider the example of a descriptive epidemiologic study of children who were exclusively breastfed. The practice of breastfeeding has been recommended for reinforcing the health of babies and mothers and promoting mother-child bonding. Table 4-2 provides the characteristics (a descriptive epidemiologic statement) of babies who were breastfed. Note that the table shows person variables: sex and race/ethnicity (of child) and the mother's age, education, marital status, and socioeconomic status (as measured by income-to-poverty ratio). A place variable (location of residence of mother) is shown also.

What conclusions can you infer from this example? The table indicates that approximately 30% of infants in the United States are breastfed exclusively through three months of age and that the percentage drops to about 11% through the age of six months. Other observations include the following: non-Hispanic black mothers tend to engage in breastfeeding less often than other racial/ethnic groups and lower frequencies of breastfeeding occur among women (in comparison with the rest of the study population) who are younger, have lower levels of education and income, and are unmarried. The reader may want to speculate as to the reasons for the results that are displayed and develop hypotheses for interventions to increase breastfeeding.

USES OF DESCRIPTIVE EPIDEMIOLOGIC STUDIES

As you may have inferred from the foregoing example, descriptive epidemiologic studies aid in the realization of the following general aims, which are shown in the text box.

Aims of descriptive epidemiology

1. permit evaluation of trends in health and disease
2. provide a basis for planning, provision, and evaluation of health services
3. identify problems to be studied by analytic methods and suggest areas that may be fruitful for investigation

Source: Adapted from Friis RH, Sellers TA. *Epidemiology for Public Health Practice.* 4th ed. Sudbury, MA: Jones and Bartlett Publishers; 2009:143.

Permit Evaluation of Trends in Health and Disease

This objective includes monitoring of known diseases as well as the identification of emerging problems. Comparisons are made among population groups, geographical areas, and time periods. In the breastfeeding example, investigators reported that infants who resided in metropolitan areas were breastfed more frequently than infants who resided outside of metropolitan areas; in addition, infants from families with lower income levels (less than 100% of the income-to-poverty ratio) were breastfed less frequently than infants from families with higher income levels. These findings highlighted the relationships between the frequency of breastfeeding and both residential locations and income levels as potential emerging problems.

Provide a Basis for Planning, Provision, and Evaluation of Health Services

Data needed for efficient allocation of resources often come from descriptive epidemiologic studies. The breastfeeding example demonstrated that race (non-Hispanic African Americans), age of mother (mothers who were younger than 20 years of age), and marital status (unmarried) were associated with lower frequency of breastfeeding. An implication of this descriptive study is that an intervention program to increase the frequency of breastfeeding might target pregnant, unmarried, younger African American women.

Identify Problems to Be Studied by Analytic Methods and Suggest Areas That May Be Fruitful for Investigation

Among the phenomena identified by the breastfeeding study was a reduction in breastfeeding after infants reached three months

TABLE 4-2 Estimated Percentage of Infants Born in 2004 Who Were Exclusively Breastfed* through Ages 3 and 6 Months, by Selected Sociodemographic Characteristics—National Immunization Survey, United States

	Exclusive breastfeeding through age 3 mos		Exclusive breastfeeding through age 6 mos	
Characteristic	**(%)**	**(95% CI[§])**	**(%)**	**(95% CI)**
U.S. overall (N = 17,654[†])	**(30.5)**	**(29.4–31.6)**	**(11.3)**	**(10.5–12.1)**
Sex				
Male	(30.7)	(29.1–32.3)	(10.8)	(9.8–11.8)
Female[¶]	(30.3)	(28.7–31.9)	(11.7)	(10.5–12.9)
Race/Ethnicity (child)				
Hispanic	(30.8)	(28.3–33.3)	(11.5)	(9.7–13.3)
White, non-Hispanic[¶]	(33.0)	(31.6–34.4)	(11.8)	(10.9–12.7)
Black, non-Hispanic	(19.8)**	(17.0–22.6)	(7.3)**	(5.5–9.1)
Asian, non-Hispanic	(30.6)	(25.0–36.2)	(14.5)	(10.0–19.0)
Other race, non-Hispanic[††]	(29.3)	(24.9–33.7)	(12.2)	(9.2–15.2)
Age of mother at child's birth (yrs)				
<20	(16.8)**	(10.3–23.3)	(6.1)**	(1.5–10.7)
20–29	(26.2)**	(24.4–28.0)	(8.4)**	(7.3–9.5)
≥30[¶]	(34.6)	(33.2–36.0)	(13.8)	(12.7–14.9)
Education				
Less than high school	(23.9)**	(21.0–26.8)	(9.1)**	(7.1–11.1)
High school	(22.9)**	(20.9–24.9)	(8.2)**	(7.0–9.4)
Some college	(32.8)**	(30.3–35.3)	(12.3)**	(10.2–14.4)
College graduate[¶]	(41.5)	(39.7–43.3)	(15.4)	(14.1–16.7)
Marital status				
Married[¶]	(35.4)	(34.0–36.8)	(13.4)	(12.4–14.4)
Unmarried	(18.8)**	(16.9–20.7)	(6.1)**	(5.0–7.2)
Residence				
MSA,[§§] central city[¶]	(30.7)	(29.0–32.4)	(11.7)	(10.5–12.9)
MSA, non-central city	(32.8)	(30.9–34.7)	(12.1)	(10.8–13.4)
Non-MSA	(23.9)**	(21.8–26.0)	(8.2)**	(6.9–9.5)
Income-to-poverty ratio (%)[¶¶]				
<100	(23.9)**	(21.6–26.2)	(8.3)**	(6.9–9.7)
100–184	(26.6)**	(23.8–29.4)	(8.9)**	(7.2–10.6)
185–349	(33.2)**	(30.9–35.5)	(11.8)**	(10.3–13.3)
≥350[¶]	(37.7)	(35.7–39.7)	(14.0)	(12.6–15.4)

*Defined as an infant receiving only breast milk and no other liquids or solids except for drops or syrups consisting of vitamins, minerals, or medicines.
[†]Weighted sample.
[§]Confidence interval. [This term is defined in Chapter 5.]
[¶]Referent group.
**$p < 0.05$ by chi-square test, compared with the referent group.
[††]Includes American Indian/Alaska Native, Native Hawaiian, other Pacific Islander, and multiple race.
[§§]Metropolitan statistical area, defined by the U.S. Census Bureau.
[¶¶]Ratio of self-reported family income to the federal threshold value, defined by the U.S. Census Bureau.
Source: Reprinted from Centers for Disease Control and Prevention. Breastfeeding trends and updated national health objectives for exclusive breastfeeding—United States, birth years 2000–2004. *MMWR*. 2007;56:762.

of age. This observation raises the question: "What caused the drop-off in breastfeeding?" You might hypothesize that when mothers return to work or other activities, breastfeeding becomes inconvenient. You might be able to think of many other hypotheses as well. The next step would be to design a more complex study—an analytic study to explore the hypotheses that have been raised. Examples of these studies are case-control, cohort, and experimental designs (covered in Chapter 6).

TYPES OF DESCRIPTIVE EPIDEMIOLOGIC STUDIES

Three of the types of descriptive epidemiologic studies are individual case reports, case series, and cross-sectional studies (e.g., a survey of a population). Case reports and case series are among the most basic types of descriptive studies.

Case Reports

Case reports are accounts of a single occurrence of a noteworthy health-related incident or small collection of such events. Here is an example of case reports that pertain to cosmetic surgery and related procedures that are typically (but not invariably) performed on healthy individuals. The use of cosmetic procedures to enhance beauty is becoming increasingly popular in many parts of the United States among all classes of people, no longer just affluent VIPs. Sometimes these procedures, which are often invasive, incur the risk of serious complications or even death.

The Centers for Disease Control and Prevention (CDC) published three case reports of women who developed adverse reactions (acute kidney failure) to injections of cosmetic soft-tissue fillers, which are substances used to improve the appearance of bodily areas such as lips and buttocks. The injections were administered by an unlicensed and unsupervised practitioner at the same clinic (facility A) in North Carolina:[2]

> "**Case 1.** On December 8, 2007, a District of Columbia woman aged 42 years, who was previously healthy except for a history of anemia, received cosmetic soft-tissue filler injections in her buttocks at facility A. . . . The woman experienced headache and vomiting within 30 minutes of these injections and noted that her urine looked like purple blood."[2(p453)] The woman was diagnosed with acute renal failure and required a 10-day stay in the hospital.
>
> "**Case 2.** On December 8, 2007, a previously healthy Illinois woman aged 26 years received cosmetic soft-tissue filler injections in her buttocks at facility A."[2(p453)] The patient also was diagnosed with acute renal failure and required 13 days of hospitalization and 5 weeks of hemodialysis.
>
> "**Case 3.** A previously healthy Maryland woman aged 26 years received soft-tissue filler injections in her buttocks at facility A on December 8, 2007, and again on December 22."[2(p454)] Afterwards, the patient became ill and required a two-week hospital stay and hemodialysis.
>
> Follow-up interviews, investigations, and inspections of facility A were conducted. Subsequently, the Guilford County (North Carolina) Health Director mandated that facility A cease administration of all injections and initiated legal action against the unlicensed practitioner.

