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وزارة التعليم
Ministry of Education

المملكة العربية السعودية

Principles of Health Sciences

Secondary Stage – Pathways System
Second Year

The book is distributed freely and cannot be sold.

1447–2025 Edition

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بسم الله الرحمن الرحيم

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INTRODUCTION

The progress and development of countries can be measured by their ability to invest in education and by the extent to which their educational system responds to the requirements and changes of the age. It is the responsibility of the Ministry of Education to sustain the development of its educational systems. In response to the concept of Saudi Arabia's Vision 2030 policy, the Ministry has taken the initiative in adopting the Secondary Education Pathways system with the aim of bringing about effective and comprehensive reform at the secondary stage.

The Secondary Education Pathways system provides a distinguished and modern educational model for secondary education in Saudi Arabia, which efficiently contributes to:

- Strengthening the values associated with belonging to our homeland, the Kingdom of Saudi Arabia, and of loyalty to its wise leaders, may Allah protect them, based on pure belief founded on tolerant Islamic teachings.
- Strengthening the values of citizenship by focusing on them in the school curriculum and in class activities, in line with the demands of sustainable development and the development plans of Saudi Arabia, which emphasize the consolidation of the duality of values and identity, founded on the teachings of Islam and moderation.
- Offering qualifications to students that are in line with future specializations in universities and colleges or the required professions, and ensuring that educational outputs are consistent with the requirements of the labor market.
- Enabling students to pursue education along their preferred track at an early stage, according to their inclinations and abilities.
- Enabling students to enrol in specific scientific and administrative disciplines related to the labor market and future jobs.
- Integrating students into an enjoyable and stimulating learning environment within the school, based on a constructive philosophy and applied practices within an active learning environment.
- Guiding students on an integrated educational journey from the primary stage to the end of secondary stage, and facilitating the process of their transition to the post-general education stage.
- Providing students with the technical and personal skills which will help them to deal with life and to respond to the requirements of the stage they are at.
- Expanding opportunities for graduate secondary school students through various options in addition to universities, such as by obtaining professional certificates, joining applied colleges, and obtaining job diplomas.

The Pathways system consists of six semesters taught over three years, including a common first year in which students receive lessons in various scientific and human fields, followed by two specialized years during which students follow a general pathway as well as four specialized pathways consistent with their inclinations and abilities. These are: the Legal Pathway, the Business Administration Pathway, the Computer Science and Engineering Pathway, and the Health and Life Pathway. This makes this system the best option for students in terms of:

- The existence of new study materials that comply with the requirements of the so-called Fourth Industrial Revolution and its associated development plans, as well as the Saudi Vision 2030 policy which aims to develop higher-order thinking, problem solving, and research skills.

- Elective field programs which are consistent with the needs of the labor market and the students' own preferences. This enables students to enrol in a specific elective field according to a specific job skills matrix.
- An "inclination" scale that ensures the attainment of students' efficiency levels and effectiveness, and helps them to determine their own tendencies, predispositions, and strengths—all of which enhances their chances of success in the future.
- Volunteer work designed specifically for students in line with the philosophy of activities in schools, which is also one of the graduation requirements. This helps to promote humane values, build up society, and ensures its development and cohesion.
- A transfer procedure that enables students to move from one pathway to another according to specific mechanisms.
- Proficiency classes in which skills are developed and achievement levels improved, by providing intensive and remedial lessons.
- Options for combining education with e-learning and blended learning/teaching, which are built into the Pathways system for reasons of flexibility, convenience, interaction, and effectiveness.
- A graduation project that helps students to integrate theoretical experiences with applied practices.
- Professional and skill-based certificates that are awarded to students after completing specific tasks and certain tests in partnership with specialized bodies.
- The Health and Life Pathway is one of paths developed at secondary level. It contributes to promoting national health and disease prevention, by providing students with knowledge, skills, and positive attitudes that strengthen healthy individual and social behaviors, and investing in the potential of its citizens in biomedical specializations, preparing them for the world of work. The Health and Life Pathway is distinguished by its detailed content in the fields of science and mathematics, and specialized courses in the field of health and life, enhanced by teaching techniques that emphasize the role of the learner in the educational process.

