CHAPTER 2

Most Frequent and Significant Diseases

OUTLINE

OBJECTIVES

1. List the leading causes of death and what percentage of people dies from each.
2. Define incidence, prevalence, and mortality rates, as well as other measures of the impact of diseases on populations such as disability and healthcare costs. State what the statistics are useful for.
3. State the relative frequency of the leading causes of acute disease and how they relate to age.
4. List the most common chronic diseases and state whether they are age-related or age-dependent.
5. List the acute and chronic diseases that most frequently bring patients to the doctor's office.
6. State which factors determine the limits of life expectancy.
7. Be able to define and use in proper context all words and terms in bold print in this chapter.

KEY TERMS

acute diseases
age dependent
age related
aging
atherosclerosis
cancer
cerebral vascular accident (CVA)
chronic diseases
chronic pulmonary disease
direct cost
disability
heart disease
incidence
indirect cost
life expectancy
morbidity
mortality
mortality rate
prevalence
prognosis
stroke
survival rate
trauma

Causes of Death (Mortality)

Causes of death (**mortality**) are compiled by government agencies from death certificates, which must be filled out by trained personnel at the time of a person's death. Approximately 70% of all deaths in the United States are accounted for by the five most frequent causes (see **Table 2–1**). The causes of death vary considerably by age. The most common causes of death of children aged 1–14 years are given in **Table 2–2**. In children less than 1 year, the most common causes of death relate to congenital anomalies, low birth weight, and complications of premature birth.

Heart disease accounted for 25% of deaths in the United States in 2011. The vast majority of these deaths are caused by **atherosclerosis**, a degenerative disease of arteries. Over the course of many years, lipid-rich deposits develop in the arterial lining. These areas of thickening may induce the sudden development of a thrombus that completely occludes the vessel and obstructs the flow of blood to a portion of myocardium (heart muscle), which subsequently dies. This is a "heart attack," or myocardial infarct. Myocardial infarcts are more frequent and occur at an earlier age in men than in women under the age of 50, but after this the incidence of myocardial infarct equalizes between the two sexes. Myocardial infarcts can be lethal by causing sudden death (death within an hour of the onset of symptoms), or they can induce degenerative

TABLE 2–1 Overall Leading Causes of Death, United States, 2011

Cause of Death	Number of Deaths
1. Heart disease	596,339
2. Cancer	575,313
3. Chronic pulmonary disease	143,382
4. Cerebrovascular disease (stroke)	128,931
5. Accidents	122,777
6. Alzheimer dementia	84,691
7. Diabetes	73,282
8. Pneumonia and influenza	53,667
9. Kidney disease	45,731
10. Suicide	38,285
11. Septicemia	35,539
12. Chronic liver disease	33,539
13. Hypertension	27,477
14. Parkinson disease	23,107
15. Pneumonitis due to aspiration	18,090
— all other causes	512,723

Data from Hoyert DL, Xu J. Deaths: preliminary data for 2011. *National Vital Statistics Reports*. October 10, 2012;61(6). U.S. Department of Health and Human Services.

TABLE 2–2 Leading Causes of Death in Children Aged 1–14 Years, United States, 2006

Cause of Death	Number of Deaths
1. Accidental trauma	3,868
2. Cancer	1,284
3. Congenital anomalies	859
4. Homicide	756
5. Heart disease	314
6. Sepsis	172
7. Influenza and pneumonia	149
8. Cerebrovascular disease	165
9. Benign neoplasms	136
10. Chronic lower respiratory disease	119

Reproduced from Heron M. Deaths: leading causes for 2006. *National Vital Statistics Reports*. March 31, 2010;58(14). National Center for Health Statistics, CDC.

and compensatory changes in the heart that can be lethal from days to years after the infarct, such as sudden rupture of the myocardial wall or congestive heart failure.