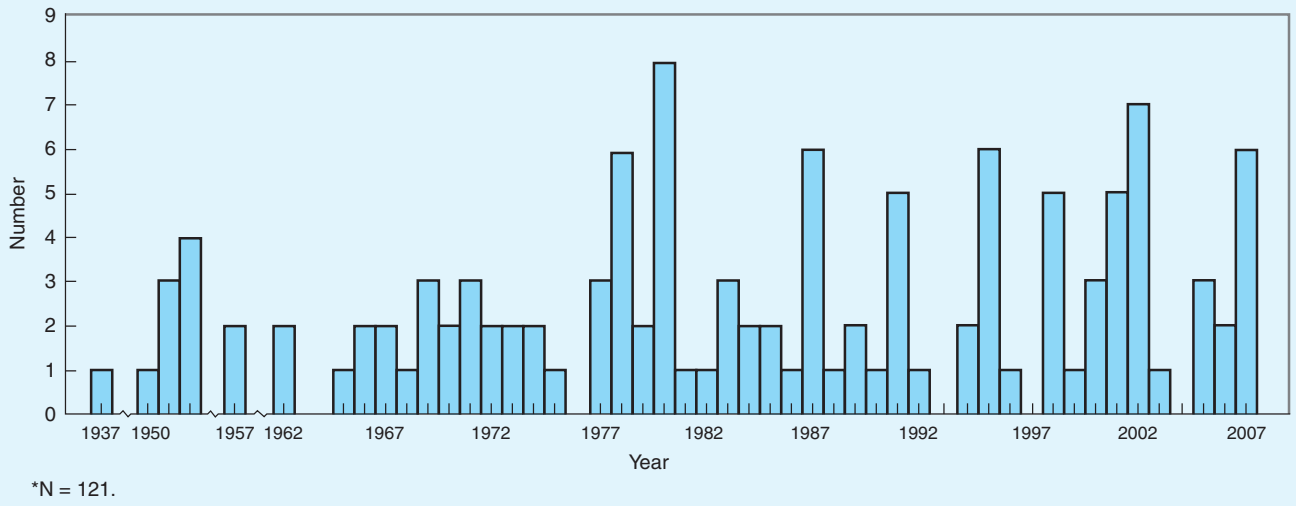
Case Series

In comparison with a case report, a case series is a larger collection of cases of disease, often grouped consecutively and listing common features such as the characteristics of affected patients. For example, Chapter 2 presented information on primary amebic meningoencephalitis (PAM), a disease that is caused by infection with *Naegleria fowleri* and that has a high case fatality rate. The *Naegleria* workgroup (formed by the CDC and the Council of State and Territorial Epidemiologists) reviewed all cases of PAM that were reported in the United States between 1937 and 2007. Preliminary findings were that a total of 121 cases occurred during the approximately 70-year time period. The largest number of cases reported in any one year (2007) was six. About 93% of the persons afflicted were male (median age = 12 years). The primary exposure source was described as freshwater (untreated and warm) in lakes and rivers.[3] Figure 4-1 demonstrates the number of PAM cases distributed according to the year in which they were reported.

Cross-Sectional Studies

More complex than case reports and case series are **cross-sectional studies**. This type of investigation is defined as one ". . . that examines the relationship between diseases (or other health-related characteristics) and other variables of interest as they exist in a defined population at one particular time. The presence or absence of disease and the presence or absence of the other variables . . . are determined in each member of the study population or in a representative sample at one particular time."[4] Thus, a cross-sectional study is a type of prevalence study in which exposures and distributions of disease are determined at the same time, although it is not imperative for the study to include both exposure and disease. A cross-sectional study may focus only on the latter.[1] Cross-sectional designs make a one-time assessment (similar to a snapshot) of the prevalence of disease in a study group that in most situations has been sampled randomly from the parent population of interest. As is true of descriptive studies in general, cross-sectional studies may be used to formulate hypotheses that can be followed up in analytic studies.

FIGURE 4-1 Number* of identified cases of primary amebic meningoencephalitis (PAM)—United States, 1937–2007.



*N = 121.

Source: Reprinted from Centers for Disease Control and Prevention. Primary amebic meningoencephalitis—Arizona, Florida, and Texas, 2007. *MMWR.* 2008;57:575.

Here is an example of a cross-sectional study: The Behavioral Risk Factor Surveillance System (BRFSS) conducts an ongoing survey of civilian, noninstitutionalized U.S. residents aged 18 years and older. (Refer also to Chapter 3.) The 2006 survey examined the problem of chronic sleep loss in four states (Delaware, Hawaii, New York, and Rhode Island). The survey question was: "During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?" Responses were coded according to the following schema (0 days, 1–6 days, 7–13 days, 14–20 days, 21–29 days, and 30 days). Table 4-3 presents the results distributed according to the variables of race/ethnicity, age group, sex, education level, and employment status.

Overall, Table 4-3 shows that approximately 10% of the sample reported 30 or more days of insufficient rest or sleep. Those who were more likely to report insufficient rest or sleep were younger and unable to work. About one-third of the sample reported having no days of insufficient rest or sleep; related factors were older age, retired status, and higher levels of education.

Epidemiologic Inferences from Descriptive Data

Descriptive epidemiology and descriptive studies provide a basis for generating hypotheses; thus studies of this type connect intimately with the process of epidemiologic inference. The process of inference in descriptive epidemiology refers to drawing conclusions about the nature of exposures and health outcomes and formulating hypotheses to be tested in analytic research. Figure 4-2 illustrates the process of epidemiologic inference.

Refer to the figure's center panel, which suggests that epidemiologic inference is initiated with observations. The observation(s) made in descriptive epidemiology (left-hand panel) culminate in hypotheses. As discussed previously, descriptive epidemiology aims to characterize health phenomena according to person, place, and time (who, where, and when). This process involves quantifying the findings (how many cases) and providing insights into what happened. After conducting a descriptive study, the epidemiologist must evaluate the findings carefully in order to rule out chance factors, biases, and confounding. (These terms are discussed in Chapter 6.) The right-hand panel is titled "analytic epidemiology," which is concerned with testing hypotheses in order to answer the questions "why?" and "how?"

PERSON VARIABLES

Examples of person variables covered in this chapter are age, sex, race, and socioeconomic status. Other person variables include marital status, nativity (place of origin), migration, and religion.

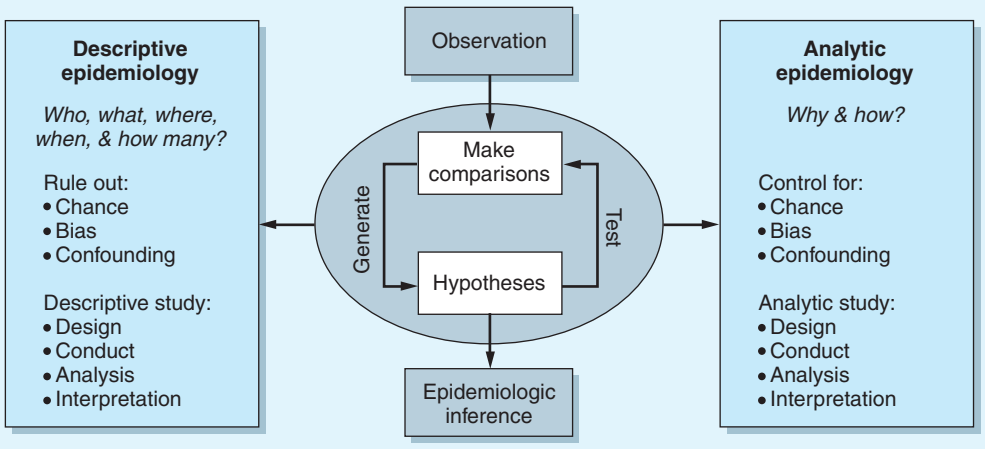
TABLE 4-3 Percentage of Adults Who Reported Insufficient Rest or Sleep during the Preceding 30 Days,* by Number of Days and Selected Sociodemographic Characteristics—Behavior[al] Risk Factor Surveillance System, Delaware, Hawaii, New York, and Rhode Island, 2006

	0 days		1-6 days		7-13 days		14-20 days		21-29 days		30 days	
Characteristic	%	(95% CI†)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
State (unweighted sample size)												
Delaware (n = 3,876)	27.7	(25.9–29.7)	32.9	(30.8–35.1)	12.6	(11.2–14.3)	11.2	(9.8–12.8)	1.5	(1.1–2.1)	14.0	(12.2–16.0)
Hawaii (n = 6,077)	38.4	(36.7–40.1)	29.8	(28.2–31.4)	11.1	(10.0–12.2)	10.3	(9.2–11.4)	1.7	(1.3–2.2)	8.8	(7.9–9.8)
New York (n = 5,293)	29.2	(27.6–30.9)	32.9	(31.2–34.6)	13.0	(11.8–14.3)	12.3	(11.1–13.6)	2.7	(2.2–3.3)	9.9	(8.9–11.1)
Rhode Island (n = 4,343)	27.7	(26.1–29.4)	31.6	(29.7–33.5)	13.3	(11.9–14.9)	12.9	(11.5–14.4)	2.6	(2.0–3.4)	11.9	(10.7–13.3)
Age group (yrs)												
18-34 (n = 3,147)	21.9	(18.9–25.3)	27.8	(24.6–31.2)	16.5	(14.0–19.3)	17.1	(14.5–20.1)	3.4	(2.3–4.9)	13.3	(11.1–15.9)
35-44 (n = 3,505)	20.9	(18.1–23.9)	38.2	(34.9–41.6)	13.5	(11.6–15.7)	14.0	(12.0–16.3)	3.4	(2.5–4.7)	10.0	(8.2–12.0)
45-54 (n = 4,195)	26.2	(23.6–29.1)	36.0	(33.2–38.9)	14.4	(12.5–16.5)	11.3	(9.7–13.2)	2.1	(1.4–3.2)	10.0	(8.3–11.9)
≥55 (n = 8,742)	44.7	(42.7–46.7)	31.7	(29.9–33.7)	8.1	(7.1–9.2)	6.6	(5.7–7.7)	1.5	(1.1–2.1)	7.3	(6.3–8.4)
Race/Ethnicity												
White, non-Hispanic (n = 13,258)	28.2	(26.8–29.7)	33.0	(31.5–34.5)	13.7	(12.6–14.9)	12.7	(11.6–13.9)	2.7	(2.2–3.3)	9.7	(8.7–10.8)
Black, non-Hispanic (n = 1,006)	27.1	(22.7–32.1)	32.5	(27.5–38.0)	13.4	(10.1–17.6)	13.9	(9.9–19.0)	—§	—	11.4	(8.3–15.4)
Hispanic (n = 1,258)	33.7	(28.6–39.2)	32.3	(27.2–37.8)	9.8	(7.3–13.0)	9.7	(6.7–13.8)	—	—	11.6	(8.6–15.4)
Other, non-Hispanic¶ (n = 4,067)	33.8	(29.4–38.5)	31.2	(26.8–36.0)	12.1	(9.0–16.0)	11.1	(8.5–14.5)	2.2	(1.3–3.8)	9.5	(7.2–12.6)
Sex												
Men (n = 7,598)	31.1	(28.8–33.4)	34.6	(32.2–37.0)	11.5	(10.1–13.1)	11.2	(9.8–12.9)	2.7	(2.0–3.7)	8.9	(7.6–10.5)
Women (n = 11,991)	28.3	(26.7–30.0)	30.8	(29.1–32.5)	14.2	(12.9–15.6)	13.1	(11.6–14.6)	2.5	(2.0–3.1)	11.2	(10.0–12.6)
Employment status												
Employed (n = 11,610)	24.0	(22.3–25.7)	37.2	(35.3–39.2)	13.7	(12.5–15.0)	12.4	(11.2–13.8)	2.8	(2.2–3.5)	9.9	(8.8–11.2)
Unemployed (n = 706)	32.9	(26.0–40.6)	27.5	(21.6–34.3)	9.5	(6.1–14.4)	14.7	(9.4–22.3)	—	—	12.8	(8.7–18.5)
Retired (n = 4,781)	53.5	(50.8–56.1)	28.9	(26.6–31.4)	5.9	(4.8–7.3)	4.9	(3.9–6.1)	1.2	(0.8–1.9)	5.5	(4.4–6.9)
Unable to work (n = 968)	24.6	(19.4–30.7)	15.1	(11.3–20.0)	13.6	(9.3–19.4)	17.7	(13.4–23.1)	—	—	24.8	(19.6–30.8)
Other** (n = 1,524)	28.1	(23.8–33.0)	23.1	(19.1–27.8)	18.8	(14.7–23.6)	16.6	(12.8–21.3)	2.8	(1.7–4.5)	10.6	(7.7–14.3)

