

1 Introduction to Clinical Applications

Objectives

In this chapter we will study

- various approaches to the study of disease;
- the role of the Centers for Disease Control and Prevention;
- common causes of disease;
- the distinction between signs and symptoms of disease;
- terms used to describe the time course of a disease; and
- common abbreviations for medical specialists and specialties.

Homeostasis and Disease

The body's tendency to maintain internal stability is called *homeostasis*. Examples include the body's relatively stable temperature, blood glucose concentration, hormone levels, acid-base balance, and electrolyte balance. When physiological variables deviate too much from their *set point*, the body activates *negative feedback loops* that tend to restore stability and maintain health. In some cases, such as the stoppage of bleeding, *positive feedback loops* are activated to bring about rapid change. If the attempt to regain homeostasis fails, *disease* results.

There is a strong emphasis in medicine today on promoting wellness through prevention. However, this manual focuses on what happens when prevention fails, homeostasis is disrupted, and disease occurs.

The Study of Disease

Disease (illness) is any deviation from normal that interferes with correct, life-sustaining bodily function. Literally, the word means *dis-ease*, the opposite of ease (comfort and normal function). Disease may have underlying structural foundations, such as a broken bone, and its effects may be observed not just at the level of bodily form and function but also at the level of the mind, as in psychiatric diseases (mental illness).

The study of disease is called **pathology**, a field that embraces all aspects of disease, from the patient's complaints to the gross and microscopic appearance of dysfunctional tissues and organs. **Pathologists** are physicians and others who specialize in this branch of medicine. A subdivision

of pathology called **pathophysiology** focuses specifically on the physiological (functional) aspects of organ dysfunction, as opposed to their structural abnormalities. **Histopathology** is the study of diseased organs at the microscopic level.

Epidemiologists are scientists who study the social distribution and spread of diseases, especially to determine their sources and causes and to halt their spread. Since epidemiology is such an important public health concern and epidemiologists play a key role in formulating public health policy, many epidemiologists work at such organizations as the World Health Organization (WHO), U.S. Public Health Service (USPHS), and comparable national health agencies in other countries. One of the premier institutions for epidemiology is the USPHS division called the Centers for Disease Control and Prevention (CDC), headquartered in Atlanta, Georgia. The CDC was originally established in Georgia because of the prevalence of malaria in that region of the United States and the importance of this infectious disease to the U.S. military personnel who trained at bases in the Southeast. While the CDC is primarily concerned with U.S. public health, its epidemiologists work worldwide because people engaged in commerce and travel so easily carry diseases from one country to another. Disease anywhere in the world is a potential threat to public health everywhere in the world.

The Causes of Disease

Etiology, in the strict sense, means the study of the causes of disease; in the broad sense, it also means the cause itself. For example, you may see a statement that some forms of encephalitis have a viral

etiology; this means that they are caused by a virus. Diseases for which no cause can be identified are called **idiopathic** diseases, loosely translated as “disease of one’s own.”

The causes of disease are enormously diverse; they include:

- genetic disorders such as mutated genes or excess or missing chromosomes;
- immune disorders, in which the immune system is either underactive (as in AIDS) or overactive, attacking the body itself (as in **autoimmune diseases** such as asthma, rheumatic fever, and rheumatoid arthritis);
- infectious agents such as viruses, bacteria, fungi, parasitic worms, and so forth (these organisms transmit **infectious diseases** from person to person, in contrast to *nontransmissible diseases* such as Alzheimer disease or arthritis);
- **trauma** (physical injury) from such causes as blows, cuts, heat, cold, radiation, and electrical shock;
- chemical agents such as **poisons** (any substances taken into the body that disturb normal physiology) and **toxins** (poisons of plant or animal origin);
- nutritional imbalances, ranging from vitamin deficiency diseases and eating disorders (*anorexia, bulimia*) to obesity; and
- stress, which can result from other diseases as well as from *psychosocial causes* such as divorce, the death of a loved one, or having to care for a chronically ill family member.

Diseases present at birth are called **congenital diseases** and may result from several of the preceding causes—for example, trisomy-21 (Down syndrome) from a genetic defect, fetal alcohol syndrome from a poison, congenital syphilis from an infectious organism, or congenital heart defects resulting from developmental abnormalities.