Cancers are the second leading cause of death in the United States, accounting for 23% of deaths. The most lethal, in the sense of causing the largest number of deaths, is lung cancer. Cancer of the sex organs (breast, uterus, ovary, prostate) and gastrointestinal tract are the next most common cancers. The frequency of cancer overall increases dramatically between the ages of 50 and 80 years, but the median age of incidence varies considerably by cancer type. For example, prostate cancer is primarily a disease of old men, while testicular cancer is primarily a disease of young (20- to 40-year old) men. In addition, some cancers are much more rapidly lethal than are others. Pancreatic cancer has a median survival of only about 18 months, while thyroid cancer is typically cured with surgery. Overall, however, the burden caused by cancer in terms of lives lost and cost of care is staggering and is expected to increase. Within a decade, cancer is expected to take the place of heart disease as the number one cause of death in the United States.

Chronic pulmonary disease is the third leading cause of death (approximately 6% of the total), with most of these deaths the result of chronic obstructive pulmonary disease caused by cigarette smoking.

Stroke is the fourth leading cause of death in the United States, accounting for 5% of deaths. Stroke is the common name for **cerebral vascular accident (CVA)** and is caused by injury to an area of the brain due to vascular obstruction or bleeding into the brain. As in the heart, vascular obstruction results from atherosclerosis and overlying thrombus formation. Atherosclerosis of the arteries leading to the brain predisposes an individual to a cerebral infarct, or death of the brain tissue supplied by that artery. Strokes caused by bleeding usually result from high blood pressure or rupture of an aneurysm (a dilated outpouching of an artery). Strokes are most common in older adults and commonly present with weakness of one side of the body or difficulty with speech.

Trauma caused by accidents is the fifth leading cause of death in the United States, accounting for 5% of deaths. Automobile accidents are the most common cause of traumatic death. It is estimated that 50% of drivers responsible for automobile accidents are under the influence of alcohol. Young people and older adults are most commonly affected by accidents.

When comparing the overall causes of death by numbers in 2011 with those from 1990, only mortality resulting from heart disease, pneumonia, and influenza has decreased, while deaths due to cancer, stroke, accidents, chronic pulmonary disease, diabetes, and chronic liver disease have all increased. AIDS was the 10th leading cause of death in 1990, but, fortunately, is no longer within the top 15 in the United States.

From the list of the most common causes of death, it is apparent that common risk factors underlie many

of these diseases: atherosclerosis, hypertension, smoking, and obesity. Atherosclerosis induces myocardial infarcts and cerebral infarcts; hypertension causes heart disease and intracerebral hemorrhages; smoking aggravates atherosclerosis, is the leading cause of chronic pulmonary disease, and induces the development of several cancers including lung cancer; and obesity favors the development of atherosclerosis, heart disease, and cancer. Reducing mortality from these diseases therefore requires not only better interventions, such as better drugs with which to treat cancer, but also encouraging healthier lifestyles among the American people.

Causes and Measures of Disability (Morbidity)

Mortality is a crude measure of the effect of a disease on a population. It documents the frequency of lethal diseases, but it does not capture the burden of ill health in a population. Health, and not death, is what workers in the medical field need to be most concerned about anyway. But measures of ill health are not as easy to standardize or use as those for mortality because there is no one clear definition of what constitutes "ill health" or which illness is "significant," and not everyone who has a disease will come to medical attention and so be counted or included in the statistic.

When people develop an illness they often go to see a doctor. One could therefore count the reasons why people go to see doctors and use these statistics as an estimate of which diseases are most troublesome (see **Table 2–3**). As you can see from the list, the top two reasons for office visits in the United States are not feelings of ill health at all: they are screening procedures. Most routine well-child checks are performed on well children, with the goal of detecting the earliest signs of disease, providing immunizations, and counseling new parents on safety and nutrition, while visits for essential hypertension are routinely scheduled to monitor the effectiveness of therapy at maintaining healthy blood pressure readings. These two reasons for office visits therefore do not reflect what makes Americans feel ill. The next most common reason for visits to doctors is acute upper respiratory tract infections: the common cold. The common cold is a self-limited illness with no long-term sequelae. As much as it is a nuisance, it hardly reflects the severity of Americans' ill health. Not until you move farther down the list do you begin to see the names of those diseases that have a significant impact on people's lives, consume a large portion of healthcare resources, and often result in death—namely, diabetes, cancer, and heart disease.