Education level												
<High school diploma or GED[††] (n = 1,461)	39.7	(34.0–45.7)	27.8	(22.4–34.0)	9.8	(7.2–13.2)	10.1	(7.1–14.3)	—	—	10.4	(7.9–13.7)
High school diploma or GED (n = 5,565)	33.4	(30.8–36.1)	29.6	(26.9–32.5)	10.7	(9.0–12.7)	10.9	(9.1–13.0)	3.5	(2.4–5.2)	11.9	(10.0–14.0)
Some college or college graduate (n = 12,563)	26.3	(24.6–28.0)	34.7	(33.0–36.5)	14.4	(13.1–15.8)	13.1	(11.8–14.5)	2.2	(1.8–2.7)	9.3	(8.2–10.6)
Total (N = 19,589)	**29.6**	**(28.2–31.0)**	**32.6**	**(31.2–34.1)**	**12.9**	**(11.9–14.0)**	**12.2**	**(11.2–13.3)**	**2.6**	**(2.1–3.1)**	**10.1**	**(9.2–11.1)**

*Determined by response to the question, "During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?"
[†]Confidence interval.
[§]No estimate calculated (n < 50).
[¶]Asian, Hawaiian or other Pacific Islander, American Indian/Alaska Native, or multiracial.
**Homemaker or student.
[††]General Educational Development certificate.
Source: Reprinted from Centers for Disease Control and Prevention. Perceived insufficient rest or sleep—four states, 2006. *MMWR*. 2008;57:202.

FIGURE 4-2 Process of epidemiologic inference (how epidemiologists think about data).

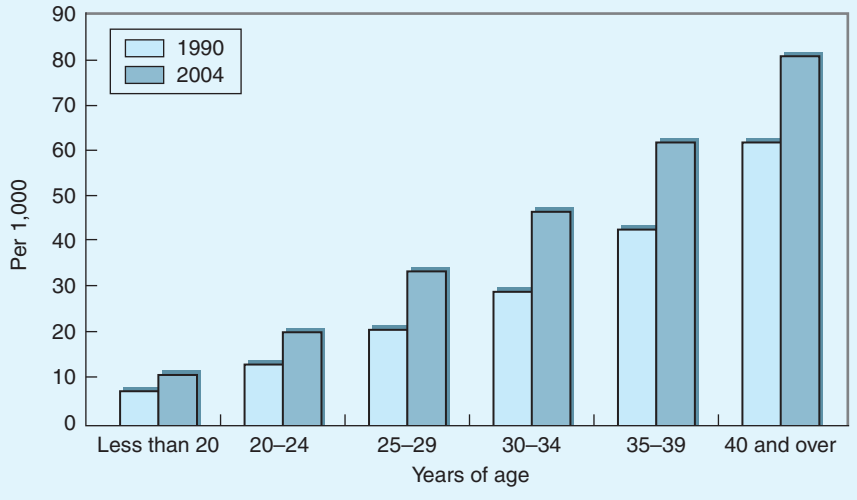


Source: Reprinted with permission from Aragón T. *Descriptive epidemiology: Describing findings and generating hypotheses.* Center for Infectious Disease Preparedness, UC Berkeley School of Public Health. Available at: http://www.idready.org/slides/feb_descriptive.pdf. Accessed August 16, 2008.

Age

Age is perhaps the most important factor to consider when one is describing the occurrence of virtually any disease or illness because age-specific disease rates usually show greater variation than rates defined by almost any other personal attribute. (For this reason, public health professionals often use age-specific rates when comparing the disease burden among populations.) As age increases, overall mortality increases as do the incidence of and mortality from many chronic diseases. For example, in the United States in 2005, age-specific death rates for malignant neoplasms (cancers) demonstrated substantial age-related increases, from 2.5 per 100,000 population at ages 5 to 14 years to 1,637.7 cases per 100,000 at age 85 years and older.

FIGURE 4-3 Diabetes rates by age of mother: United States, 1990 and 2004.



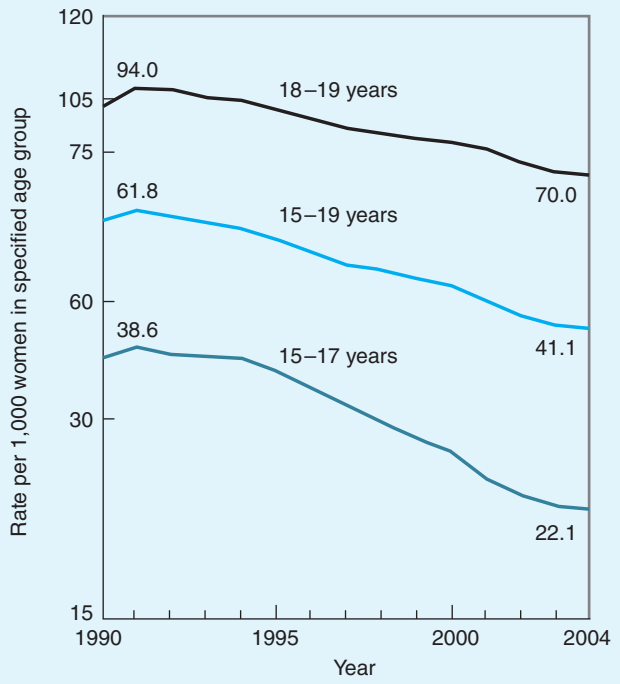
Source: Reprinted from JA Martin, BE Hamilton, PD Sutton, et al. Births: Final Data for 2004. *National vital statistics reports*; vol 55 no 1. Hyattsville, MD: National Center for Health Statistics; 2006:15.

The causes of morbidity and mortality differ according to stage of life. During childhood among unvaccinated persons, infectious diseases such as mumps and chickenpox occur most commonly. Teenagers are affected by unintentional injuries, violence, and substance abuse. Among younger adults, unintentional injury is the leading cause of death. And finally, among older adults, morbidity and mortality from chronic diseases such as heart disease and cancer take hold.

Another example of age association is the relationship between age of mother and rates of diabetes, which increases the risk of complications of pregnancy. Mothers who give birth when they are older have higher rates of diabetes than mothers who give birth at younger ages. (Refer to Figure 4-3.) In 1990, the rate of diabetes among mothers younger than 20 was less than 10 per 1,000 births. In comparison, the rate was more than six times as high among mothers who were aged 40 years and older. By 2004, the corresponding rates had increased to about 10 per 1,000 and 80 per 1,000, respectively.

A final illustration concerns age differences in birth rates for teenage mothers. In 2004, the overall teenage birth rate was 41.1 per 1,000 women aged 15 to 19 years. The birth rate (22.1 per 1,000) was lower for teenagers aged 15 to 17 years than the rate (70.0 per 1,000 women) for older teenagers aged 18 to 19 years. (See Figure 4-4.) Between 1990 and 2004, the teenage birth rate tended to decline.

FIGURE 4-4 Birth rates for teenagers: United States, 1990–2004.



Note: Rates are plotted on a log scale.

Source: Reprinted from JA Martin, BE Hamilton, PD Sutton, et al. Births: Final Data for 2004. *National vital statistics reports*; vol 55 no 1. Hyattsville, MD: National Center for Health Statistics; 2006:6.

Sex

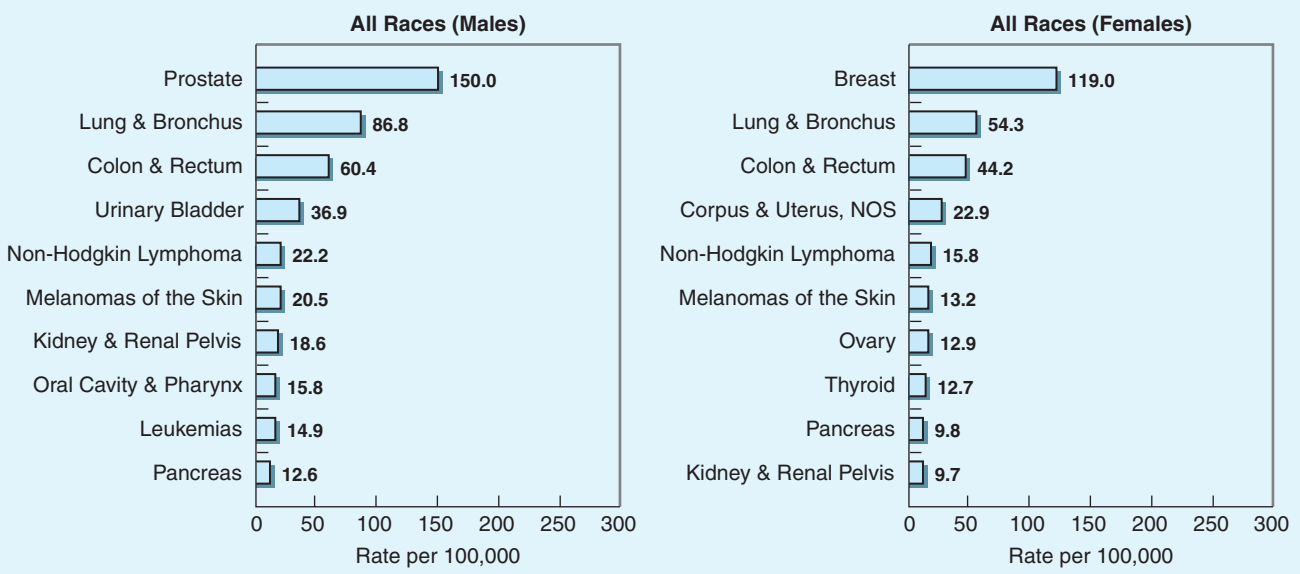
Numerous epidemiologic studies have shown sex differences in a wide scope of health phenomena, including mortality and morbidity. The following discussion presents data on sex differences in mortality. With the exception of some calendar years, the population age-adjusted death rate has declined in the United States since 1980.[5] Males generally have higher all-cause age-specific mortality rates than females from birth to age 85 and older; the ratio of male to female age-adjusted death rates in 2005 was 1.4 to 1.