Certain conditions and habits are called **risk factors** because they increase a person’s probability of contracting a disease. Some of these we can do nothing about: Old age is a risk factor for osteoporosis and rheumatoid arthritis; being of African descent is a risk factor for hypertension and

sickle-cell disease; being of eastern European Jewish descent is a risk factor for Tay-Sachs disease; and being of white European descent is a risk factor for cystic fibrosis and phenylketonuria. Other risk factors are avoidable: Smoking is a risk factor for emphysema and lung cancer; suntanning is a risk factor for skin cancer; and careless sexual activity is a risk factor for AIDS and hepatitis. Such disorders are therefore called **preventable diseases**.

The Signs and Symptoms of Disease

When a person seeks treatment for a disease, he or she becomes a **patient**. This word comes from the Latin *patior*, “to suffer.” When a person reports to a clinic or physician (other than for a routine examination), he or she usually has a **complaint**, a feeling of “something wrong.” The disease, if indeed one exists, reveals itself through characteristic *signs* and *symptoms*.

A **sign** is an objective indication of disease that can be seen by any trained observer and expressed in terms others can verify—for example, a fever, high blood pressure, unevenly dilated pupils, swollen lymph nodes, or a skin lesion. A **symptom** is a subjective feeling of disease that can be known with certainty only by the patient—for example, pain, fatigue, blurry vision, or dizziness. There is no way that another person can directly perceive another person’s pain or dizziness, or even know with certainty that they exist and are not imaginary. A physical examination must correlate the symptoms reported by the patient with the signs observed by the examiner or revealed by clinical tests (such as blood and urine tests). This combination of information is then used to make a **diagnosis** (see chapter 2 of this manual).

Signs and symptoms are sometimes collectively called **pathologies**. Over the course of a disease, there are often typical signs and symptoms that run together. From “run together,” we get the word **syndrome** to refer to a collection of signs and symptoms and the degenerative processes that characterize a particular disorder—for example, *acquired immunodeficiency syndrome (AIDS)*, *fetal alcohol syndrome*, and *Down syndrome*.

Diseases in Time

Several important terms in pathology refer to the time course of disease or the status of a disease at a particular point in time. **Prevalence** means the number of people in a given population who have a disease at a given moment (*point prevalence*) or in a given time interval (*period prevalence*). **Incidence** means the number of new cases of a disease that appear in a given population over a given period of time. For example, a disease can have a high prevalence but low incidence, suggesting that it has been brought under control. This occurred in the mid-1900s when many children contracted polio from public swimming pools, but the polio vaccine brought the transmission of this disease under control, so that the number of new cases declined sharply. Thus, the prevalence of polio remained high while its incidence declined.

On the other hand, a disease can have a low prevalence but high incidence, suggesting that it is new to the population and may be an emerging threat to public health. Examples include the emergence of AIDS, ebola, and hepatitis C in recent decades. A high incidence of disease indicates an **epidemic**, an occurrence of illness significantly above normal expectations.

Two more terms that refer to the significance of a disease at the population level are *morbidity* and *mortality*. **Morbidity** is a collective term for the incidence or prevalence of a disease in a population—

that is, how many people in a given population have the disease or are coming down with it. **Mortality** means the rate of death in a given population from a particular disease. Certain diseases are called **notifiable (reportable) diseases** because physicians and other health-care providers are required by law to report all known cases to the USPHS or to similar agencies in other countries. These are diseases of special public health importance, making it advisable for the government to be aware of their incidence and prevalence. From such data, the CDC compiles a weekly publication, *Morbidity and Mortality Weekly Reports (MMWR)*, which reports the incidence, prevalence, and interesting case studies of reportable and other diseases.

The individual patient is naturally concerned about how long a given disease is likely to last. The **onset** of a disease is the time when signs and symptoms first appear. **Duration** is how long the disease lasts. Two terms distinguish the time course of different diseases in the individual—*acute* and *chronic*. An **acute disease** typically has a sudden onset and a duration of less than 3 months. It may involve one or more days of medical attention and restricted activity. Most acute diseases respond well to medical or surgical treatment; many can be treated with nonprescription drugs. Examples of acute diseases include colds, flu, and appendicitis.

Table 1.1 Some Abbreviations for Professional Titles*

D.D.S.	Doctor of Dental Surgery	M.D.	Doctor of Medicine
D.M.D.	Doctor of Dental Medicine	O.D.	Doctor of Optometry
D.O.	Doctor of Osteopathy	O.T.	Occupational Therapist
E.M.T.	Emergency Medical Technician	P.A.	Physician's Assistant
G.P.	General Practitioner	P.T.	Physical Therapist
L.P.N.	Licensed Practical Nurse	R.N.	Registered Nurse

* The abbreviation P.C. often seen after a doctor's name stands for "Professional Corporation." This is not a professional title, but a business title similar to Inc., serving for state licensing and tax purposes (used also by lawyers, accountants, and other self-employed professionals).