TABLE 2–3 Top 20 Reasons for Office Visits to a Physician in the United States

1. Routine infant or child health check
2. Hypertension
3. Acute upper respiratory infections
4. Arthritis and related conditions
5. Diabetes
6. Spinal disorders
7. Specific procedures
8. Malignant neoplasms
9. Normal pregnancy
10. Rheumatism
11. Gynecologic examination
12. Otitis media
13. Follow-up examination
14. General medical examination
15. Nonischemic heart disease
16. Sinusitis
17. Allergic rhinitis
18. Ischemic heart disease
19. Asthma
20. Cataracts

Reproduced from Cherry DK, et al. National Ambulatory Medical Care Survey: 2006 summary. *National Health Statistics Reports*. August 6, 2008;3.

The statistics of reasons for doctor visits not only encompass a mixture of screening tests, acute and self-limited illnesses, and serious diseases that require long-term care, but they are also not universally valid, even for the American population. People who can go see a physician when they are ill are insured, and people who are insured generally have a level of health education, or shared understandings of what causes disease and what constitutes ill health, that will prompt them to see a physician for routine blood pressure readings, well-baby checks, arthritis, and monitoring of diabetes. This is not necessarily the case for the multitudes of poor and rural Americans, inner-city populations that may additionally be suffering mental health problems and drug addiction, or immigrants who come with cultural understandings of health at variance with the dominant American medical one. Many of these people rely on home health remedies, native healers, scarce public health clinics, and emergency departments for their health care, and their experience of ill health is not captured by the statistics that merely count visits to doctors' offices.

Another way of measuring ill health would be to identify people who are disabled and document the reason for their **disability**. Disabilities are health problems that interfere with a person's normal physical, mental, or emotional functions. For example, after a person has experienced a heart attack, s/he may feel depression, which may even be severe enough to induce suicidal intentions, and, if the damage to the heart is severe enough, may not be able to go about activities of daily living as before. This means the person may not be able to hold a job and may need help with routine activities such as bathing or going to the bathroom. The emotional and financial burden of disability is severe. Not only does care of people disabled by disease require money for doctor visits, therapies, special equipment (for example, wheelchairs), and pharmaceutical drugs but it also imposes a financial burden on society in terms of days lost from work. More important,

the adverse psychological effects of dependency and lost productivity are severe and can themselves require additional health care and support.

It is not as easy to measure the degree of disability or its frequency as it is to measure mortality. The frequency of disability within a population is called **morbidity**. In the United States, the top three causes of disability, defined as conditions requiring the use of an assistive device such as a cane or wheelchair, or interfering with activities of daily living, a job, or business, are arthritis, back or spine problems, and heart disease (**Table 2–4**). Note that mental or emotional problems are number four: it behooves health practitioners to remember that mental ill health is a significant cause of morbidity. The problems with measuring morbidity in this way are that it relies on self-reporting or reporting done through doctors' offices, so again it does not capture the experience of people who are not in the healthcare loop. Moreover, the definition of disability is arbitrary. How would the statistics look if, for example, one defined disability as being confined to a wheelchair or bed or, at the other extreme, as a single day lost from work or school because of a health-related issue?

Most diseases incur a financial cost. Insights into where Americans as individuals and as a society spend money on health care are also informative about the burden of ill health. **Direct cost** refers to the amount of money spent on treatment and management of a specific disease; **indirect cost** is a measure of the money lost by an ill person not performing his or her usual job and requiring disability payments. The amounts incurred by specific diseases are staggering. In 2007, for example, the cost of diabetes was $174 billion, including the cost of treatment of complications and indirect costs. The care of people with cancer was $104 billion in 2006. The costs of different diseases can be compared, as can the cost of the same disease in different years, so as to monitor trends in healthcare costs. But the financial cost of a disease is simply that: it does not take into consideration the degree of disability incurred by a disease or the psychological impact of the disease on the patient. Moreover, it obscures the fact that the treatment for some diseases is more costly than it is for others. For example, chemotherapy and radiotherapy for cancer are much more costly than are the drugs commonly used to keep diabetes in check. However, treatment of diabetes must continue over a lifetime, whereas treatment for cancer is limited to weeks, months, or a few years. These subtleties are not captured by measuring only the costs of health care.