Figure 4-5 shows male-female age-adjusted invasive cancer incidence rates for the 10 primary sites with the highest rates within race- and ethnic-specific categories. The cancer diagnoses with the highest incidence rates per 100,000 are prostate cancer for males (150.0 per 100,000) and breast cancer for females (119.0 per 100,000). The second leading cancer incidence rate is for cancer of the lung and bronchus; the rate is somewhat higher for males than for females (86.8 versus 54.3 per 100,000). For both males and females, cancer of the lung and bronchus are the leading cause of cancer mortality.

Race/Ethnicity

Increasingly, with respect to race and ethnicity, the United States is becoming more diverse than at any time in history. Race and ethnicity are, to some extent, ambiguous characteristics that tend to overlap with nativity and religion. **Nativity** refers to the place of origin of the individual or his or her relatives. A common subdivision used in epidemiology is foreign-born or native-born. Scientists have proposed that race is a social and cultural construct, rather than a biological construct.[6] In Census 2000, the U.S. Bureau of the Census classified race into five major categories: white; black or African American; American Indian and Alaska Native; Asian; and Native Hawaiian and other Pacific Islander. To a degree, race tends to be synonymous with ethnicity because people who come from a particular racial stock also may have a common ethnic and cultural identification. Also, assignment of some individuals to a particular racial classification on the basis of observed characteristics may be difficult. Often, one must ask the respondent to elect the racial group with which he or she identifies. The responses one elicits from such a question may not be consistent: Individuals may change ethnic or racial self-identity or respond differently on different occasions, depending on their perception of the intent of the race question. Classification of persons of mixed racial

FIGURE 4-5 Age-adjusted invasive cancer incidence rates for the 10 primary sites with the highest rates within race- and ethnic-specific categories.



Source: Adapted and reprinted from U.S. Cancer Statistics Working Group. *United States Cancer Statistics: 2003 Incidence and Mortality.* Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; 2006:220 and 222.

parentage also may be problematic.[7] The 2000 census allowed respondents to check a multiracial category, which was used for the first time. Changes in the definitions of racial categories affect the denominators (i.e., the numbers in a particular racial subgroup) of rates used to track various health outcomes and the consequent assessments of unmet needs and social inequalities in health.[8]

Figure 4-6 demonstrates the racial/ethnic composition of the U.S. population during 2006. At that time, the total population was estimated to be 299,398,485. The largest percentage of the population was white (73.9%). Hispanics and Latinos made up 14.8% of the population (44,252,278). People who self-identify with this ethnic group can be of any race; therefore, Hispanics and Latinos are not shown in the figure.

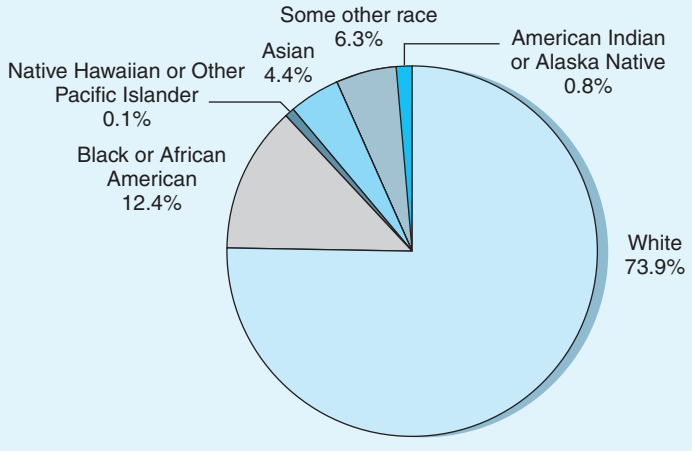
There are many examples of racial/ethnic differences in health characteristics. The following section lists three conditions that show such variations:

- Asthma: Individuals who classified themselves as Hispanic had a lower frequency of self-reported asthma than either non-Hispanic whites or non-Hispanic blacks (Figure 4-7).
- No usual source of medical care: For persons diagnosed with diabetes, serious heart conditions, and hypertension, non-Hispanic whites and non-Hispanic blacks reported less frequently that they had no usual source of care than Hispanics (Figure 4-8).
- Gonorrhea incidence: Black, non-Hispanic individuals had the highest incidence of gonorrhea during 1991 through 2006. However, the incidence of gonorrhea among African Americans declined during this period, although in 2006 it remained above the incidence for other racial and ethnic groups. Non-Hispanic blacks in 2006 had a gonorrhea incidence that was about eighteen times greater than that reported for non-Hispanic whites (Figure 4-9).

Socioeconomic Status

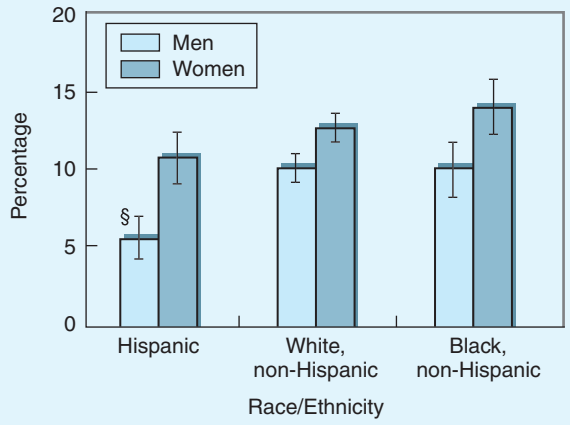
Socioeconomic status (SES) is defined as a "descriptive term for a person's position in society, . . ."[4] SES is often formulated as a composite measure of three interrelated dimensions: a person's income level, education level, and type of occupation. In some instances, income level alone is used as an indicator of SES; in other cases, two or more of the foregoing dimensions are combined into composite variables. A three-factor measure would classify persons with high SES as those at the upper levels of income, education, and employment status (e.g., the learned professions). The social class gradient (variability in

FIGURE 4-6 Racial/ethnic distribution of the population of the United States, 2006 estimates. Data for individuals who declare only one race.



Source: Author. Data from U.S. Census Bureau. Fact Sheet: 2006 American Community Survey Data Profile Highlights. Available at: http://factfinder. census.gov/servlet/ACSSAFFFacts. Accessed August 15, 2008.

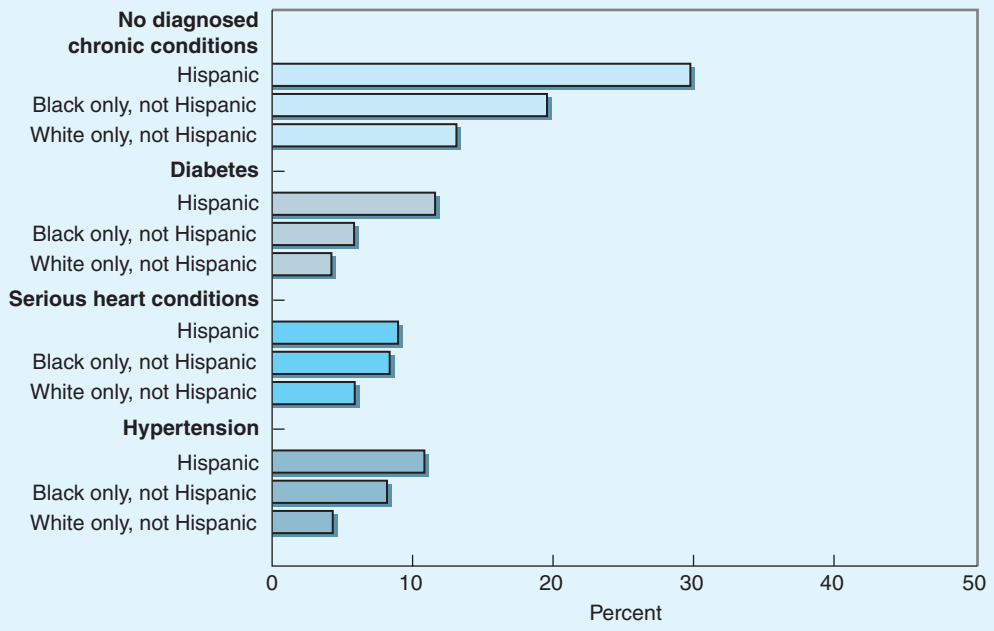
FIGURE 4-7 Estimated percentage of adults aged ≥18 years with asthma,* by sex and race/ethnicity—National Health Interview Survey, United States, 2006.†



* Based on response to the following question: "Have you ever been told by a doctor or other health professional that you had asthma?"
† Estimates were age adjusted using the 2000 U.S. population as the standard population and four age groups: 18–44 years, 45–64 years, 65–74 years, and ≥75 years. Estimates were based on household interviews of a sample of the noninstitutionalized, U.S. civilian population. Persons of unknown asthma status were not included.
§ 95% confidence interval.

Source: Reprinted from Centers for Disease Control and Prevention, National Center for Health Statistics. QuickStats: Estimated percentage of adults aged ≥18 years with asthma,* by sex and race/ethnicity—National Health Interview Survey, United States, 2006†. *MMWR.* 2007;56:1193.

FIGURE 4-8 No usual source of care among adults 45–64 years of age, by selected diagnosed chronic conditions and race and Hispanic origin: United States, 2004–2005.



Source: Reprinted from National Center for Health Statistics. *Health, United States, 2007. With Chartbook on Trends in the Health of Americans.* Hyattsville, MD: 2007:69.

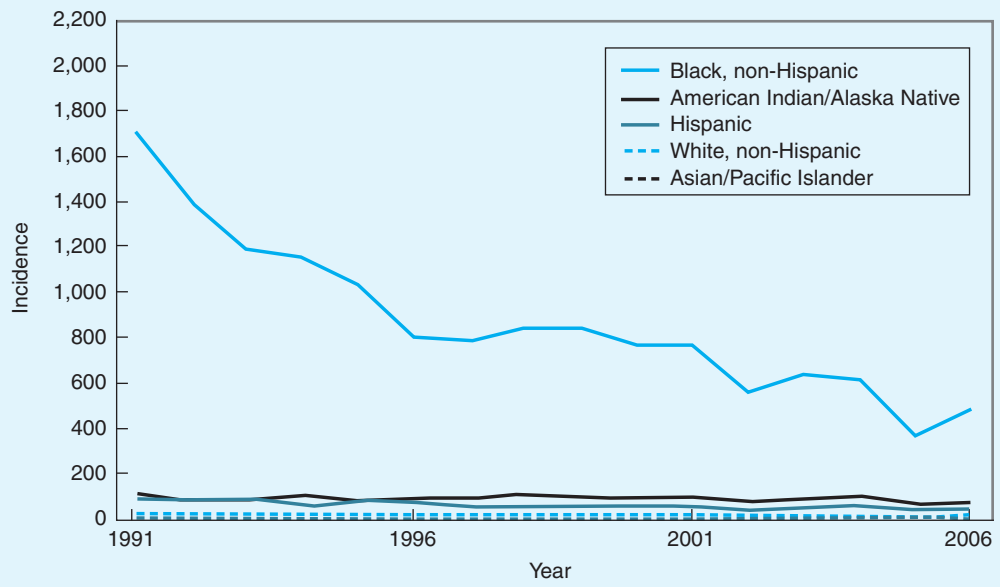
SES from high to low and vice versa) is strongly and inversely associated with levels of morbidity and mortality. Those who occupy the lowest SES positions are confronted with excesses of morbidity and mortality from numerous causes (from mental disorders to chronic and infectious diseases to the consequences of adverse lifestyle).