Table 1.2 Some Medical Specialties

<u>Specialty</u>	<u>Area of Concern or Practice</u>
Anesthesiology	Physiology, pharmacology, and clinical basis of anesthesia
Bariatrics	Prevention and treatment of obesity
Cardiology	Study of the heart and treatment of its dysfunctions
Dermatology	Study of the skin and treatment of its dysfunctions
Endocrinology	Study of the endocrine system and treatment of its dysfunctions
Endodontics	Treatment of the dental pulp
Epidemiology	Study of the incidence, distribution, and control of disease in a population
Forensic medicine	The application of medical knowledge to legal matters
Family medicine	Treatment of individuals throughout the life span from infancy to old age, with emphasis on the family as a unit
Gastroenterology	Treatment of the stomach, intestines, and associated organs
General dentistry	General treatment and preventive maintenance of the teeth and associated oral tissues
Geriatrics	Care and treatment of the aged
Gerodontology	Treatment and preventive maintenance of the teeth and associated oral tissues in the aged
Gynecology	Treatment of the female reproductive tract
Internal medicine	Nonsurgical treatment of adult diseases, excluding diseases of the skin and nervous system
Neurology	Treatment of disorders of the nervous system
Nuclear medicine	The use of radioisotopes for diagnosis and therapy
Obstetrics	Care of women during pregnancy, childbirth, and the few weeks immediately after childbirth
Oncology	The study and treatment of both benign and malignant (cancerous) tumors
Ophthalmology	Medical treatment of the eye
Optometry	Examination of the eyes, diagnosis of visual disorders, and prescription of lenses and other aids for improving vision
Orthodontics	Prevention and correction of malocclusion (misalignment of the teeth)
Orthopedics	Medical, surgical, and physical treatment of the musculoskeletal system
Otology	Study and treatment of the ear and hearing
Otolaryngology	Treatment of the ear, nose, and throat
Pathology	Study and treatment of disease
Pediatrics	Treatment of children
Pedodontics	Treatment and preventive maintenance of the dental tissues of children
Periodontics	Treatment of the tissues immediately around the teeth
Pharmacology	Study of drug chemistry, actions, and uses
Podiatry	Treatment of diseases, injuries, or defects of the feet
Psychiatry	Diagnosis and treatment of mental disorders
Radiology	Diagnosis and treatment of disease, or medical imaging, with the aid of high-energy radiation
Rheumatology	Treatment of arthritis and other joint and musculoskeletal disorders
Sports medicine	Treatment and preventive care of people engaged in sporting and recreational activities
Surgery	Treatment of disease, injury, or deformity through manipulation or operation
Teratology	The science of fetal deformity
Toxicology	The science of poisons and antidotes
Urology	Treatment of the urinary tract

A **chronic disease** has a slower onset and lasts more than 3 months. Chronic diseases often cause irreversible pathologic changes and permanent alterations of function. They typically require long-term health care. Examples of chronic diseases include diabetes, arthritis, kidney failure, and some forms of cancer. Some chronic diseases are described as **insidious** because they begin with seemingly minor changes that don't cause much immediate concern. Hypertension and glaucoma, for example, can "sneak up on us," causing irreversible damage or even death (such as a fatal stroke) before any signs or symptoms are observed. Some diseases, intermediate between acute and chronic in their course, are called **subacute (rapidly progressive)** diseases.

Medical Personnel and Facilities

Such a wide variety of treatment facilities are available today that in this manual we use the general term *clinic* to refer to all of them, whether hospital, physician's office, walk-in clinic, long-term care facility, acute-care facility, or other site. Likewise, we use the term *clinician* to refer to a variety of health-care providers: physicians, surgeons, physician's assistants, nurses, aides, dentists, physical therapists, occupational therapists, and many others. Table 1.1 lists some abbreviations for clinicians who practice various medical specialties, and table 1.2 lists some of the specialized branches of medicine.

Case Study 1 The Children with Lead Poisoning

A physician working for the U.S. Public Health Service moves to Los Angeles to assume the directorship of an inner-city health-care facility for the disadvantaged. Over a period of time, she notices that an unusually large number of children brought to the clinic are experiencing joint pain, difficulty walking, and excessive salivation. Some have had seizures. Also, many of their parents note that the children's personalities have changed, with normally outgoing children becoming shy and withdrawn.