"Principles of Health Sciences" is one of the main subjects in the Health and Life Pathway. It aims to:

- Provide students with knowledge and skills related to the health science field.
- Contribute to the students' overall educational journey and enhance the integration of subjects learned at lower academic levels.
- Apply the principles needed to identify and solve medical problems and enhance the health of individuals.
- Enable students to acquire basic skills in evaluating and applying bioethical standards to ensure effectiveness in health environments.
- Enhance students' understanding of the health care field and the careers available to them in this field.
- Develop an understanding of the basics of health, nutrition and disease prevention.
- To keep pace with global developments in this field, the book "Principles of Health Sciences" provides the teacher with an integrated set of diverse educational materials that take into account the individual differences between students. It references educational software and websites, which provide students with the opportunity to employ modern technologies and practice-based communication that serve to further consolidate the teaching and learning process outlined in the book.

"Principles of Health Sciences Part 1" lays the foundations for the principles of health science that students need to succeed in a career in health sciences. "Principles of Health Sciences Part 2" builds on the basic knowledge gained in Part 1. It explores various specialist areas of health in more detail and provides in-depth information on each topic covered.

By introducing this book to our students, we hope it excites their interest, meets their needs, and makes their learning of this course more enjoyable and useful.

May Allah grant us success

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HOW TO USE THIS TEXTBOOK

LEARNING OBJECTIVES

Review these goals before you begin reading a chapter to help you focus your study. Then, when you have completed the chapter, go back and review these goals to see if you have grasped the key points of the chapter.

LEARNING OBJECTIVES (EXAMPLES)

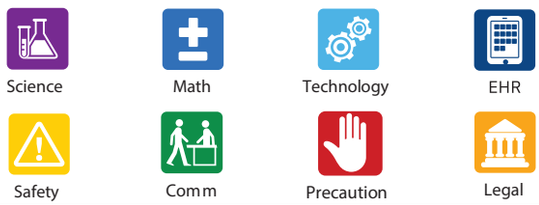
After completing this chapter, you should be able to:

- Identify the basic principles of infection and infection control.
- Wash hands following aseptic technique.
- Observe standard precautions needed while working in the laboratory or clinical area.
- Follow basic principles of sterilization, disinfection, ultrasonic cleaning, and sterile techniques.
- Explain how to care for patients in a transmission-based isolation unit.

ICONS

Icons are used throughout the text to highlight specific pieces of information.

(EXAMPLES)



KEY TERMS

Key terms highlight the critical vocabulary words you will need to learn. These terms are highlighted red within the text. You will also find most of these terms listed in the Glossary section. Use this listing as part of your study and review of critical terms.

KEY TERMS (EXAMPLES)

abrasion
burn
cardiopulmonary resuscitation (CPR)
defibrillator
diabetic coma
dislocation
first aid
fracture
heart attack
hemorrhage
infection
poisoning
shock
stroke
wound

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TODAY'S RESEARCH: TOMORROW'S HEALTH CARE

Today's Research: Tomorrow's Health Care boxes are located in most chapters. These commentaries help you learn about the many different types of research occurring today. If the research is successful, it may lead to possible cures and/or better methods of treatment in the future for a wide range of diseases and disorders. These boxes of information also highlight the fact that health care changes constantly because of new ideas and technology.

Today's Research **Tomorrow's** Health Care

Paint Away Those Germs?

Health care-associated infections are a major problem for health care providers. MRSA is one of the most common health care-associated infections. It is a bacterium that causes severe infections in humans and is difficult to treat because it is resistant to many antibiotics, which means the antibiotics will not eliminate the organism.

Now, thanks to biotechnology research, it is possible to use paint to kill MRSA germs. Researchers studied a naturally occurring enzyme, lysostaphin, that is used by nonpathogenic (nondisease-producing) strains of ***Staphylococcus*** bacteria to defend themselves against ***S. aureus***. Lysostaphin is harmless to humans and toxic only to MRSA. It is not an antibiotic to which bacteria could become resistant, and it does not leach chemicals into the environment.