One of the dimensions of SES—income—may be expressed in several ways in order to assess its impact upon health outcomes. For example, poverty is a measure based on before-tax income from sources such as earnings, unemployment compensation, interest, and Social Security. Poverty exists when a single person or family has an income that is below a threshold set by the U.S. Bureau of the Census. For a single person younger than 65 years of age, the poverty level in 2006 was annual income below the threshold of $10,488. Poverty status also can be computed for families; the poverty level is a function of the total income of a family in relationship to the poverty threshold. The threshold for poverty in a family is determined by summing the poverty thresholds provided by the U.S. Bureau of the Census for each adult and child living in a family. The poverty threshold for a five-person family that comprises three adults and two children was $24,662 in 2006. The ratio of income to poverty is the ratio of an individual's or family's income to their poverty threshold. If the five-person family had an annual income of $25,000 in 2006, their income-to-poverty ratio was $25,000/$24,662 or 1.01; this ratio can also be expressed as 101% of poverty. Similarly, all poverty ratios can also be expressed as percentages; to illustrate, 200% of poverty refers to an income that is twice the poverty threshold.[9]

An example of the association between poverty and health outcomes is provided by access to dental care. Refer to Figure 4-10, which presents U.S. data for 2005 for persons who made no dental visits during the past year. The respondents were classified according to four poverty levels. At all age levels, as the percent of poverty level increased, there was a stepwise increase in the number of persons who made no dental visits. Among all age groups shown, the largest percentage of persons who made no dental visits was for those below 100% of the poverty level.

Related to the topic of race (as well as other demographic variables including age, gender, and socioeconomic status) is the term **health disparities**, which refers to differences in the occurrence of diseases and adverse health conditions in the population.

FIGURE 4-9 Gonorrhea. Incidence,* by race/ethnicity—United States, 1991–2006.



*Per 100,000 population.

Source: Reprinted from Centers for Disease Control and Prevention. Summary of Notifiable Diseases—United States, 2006. *MMWR.* 2008;55:52.

An example is cancer health disparities, defined as "... adverse differences in cancer incidence (new cases), cancer prevalence (all existing cases), cancer death (mortality), cancer survivorship, and burden of cancer or related health conditions that exist among specific population groups in the United States."[10] Currently, African Americans have the highest age-adjusted overall cancer incidence and death rates in comparison with four other racial/ethnic groups (Asian/Pacific Islander, Hispanic/Latino, American Indian/Alaska Native, and white).

PLACE VARIABLES

Morbidity and mortality vary greatly with respect to place (geographic regions that are being compared). Examples of comparisons according to place are international, national (within-country variations such as regional and urban-rural comparisons), and localized occurrences of disease.

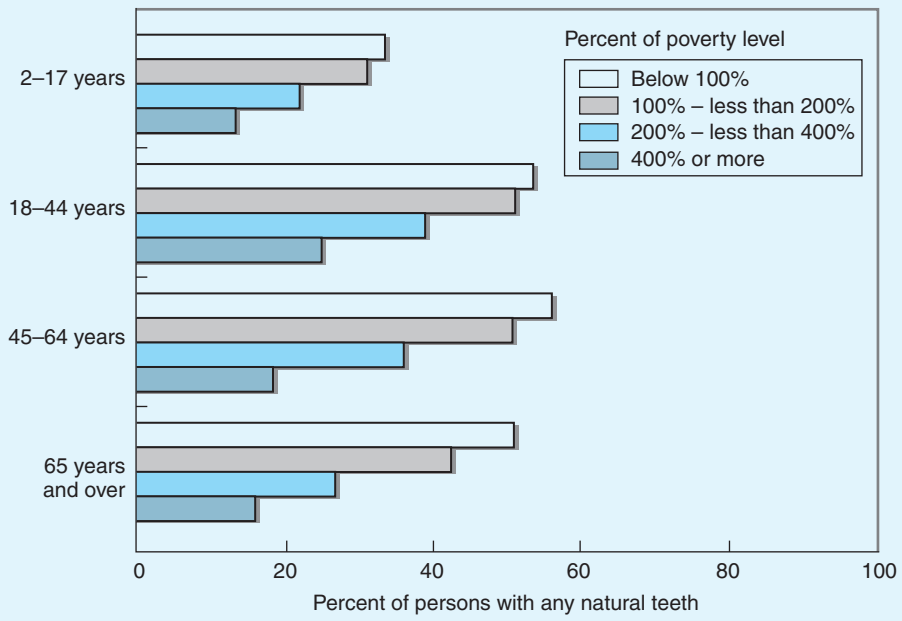
International

The World Health Organization (WHO), which sponsors and conducts ongoing surveillance research, is a major source of information about international variations in rates of disease. WHO statistical studies portray international variations in infectious and communicable diseases, malnutrition, infant mortality, suicide, and other conditions. As might be expected, both infectious and chronic diseases show great variation from one country to another. Some of these differences may be attributed to climate, cultural factors, national dietary habits, and access to health care.

Such variations are reflected in great international differences in life expectancy. The United States Central Intelligence Agency reported the ranked life expectancy at birth for 223 countries and indicated that the world life expectancy was 66.1 years (2008 estimate).[11] The three countries with the highest life expectancy in 2008 were Andorra (83.5 years), Macau—technically not a country—(83.3 years), and Japan (82.1 years); the United States ranked number 47 (78.1 years). The countries ranked as having the three lowest life expectancies were Zambia (38.6 years), Angola (37.9 years), and Swaziland (32.0 years). Life expectancy in many European countries including France, Italy, and Germany exceeded that of the United States. The United States' neighboring country, Canada, ranked seventh in life expectancy worldwide (81.2 years).

An example of an infectious disease that shows international variations and decreasing incidence is polio, which at

FIGURE 4-10 No dental visit in the past year among persons with natural teeth, by age and percent of poverty level: United States, 2005.



Source: Reprinted from National Center for Health Statistics. *Health, United States, 2007. With Chartbook on Trends in the Health of Americans.* Hyattsville, MD: 2007:85.

one time occurred worldwide. Polio is a viral infection that either is asymptomatic or produces a nonspecific fever in the majority of cases; about 1% of cases produce a type of paralysis known as flaccid paralysis. Immunization programs have helped to eradicate indigenous wild polio cases in the Western Hemisphere, Europe, and many other parts of the world. Figure 4-11 illustrates the spread of polio during 2002–2005. In 2002, polio was endemic in parts of Africa, Afghanistan, Pakistan, and on the Indian subcontinent. From these endemic areas, polio spread to several African and Middle Eastern countries where the wild polio virus was reestablished.

National (Within Country)

Many countries, especially large ones, demonstrate within-country variations in disease frequency. Regional differences in factors such as climate, latitude, and environmental pollution affect the prevalence and incidence of diseases. In the United States, comparisons of disease occurrence are made by geographic region (north, east, south, and west), state, or county. An example of state-level variation is the percentage of adults who reported a history of stroke in 2005. The states with the highest percentages included those in the southern United States (e.g., Louisiana and Alabama) and Nevada. (Refer to Figure 4-12.)

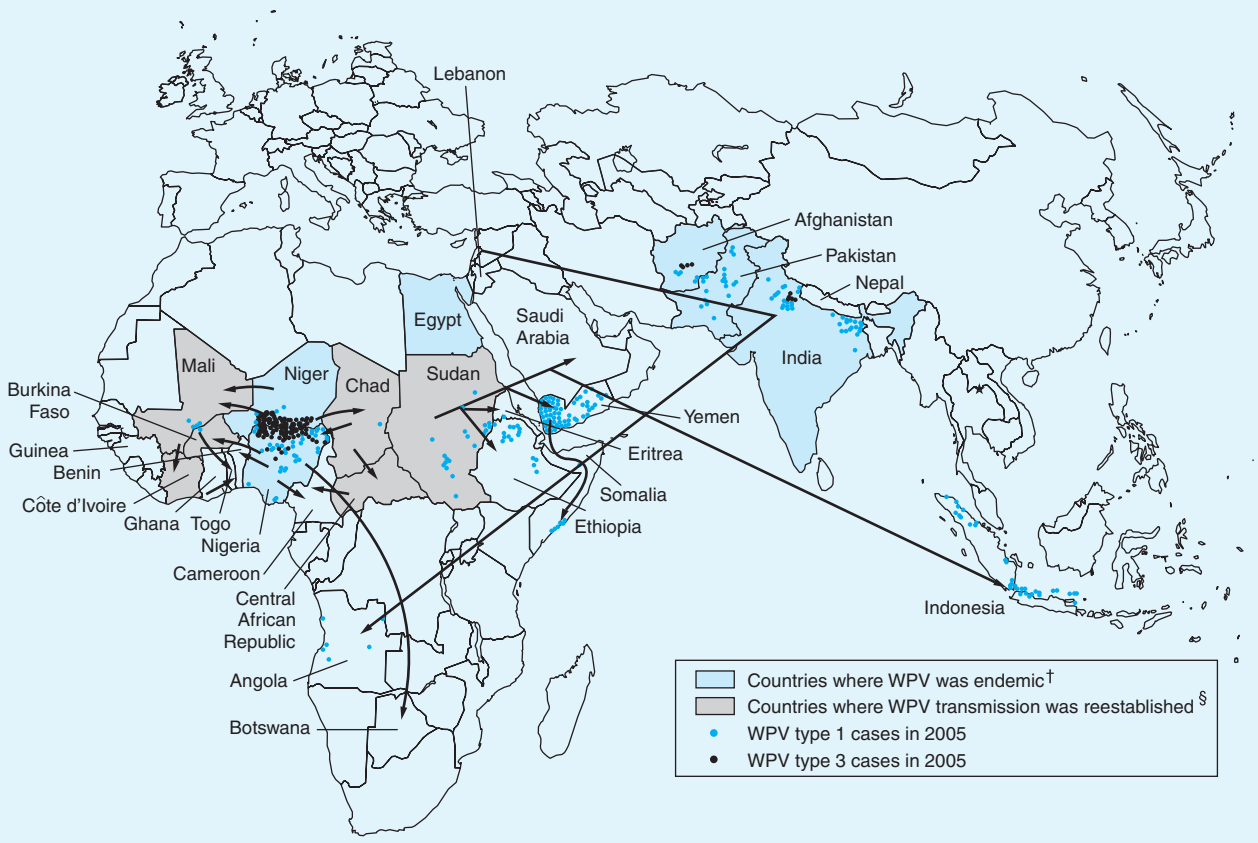
Urban-Rural Differences

Urban and rural sections of the United States show variations in morbidity and mortality related to environmental and lifestyle issues. Urban diseases and causes of mortality are more likely to be those spread by person-to-person contact, crowding, and inner-city poverty or associated with urban pollution. Children's lead poisoning is an example of a health issue that occurs among urban residents who may be exposed to lead-based paint from decaying older buildings.