The physician decides to investigate the situation and contacts the CDC, which sends an epidemiologist to assist her. They obtain more complete medical histories for 15 children, ranging from 6 to 15 years of age, and perform blood and urine tests on each. In addition to the signs and symptoms already noted, the children frequently report numbness and tingling in their limbs; they perform poorly on hearing, vision, and intelligence tests; and their laboratory results show reduced red blood cell (RBC) counts and traces of lead in the blood and urine.

All of these children live in the same housing project, play together in the neighborhood, and contribute a little to the family finances by salvaging scrap metal from a closed manufacturing plant nearby and selling it to recyclers. When the epidemiologist inspects the site, he finds paint peeling from the

factory walls and dust on the floor composed in large part of pulverized paint chips. Analysis of the paint chips and dust reveals a high lead content. (Lead was commonly used in paint before the 1950s) Lead and other heavy metals are also found in soil samples taken around the factory yard.

Suspicious of lead poisoning, the physician initiates a broader campaign of medical examination. Among children under 16 living in the area, she finds a high prevalence of lead poisoning. Specifically, of the 112 children examined during the course of the study, over 70 show at least some signs and symptoms. By contrast, she finds relatively little evidence of lead poisoning among adults 25 and older, who of course do not play on the factory grounds and most of whom have means of employment other than collecting and recycling scrap metal. The only adult with significant indications of lead poisoning is an elderly woman with *pica*, a compulsive habit of chewing on nonnutritive substances—in this case, the lead foil wrapped around wine bottle corks. *Pica* is often associated with a dietary iron deficiency and with iron-deficiency anemia. The physician treats the affected patients for lead poisoning, and the CDC enlists the Environmental Protection Agency to demolish the old factory and decontaminate the soil.

Based on this case study and other information in this chapter, answer the following questions.

1. What is the etiology of the mental and physiological signs shown by these patients?
2. What risk factors for lead poisoning can you identify in this case study?
3. Is lead a toxin?
4. Do any of the people in this story exhibit idiopathic lead poisoning? Why or why not?
5. Would you consider lead poisoning a syndrome? Why or why not?
6. At what point in this case does histopathology become relevant?
7. Based on the information presented, does the lead poisoning in this community show a high morbidity? A high mortality? A high prevalence? A high incidence? For each term, answer yes or no, or state that there is insufficient information on which to base an opinion. Explain your answers.
8. Would you consider the lead poisoning in this case an epidemic? Would you consider it an infectious disease? Explain each answer.
9. Identify each of the following as either a sign or a symptom of lead poisoning:
 - a. joint pain
 - b. difficulty walking
 - c. excessive salivation
 - d. personality changes
 - e. low RBC count
 - f. subnormal intelligence
 - g. dimness of vision
 - h. lead in the urine
10. The elderly woman with pica lives with her daughter's family. Her daughter says she can't get her mother to stop chewing the foil from the wine bottles, and the mother says she likes the metallic feel on her teeth. If you were the physician, what might you suggest to control her lead poisoning?

Selected Clinical Terms

acute disease A disease that has a sudden onset and a relatively short duration (less than 3 months), such as acute appendicitis or rhinitis (a cold).

autoimmune disease Any disease in which the immune system attacks the body's own tissues—for example, rheumatic fever, rheumatoid arthritis, and systemic lupus erythematosus.

chronic disease A disease that has a slow onset and relatively long duration (more than 3 months), such as cancer or emphysema.

disease Any deviation from normal that interferes with correct, life-sustaining bodily function.

epidemiology The study of the social distribution and spread of diseases, especially to determine their sources and causes and to halt their spread.

etiology 1. The study of the causes of disease. 2. The cause of any specific disease.

incidence The number of new cases of a disease that appear in a population over a given time period.

infectious disease Any disease caused by organisms such as bacteria, viruses, fungi, etc., that can be transmitted from one person to another.

morbidity The incidence or prevalence of a disease in a population.

mortality The rate of death from a particular disease in a population.

pathology 1. The study of disease. 2. Collective term for the signs and symptoms of a disease.

poison Any substance taken into the body that disturbs normal physiology.

prevalence The number of people in a population who have a disease at a given moment in time or in a given time interval.

risk factor Any condition or habit that increases the probability of contracting a particular disease, such as age, sex, heredity, smoking, diet, or occupation.

sign An objective indication of disease that can be seen by any trained observer, such as a fever or skin lesion.