TABLE 2–4 Leading Causes of Disability Among Adults and Percentage of All Disabilities

Condition	Percentage
Arthritis	19
Back and spine problems	17
Heart trouble	7
Mental or emotional problems	5
Lung, respiratory trouble	5
Diabetes	4.5
Deafness or hearing problems	4
Stiffness or deformity of limbs/ extremities	4
Blindness	3
Stroke	2

Reproduced from Centers for Disease Control and Prevention. Prevalence and most common causes of disability among adults—United States, 2005. *Morb Mortal Wkly Rep*. 2009;58(16): 421–426.

The most commonly used measure of the impact of a disease on a population is its frequency, or the number of people affected by a disease in comparison to the number of people in the population. The frequency of disease can be measured at a given time or over a period of time. **Incidence** is a measure of the number of newly diagnosed patients in a given time period, usually a year. Persons who had the disease diagnosed before the year began are not counted. **Prevalence** refers to the number of persons with a disease at any one time, regardless of when they were diagnosed. For example, the incidence rate of breast cancer between 2003 and 2007 (SEER data) was 123 per 100,000 population, meaning that for every 100,000 women, 123 got breast cancer every year.[1] The prevalence of breast cancer in the United States on January 1, 2007, was 2,591,855 women: this included women with active disease, those undergoing treatment, and those who were diagnosed with breast cancer at any time in the past, including those who are considered to be cured. When discussing incidence and prevalence, it is important to specify both the time interval over which the observation is made and the specific population under study. For example, you can discuss incidence and prevalence of a disease in all of the people living in one state, or all of the men in one state, or all of the women in the state aged 50 to 59, or black women as compared to white or Hispanic women.

Incidence is a useful measure of the impact of acute diseases in a population. **Acute diseases** are those that come on abruptly and last a short amount of time, such as a few days or a few weeks. Acute conditions include such things as the common cold, urinary tract infection, appendicitis, or a broken leg or arm. Because the condition is of short duration, the prevalence of the disease is not very helpful in managing the disease; it is more important to identify who will get the disease and design methods of avoiding it. Thus, incidence is a measure of the risk of developing a disease. Prevalence is a more useful tool for measuring the impact of **chronic diseases**,

or diseases that last for a long time and that may not be cured. Examples of chronic diseases are diabetes, Alzheimer disease, rheumatoid arthritis, and cancer. Although it is important to know the incidence of these diseases so as to determine risk factors and design preventive strategies, the majority of patient care revolves around management of the disease for a long period of time. It is therefore essential to know how many people have the disease at any one time so as to adequately allocate healthcare resources.

Mortality rate is a measure of the number of people dying in a given time period. It is usually expressed as the number dying per 100,000 population per year. **Survival rate** is the percentage of people with a particular condition who live for a given period of time after diagnosis. For example, the 5-year survival rate of breast cancer is the percentage of all women with breast cancer who are alive 5 years after diagnosis, regardless of whether they still have cancer, are about to die of metastatic disease, or are considered cured of cancer. The age-adjusted or relative survival rate adjusts the rate for those who might have died from other causes based on their age. The term **prognosis** refers to the outcome of a disease. Prognosis includes both morbidity and mortality estimates.

Frequency of Acute Diseases

Almost half of acute diseases are respiratory illnesses, mostly acute viral diseases (**Figure 2–1**). Approximately one-sixth of acute diseases result from injuries of various types. Another one-third of acute diseases are divided among nonrespiratory infections and a variety of noninfectious-, noninjury-type diseases. The frequency of acute illnesses decreases with age. For example, children younger than 6 years of age have three acute illnesses per year compared to one per year for persons older than age 44.

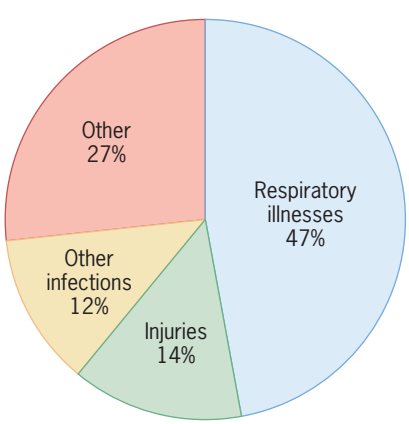

FIGURE 2–1 Approximate frequency of acute diseases.