Agriculture is a major category of employment for the residents of rural areas. Farm workers often are exposed to hazards such as toxic pesticides and unintentional injuries caused by farm equipment. Figure 4-13 shows the distribution of nonfatal occupational farming injuries by state during 1993–1995 (the most recent data available). The highest rate of injuries occurred in Mississippi (14.5 per 100 full-time workers).

One group of employees who are at risk of health hazards associated with farming is migrant workers. Often they reside

FIGURE 4-11 Wild poliovirus (WPV) cases in 2005 and WPV importation routes* during 2002–2005—worldwide.



* Routes (not all importation events) indicated by arrows.
† As of February 1, 2006, Niger and Egypt were considered no longer endemic for WPV because neither country had indigenous transmission during the preceding 12 months.
§ Countries were considered to have reestablished transmission if WPV was detected for >1 year after importation. The majority of these countries have not experienced WPV type 1 transmission since July 2005.

Source: Reprinted from Centers for Disease Control and Prevention. Resurgence of wild poliovirus type 1 transmission and consequences of importation—21 countries, 2002-2005. *MMWR.* 2006;55:147.

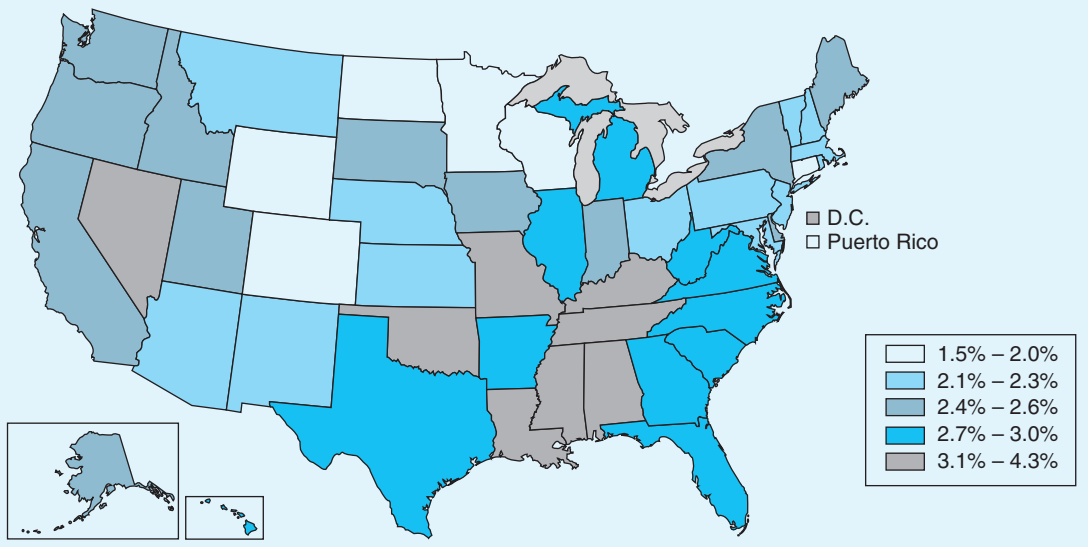
in crowded, substandard housing that exposes them to infectious agents found in unsanitary milieus. Many of these workers labor under extremely arduous conditions and lack adequate rest breaks, drinking water, and toilet facilities.

Localized Patterns of Disease

Localized patterns of disease are those associated with specific environmental conditions that may exist in a particular geographic area. Illustrations include cancer associated with radon gas found in some geographic areas and arsenic poisoning linked to high levels of naturally occurring arsenic in the water. Local environmental conditions also may support disease vectors that may not survive in other areas. (Vectors are intermediaries—insects or animals—involved in the transmission of disease agents; see Chapter 8 for a further discussion of vectors.)

An example of a localized pattern of disease is provided by dengue fever, a viral disease transmitted by a species of mosquito (a vector) that is present along the border that separates Texas from Mexico near the Gulf of Mexico. Localized populations of the mosquitoes are thought to have contributed to an outbreak of dengue fever in 2005. The affected areas are shown in Figure 4-14. Chapter 8 provides additional information about this outbreak.

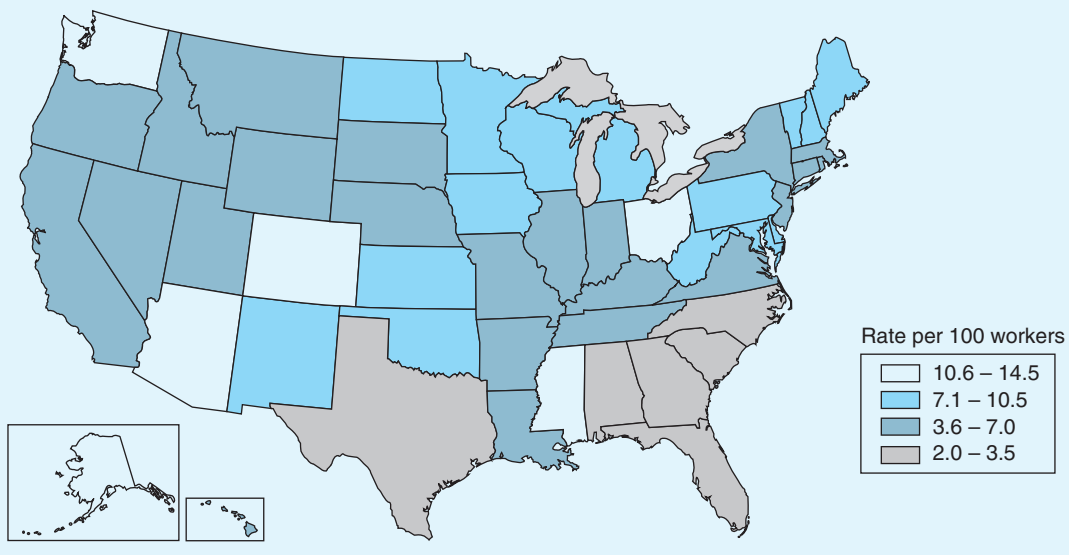
FIGURE 4-12 Percentage of respondents aged ≥18 years who reported a history of stroke, by state/area—Behavioral Risk Factor Surveillance System, United States, 2005.*



*Age adjusted to the 2000 U.S. standard population of adults.

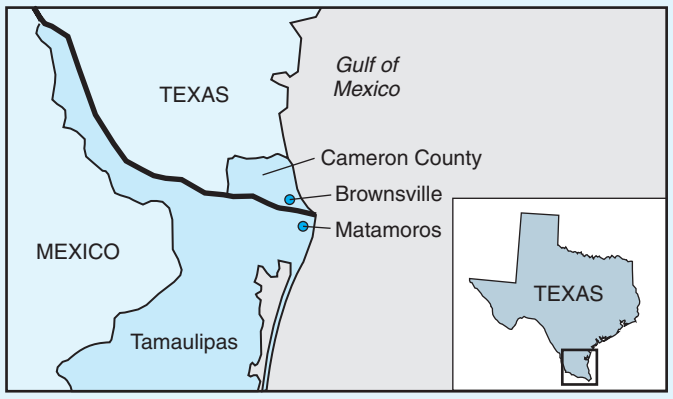
Source: Reprinted from Centers for Disease Control and Prevention. Prevalence of stroke—United States, 2005. *MMWR.* 2007;56:473.

FIGURE 4-13 Rates of nonfatal occupational farming injuries by state, 1993–1995.



Source: Reprinted from Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Worker Health Chartbook, 2004. DHHS (NIOSH) Publication No. 2004-146. Cincinnati, OH: National Institute for Occupational Safety and Health; 2004: 203.

FIGURE 4-14 Jurisdictions affected by dengue fever outbreak—Texas-Mexico border, 2005.



Source: Reprinted from Centers for Disease Control and Prevention. Dengue hemorrhagic fever—U.S.-Mexico border, 2005. *MMWR.* 2007;56:785.

TIME VARIABLES

Examples of disease occurrence according to time are secular trends, cyclic fluctuation (seasonality), point epidemics, and clustering.

Secular Trends

Secular trends refer to gradual changes in the frequency of diseases over long time periods. Figure 4-15 reports trends in yearly suicide rates of females. In both age groups, the frequency of suicides by firearms has declined over time, whereas suicides by hanging have increased.

Here is an example of the absence of a secular trend. Hypertension (high blood pressure) is a risk factor for stroke, cardiovascular disease, kidney disease, and other adverse health outcomes. Effective regimens and medications are available for the treatment and control of the condition; despite this fact, nearly one-third of the U.S. population has hypertension. Among all adults, this level did not change very much over the seven years shown in Figure 4-16, which tracks the age-adjusted prevalence of hypertension. The data reveal only slight variations in the age-adjusted prevalence between 1999 and 2006. Comparisons by gender, age, or race/ethnicity demonstrate that there has been no secular change.

Cyclic (Seasonal) Trends

Many phenomena (e.g., weather and health related) show cyclic trends. What is meant by a cyclic trend? **Cyclic trends** are increases and decreases in the frequency of a disease or other phenomenon over a period of several years or within a year.

Severe weather events in the Atlantic basin of the United States show cyclic trends, demonstrating a high level of seasonal activity since 1995. (Refer to Figure 4-17.) The 2005 season when Hurricane Katrina struck was the most active hurricane season on record.

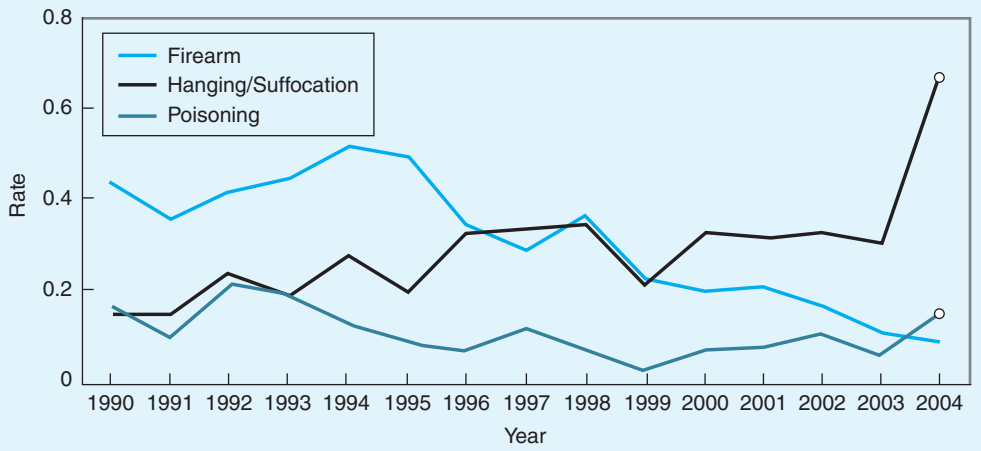
With respect to health-related events, many infectious diseases and chronic adverse conditions manifest cyclical patterns of occurrence, with annual increases and decreases. Mortality from pneumonia and influenza peaks during February, decreases during March and April, and reaches its lowest level during the early summer. Enteroviruses are common viruses that affect human beings globally and are linked to a spectrum of illnesses that range from minor to severe; detections of enterovirus infections have increased in frequency during the summer months within the past two decades. (See Figure 4-18.)

Point Epidemics

A **point epidemic** may indicate the response of a group of people circumscribed in place to a common source of infection, contamination, or other etiologic factor to which they were exposed almost simultaneously.[12] An example was demonstrated by an outbreak of *Vibrio* infections that followed Hurricane Katrina in 2005.

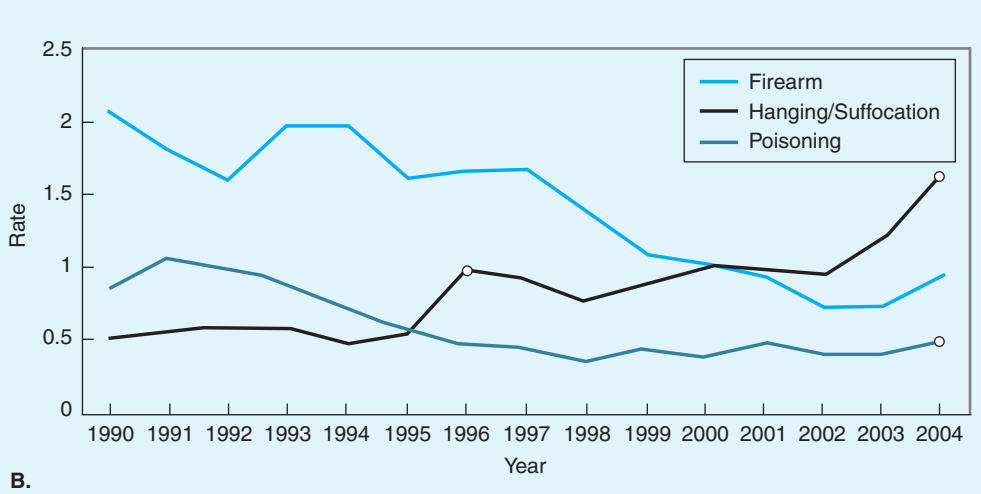
A *Vibrio* is a bacterium that can affect the intestines (producing enteric diseases) and can cause wound infections. One of the illnesses caused by *Vibrio* is cholera (agent: *Vibrio*

FIGURE 4-15 Yearly suicide rates* for females aged 10–14 years, by method—National Vital Statistics System, United States, 1990–2004 (A); and Yearly suicide rates* for females aged 15–19 years, by method—National Vital Statistics System, United States, 1990–2004 (B).



A.

*Per 100,000 population.



B.

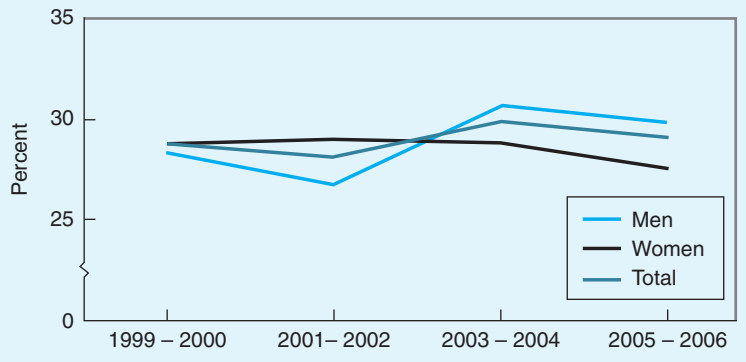
*Per 100,000 population.

Source: Modified from Centers for Disease Control and Prevention. Suicide trends among youths and young adults aged 10–24 years—United States, 1990–2004. *MMWR.* 2007;56:907.

cholerae), discussed in Chapter 1. Some other types of *Vibrio* are *Vibrio parahaemolyticus* (can cause intestinal disorders) and *Vibrio vulnificus* (can cause wound infections). These bacteria can be transmitted through contaminated food and water and by many other mechanisms. During floods, public health officials need to monitor the presence of infectious disease agents such as *Vibrio* in the drinking-water supply.

Figure 4-19 shows clustering of cases of *Vibrio*-associated illnesses after Hurricane Katrina in 2005. The figure demonstrates that five persons died and 22 persons were hospitalized for *Vibrio* illness; these cases occurred among residents of Louisiana and Mississippi. The first hospital admission occurred on August 29 and the last on September 5. The frequency of cases peaked on September 3. Most of these cases

FIGURE 4-16 Age-adjusted prevalence of hypertension in adults: United States, 1999–2006.



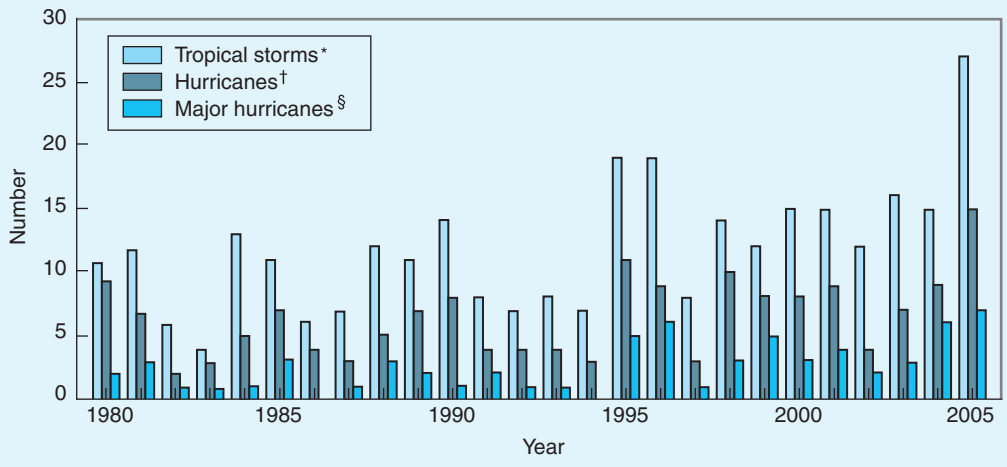
Source: Reprinted from Ostchega Y, Yoon SS, Hughes J, Louis T. Hypertension awareness, treatment, and control—continued disparities in adults: United States, 2005–2006. NCHS Data Brief no. 3. Hyattsville, MD: National Center for Health Statistics; 2008:1.

were wound associated and believed to have been the result of an infection acquired by contact with floodwaters.

Clustering

An example of a pattern derived from descriptive studies is disease **clustering**, which refers to "a closely grouped series of events or cases of a disease or other health-related phenomena with well-defined distribution patterns in relation to time or place or both. The term is normally used to describe aggregation of relatively uncommon events or diseases (e.g., leukemia, multiple sclerosis)."[4] Clustering may suggest common exposure of the population to an environmental hazard; it also may

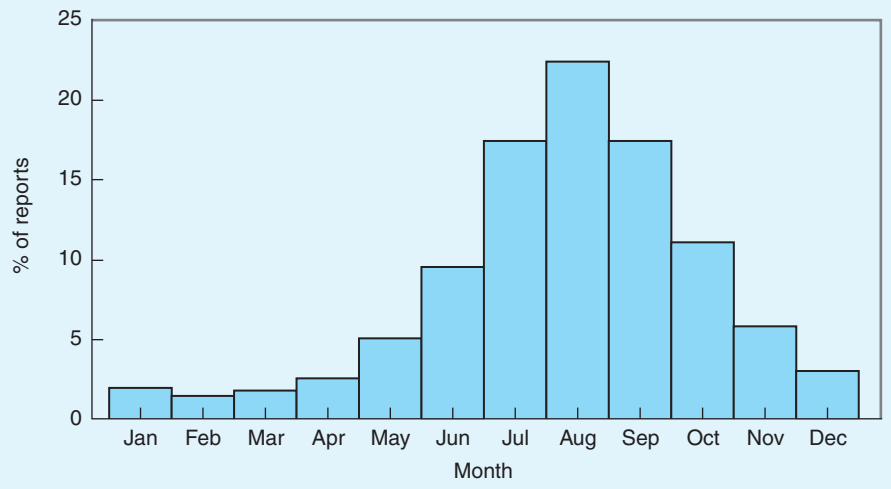
FIGURE 4-17 Number of tropical storms, hurricanes, and major hurricanes, by year—Atlantic basin, 1980–2005.



* Includes hurricanes.
† Includes major hurricanes.
§ Category 3, 4, or 5 on the Saffir-Simpson Hurricane Scale.

Source: Reprinted from Centers for Disease Control and Prevention. Public health response to hurricanes Katrina and Rita—United States, 2005. *MMWR.* 2006;55:231.

FIGURE 4-18 Percentage of enterovirus reports, by month of specimen collection—United States, 1983–2005.



Source: Reprinted from Khetsuriani N, LaMonte-Fowlkes A, Oberste MS, Pallansch MA. Centers for Disease Control and Prevention. Enterovirus surveillance—United States, 1970–2005. In: Surveillance Summaries, September 15, 2006. *MMWR.* 2006;55 (No. SS-8):17.