Frequency of Chronic Diseases

Unlike acute disease, the frequency of chronic disease dramatically increases with age. One of the most prevalent chronic diseases is periodontal disease (inflammation of the gums), which affects about one-third of persons between 45 and 65 years of age and about one-half of persons older than age 65. Patients often do not report periodontal disease as a disabling condition, so it is not listed in comparative data. Mental diseases are also quite prevalent but are not necessarily accurately reported. Most of the leading causes of chronic disease reported in a national survey are associated with aging. Arthritis occurs predominantly in older adults. Diabetes mellitus, back ailments, hearing impairments, and visual impairments are other common chronic diseases that increase in frequency with age. Two chronic conditions that are about equally frequent in young and old persons are chronic bronchitis and asthma.

Certain physical conditions, although not diseases per se, contribute to the development of diseases. A good example is obesity, which is associated with enhanced development of hypertension, diabetes, and atherosclerosis—all three of which contribute to earlier onset and greater incidence of heart disease and strokes. Chronic disease accounts for 70% of all U.S. deaths and for more than 75% of all medical care costs.

Aging

Humans, like other species, have a finite life span. This life span is determined by the process of **aging**, a normal process affecting all individuals that is progressive and irreversible. Over the past century in the United States, a combination of sanitation, healthier lifestyles, better preventive care such as immunizations, and better medical care for previously fatal or potentially fatal conditions such as acute cholecystitis or traumatic accidents have markedly prolonged the life span. For example, in the 1920s, the **life expectancy**, or the amount of time an infant could expect to live, was around 55 years. In 2004, the life expectancy of an infant was around 80 years. It is estimated that by the middle of the 21st century, life expectancy will be close to 90 years. Although for many people this means they have a longer time to be active and enjoy life, it also means that many people will suffer chronic diseases for a longer period of time.

The aging process begins at physical maturity—in other words, at the end of adolescence, usually around age 17 through 20 years. It does not have a marked influence on death rate until much later in life. The mechanism of death from aging is increased susceptibility to disease. For example, aged individuals can die from respiratory infections, accidents, or exposure to cold that would not have killed them at a younger age.

There is no simple explanation for aging. Both genetic and acquired factors are involved. From a genetic

standpoint, each species has a maximum life span that is attained by a few individuals. The maximum life span of about 110 years for humans has not changed during the time that the average life expectancy has risen so dramatically in developed nations. Some families or inbred groups of people tend to live longer than others, perhaps because of a lesser tendency to develop certain diseases. Conversely, individuals with the rare genetic disease called progeria show the changes of aging at a very young age.

From an experimental standpoint, cells in culture undergo a limited number of cell divisions before dying out. Apparently, cell metabolism and cell turnover rates decrease with age, possibly secondary to the accumulation of acquired injuries. Mutations, damage to DNA, and cell death resulting from radiation or the formation of oxygen-derived free radicals may account for decreased cell turnover and decreased cell function. Cross-linking of collagen and other long-lived connective tissue substances makes them more rigid and less functional, leading to changes such as degenerative arthritis, wrinkling of the skin, and cataracts.

Diseases that increase in frequency with age can be roughly divided into those that are age dependent and those that are age related. **Age-dependent** diseases occur to some extent in all individuals with time. Examples include degenerative arthritis, osteoporosis, presbyopia, endocrine changes associated with atrophy of ovaries and testes, and hyperplasia of the prostate. **Age-related** diseases are not part of the aging process itself because not all individuals are affected. Examples include many types of cancer, actinic and seborrheic keratoses of the skin, atherosclerosis, hypertension, Alzheimer disease, diverticulosis of the colon, and cataracts. Still another group of diseases accumulates in frequency with age, although their onset is not age related. Examples include chronic lung disease from smoking and gallstones.

There is considerable variation in the degree to which body systems are affected by aging. Decrease in immunity is not overtly obvious but is expressed by an increased susceptibility to and severity of infections in older adults and by an increased rate of development of cancer caused by a failure of the immune system to reject cancer cells as foreign. Manifestations of aging in the endocrine system include impaired glucose tolerance that predisposes individuals to diabetes mellitus, decreased thyroid function, and decreased gonadal function leading to osteoporosis and other changes. Neuronal loss is part of the aging process. The musculoskeletal system and skin are also affected by aging. It becomes more difficult for older adults to maintain muscle strength and the skin becomes thin and loses its elasticity. Decrease in function of the heart, lungs, liver, and kidneys can be demonstrated, but the direct changes of aging have relatively little effect on them. Most of the decreased function of these organs is the result of major diseases such as atherosclerosis, emphysema, and diabetes, which may be age related but not age dependent. The intestines show little morphologic evidence of aging, but decreased motility is frequently manifested by constipation and diverticulosis in older persons.

As you have seen, most deaths in the United States result from heart disease, cancer, and stroke. Heart disease and stroke deaths are in part the result of aging itself, but there is also an environmental factor that causes accelerated atherosclerosis in the United States as compared to societies with a low-cholesterol diet such as in Japan. Japanese, like Americans, die from the effects of aging on the vascular system, but they rarely die at an early age from myocardial infarcts. This evidence suggests that some gain toward the ideal health curve could be made by a change in diet. The same could be said for many of the other factors that predispose to heart disease, cancer, and stroke, such as smoking, sedentary lifestyle, and obesity. It is clear that the major challenge in health care in the United States in the near future is to alter disease-promoting behaviors. Aging may not be reversible, but people can strive to live as long as their genes will let them.

Practice Questions

1. The leading causes of death
   - **A.** are the same all over the world.
   - **B.** are the same in children and adults.
   - **C.** are compiled from death certificates.
   - **D.** are stable over time.
   - **E.** are unrelated to aging.
2. Which are currently the three leading causes of death in the United States?
   - **A.** Stroke, lung disease, myocardial infarct
   - **B.** Heart disease, lung cancer, breast cancer
   - **C.** Heart disease, cancer, stroke
   - **D.** Atherosclerosis, myocardial infarct, stroke
   - **E.** Cancer, stroke, lung disease
3. Which of the following are not measures of ill health?
   - **A.** Death certificate statistics
   - **B.** Reasons for doctor office visits
   - **C.** Measures of disability
   - **D.** Financial costs of care
   - **E.** Prevalence and incidence
4. Which of the following is an accurate statement about prevalence and incidence?
   - **A.** Incidence is a more useful measure of chronic disease.
   - **B.** Prevalence measures the number of people with a particular disease at a particular time.
   - **C.** Incidence is used to assess direct and indirect costs of care.
   - **D.** Prevalence is the same as prognosis.
   - **E.** Prevalence measures the number of people who develop a disease in a particular time period.

5. The most common causes of disability (as defined in this chapter) are
   - **A.** acute infections, pregnancy and the neonatal period, and chronic obstructive pulmonary disease.
   - **B.** Alzheimer disease, mental illness, and aging.
   - **C.** heart disease, cancer, and stroke.
   - **D.** heart disease, arthritis, and mental illness.
   - **E.** arthritis, back pain, and heart disease.
6. The most common cause of death in the pediatric population is
   - **A.** accidents.
   - **B.** leukemia.
   - **C.** heart disease.
   - **D.** solid-organ cancer.
   - **E.** stroke.
7. A 76-year-old woman who is otherwise perfectly healthy, does not smoke, and does not have hypertension develops pneumonia. She is at greater risk of dying from this disease than a 42-year-old woman would be because of age-related changes in her
   - **A.** heart.
   - **B.** liver.
   - **C.** brain.
   - **D.** immune system.
   - **E.** endocrine system.
8. Life expectancy is
   - **A.** the same for everyone all over the world.
   - **B.** influenced by genetic and environmental factors.
   - **C.** lower now than it was 100 years ago.
   - **D.** unrelated to aging.
   - **E.** influenced most by access to medical care and pharmaceutical drugs.

REFERENCE

1. Surveillance Epidemiology and End Results (SEER). SEER Stat Fact Sheets: Breast. Available at http://seer.cancer.gov/statfacts/html/breast.html. Accessed August 24, 2010.