Texas sharpshooter effect

A traveler passing through a small town in Texas noted a remarkable display of sharpshooting. On almost every barn he passed there was a target with a single bullet hole that uncannily passed through the center of the bull's-eye. He was so intrigued by this that he stopped at a nearby gas station to ask about the sharpshooter. With a chuckle, the attendant told him that the shooting was the work of Old Joe. Old Joe would first shoot at the side of a barn and then paint targets centered over his bullet holes so that each shot appeared to pass through the center of the target. . . . In a random distribution of cases of cancer over a geographic area, some cases will appear to occur very close together just on the basis of random variation. The occurrence of a group of cases of a disease close together in time and place at the time of their diagnosis is called a cluster.

Source: Reprinted from Grufferman S. Methodologic approaches to studying environmental factors in childhood cancer. *Environ Health Perspect.* 1998;106 (Suppl. 3):882.

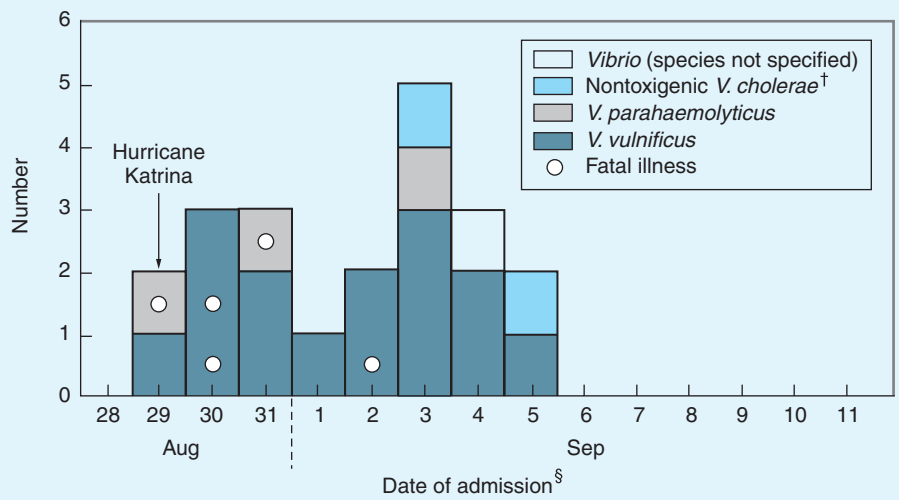
be purely spurious—due to the operation of chance. One cause of spurious clustering is called the Texas Sharpshooter Effect.

Clustering can refer to spatial clustering and temporal clustering. Spatial clustering indicates cases of disease (often uncommon diseases) that occur in a specific geographic region, a common example being a cancer cluster. Temporal clustering denotes health events that are related in time, such as the development of maternal postpartum depression a few days after a mother gives birth. Another example of temporal clustering is postvaccination reactions such as syncope (fainting); the number of such reactions increased among females aged 11 to 18 years during 2007. (Refer to Figure 4-20.)

CONCLUSION

Descriptive epidemiology classifies the occurrence of disease according to the variables of person, place, and time. Descriptive epidemiologic studies aid in generating hypotheses that can be explored by analytic epidemiologic studies. Some of the uses of descriptive epidemiology are to demonstrate which health outcomes should be prioritized for the design of interventions. Chapter 4 presented information on several types of descriptive studies including case reports, case series, and cross-sectional studies. The Behavioral Risk Factor Surveillance System (BRFSS) is an example of an ongoing

FIGURE 4-19 Cases of post-Hurricane Katrina *Vibrio* illness among residents of Louisiana and Mississippi,* by date of hospital admission—United States, August 29–September 11, 2005.

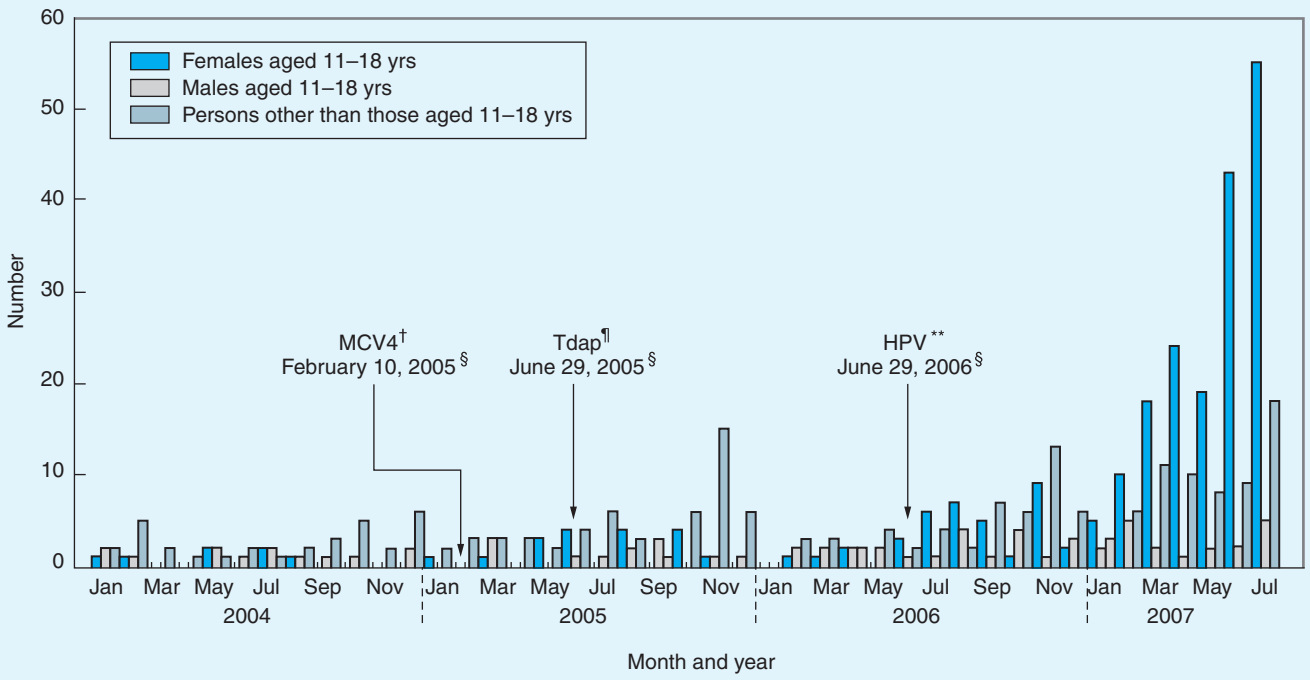


* N = 22; Alabama, a third state under surveillance, reported no cases.
† Nontoxigenic *V. cholerae* illnesses represent infections entirely distinct from the disease cholera, which is caused by toxigenic *V. cholerae* serogroup O1 or O139.
§ Date of admission was not available for one Louisiana resident. In cases that did not require hospitalization, the date represents the first contact with a healthcare provider for the illness.

Source: Reprinted from Centers for Disease Control and Prevention. *Vibrio* illnesses after Hurricane Katrina—multiple states, August–September 2005. *MMWR.* 2005;54:928.

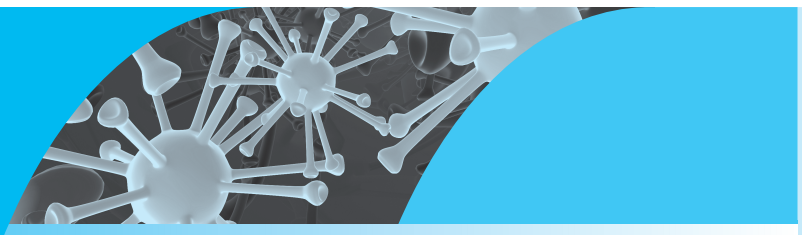
cross-sectional study of health characteristics of the population of the United States. Person variables discussed in the chapter were age, sex, race/ethnicity, and socioeconomic status. Place variables included the following types of comparisons: international, national (within country), urban-rural, and localized patterns. Time variables encompassed secular time trends, cyclic trends, point epidemics, and clustering. Descriptive epidemiology is an important component of the process of epidemiologic inference.

FIGURE 4-20 Number of postvaccination syncope* episodes reported to the Vaccine Adverse Event Reporting System, by month and year of report—United States, January 1, 2004–July 31, 2007.



* Includes persons aged ≥5 years who had syncope onset after vaccination on the same date.
† Meningococcal conjugate vaccine.
§ Date on which the Advisory Committee on Immunization Practices decided to add this newly licensed adolescent vaccine to the Vaccines for Children Program.
¶ Tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine.
** Quadrivalent human papillomavirus recombinant vaccine. HPV is licensed only for females.

Source: Reprinted from Centers for Disease Control and Prevention. Syncope after vaccination—United States, January 2005–July 2007. *MMWR.* 2008;57:458.



Study Questions and Exercises

1. Refer back to Table 4-2, which presents characteristics of infants who were exclusively breastfed. Describe the results shown in the table. Suppose you wanted to conduct a survey of breastfeeding in your own community:
   a. How would you choose the participants?
   b. What questionnaire items would you include in the survey?
   c. What type of study design is a survey?
2. State three uses for descriptive epidemiologic studies. How could descriptive epidemiologic studies examine the following health issues?
   a. The obesity epidemic in the United States
   b. Increases in the prevalence of type 2 diabetes among adolescents
   c. Abuse of prescription narcotic drugs
3. Define the terms case reports and case series. Indicate how they are similar and how they differ. Search the Internet for examples of case reports of disease as well as case series.
4. Refer back to Table 4-3, which gives the percentage of adults who reported insufficient rest or sleep. Provide a detailed account of the findings presented in the table. What additional information would you like to have in order to determine the reasons why people have insufficient rest or sleep?
5. Refer back to the section on sex differences. How did the top five types of invasive cancer differ in incidence between males and females? Can you hypothesize reasons for these differences?
6. What are some examples of racial/ethnic classifications used to describe health characteristics? Name two conditions that vary according to race/ethnicity.
7. What is meant by the term health disparities? What do you think could be done about them from the societal and public health points of view?
8. How does life expectancy at birth in the United States compare with that in other countries? Do you have any suggestions for improving life expectancy in the United States? What could be done to raise the life expectancies of residents in the countries that have the three lowest levels?
9. Name three characteristics of time that are used in descriptive epidemiologic studies and give an example of each one.
10. The prevalence of hypertension has remained essentially unchanged for nearly a decade. Propose a descriptive epidemiologic study to explore the reasons for this phenomenon.

Young Epidemiology Scholars (YES) Exercises

The Young Epidemiology Scholars Web site provides links to teaching units and exercises that support instruction in epidemiology. The YES program is administered by the College Board and supported by the Robert Wood Johnson Foundation. The Web address of YES is www.collegeboard.com/yes. The following exercises relate to topics discussed in this chapter and can be found on the YES Web site.

1. Kaelin MA, St. George DMM. Descriptive epidemiology of births to teenage mothers.
2. Olsen C, St. George DMM. Cross-sectional study design and data analysis.

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