Lysostaphin kills MRSA bacteria by slicing open the cell wall, causing the MRSA cell to explode and die. One problem encountered during the research was that the lysostaphin was not stable and would not remain in other substances for long periods. The researchers solved this problem by packing the lysostaphin in carbon nanotubes, tiny structures that lock the enzyme in place. The nanotubes containing the enzyme were put in a can of ordinary house paint, which was used to paint a wall. Studies showed that 100% of MRSA organisms were destroyed when they came into contact with the paint. The paint remained effective even after repeated washings. Recently, a microbicidal paint has been created that kills more than 99% of MRSA, ***Escherichia coli***, and vancomycin-resistant ***Enterococcus faecalis*** pathogens within 2 hours of exposure on painted surfaces.

This initial research could provide many benefits for both health care and other commercial products. By creating coatings containing nanotubes of lysostaphin, commercial products could be developed for walls, furniture, medical equipment, food-processing equipment, and even items such as shoes, masks, or hospital gowns. If this happens, a simple, inexpensive, naturally occurring substance could prevent health care-associated infections, save lives, and decrease medical costs.

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REVIEW QUESTIONS

Review Questions enhance your comprehension of chapter content. After you have completed the chapter reading, try to answer the review questions at the end of the chapter. If you find yourself unable to answer the questions, go back and review the chapter again.

REVIEW QUESTIONS (EXAMPLES)

1. What is hyperthermia and why is it dangerous?
2. What is pain and how can it be assessed?
3. Define each of the following: oral; axillary; aural.
4. What three factors must be noted about every pulse?

CRITICAL THINKING

Critical Thinking questions offer you the ability to build upon the content learned throughout the chapter. You will form greater knowledge by investigating complementary topics.

CRITICAL THINKING (EXAMPLES)

1. Describe why the assessment of vital signs is important.
2. What factors increase your pulse rate? What could you do to lower your pulse rate?
3. Using the Internet, research different types of thermometer. Write a presentation for the class about choosing a thermometer.

ACTIVITIES

Activities give you the chance to work with fellow classmates. Using real-life medical scenarios, you will have the opportunity to apply what you learned in a creative and challenging way.

ACTIVITIES (EXAMPLES)

1. In a group of four, create a skill checklist to demonstrate safely using a fire extinguisher and putting out a fire. To practice: two people are partners that go in to put out the fire, one person is a "scribe" observing and completing the checklist, and one is assisting the scribe in spotting procedure specifics.
2. In a small group, develop a scenario that demonstrates observation of good practice in the event of a chemical spill such as mercury.
3. With a partner, research and create a training video covering good posture and how to use effective body mechanics.

FOREWORD

Welcome to the world of health science education!

You have chosen a career in a field that offers endless opportunities. If you learn and master the knowledge and skills required, you can find employment in any number of rewarding careers.

What would you do?
Mohammed is cycling fast when he hits an obstacle and falls heavily. Hamad sees the fall and goes to help. What should Hamad do first?

What could be wrong?
Hamad sees Mohammed's foot is swollen and lying at an odd angle. He suspects his ankle may be broken. What can he do to help before the emergency services arrive?

What is the answer?
Mohammed must check that it is safe to approach and then ask Hamad if he is OK. He should not attempt to move Hamad, but he should call the emergency services as soon as possible, and reassure Hamad that help is on the way.

Let's get started using this book to lay the foundation and learn the principles of health science you will need to help this patient.



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Part 1

Chapter 1 HISTORY AND TRENDS OF HEALTH CARE

Chapter 2 HEALTH CARE SYSTEMS

Chapter 3 CAREERS IN HEALTH CARE

Chapter 4 PERSONAL AND PROFESSIONAL QUALITIES OF A HEALTH CARE TEAM MEMBER

Chapter 5 LEGAL AND ETHICAL RESPONSIBILITIES

Chapter 6 MEDICAL TERMINOLOGY

Chapter 7 HUMAN GROWTH AND DEVELOPMENT

Chapter 8 NUTRITION AND DIETS

Chapter 9 COMPUTERS AND TECHNOLOGY IN HEALTH CARE

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Link to digital lesson

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CHAPTER

1 HISTORY AND TRENDS OF HEALTH CARE

Case Study Investigation

Fatima is a 53-year-old Saudi woman whose blood pressure has begun to rise above normal levels. Fatima is taking care of her ill mother and is still working full time, which makes her stressed. She is looking for ways to help manage her blood pressure, and she would like to find a complementary medicine that might help her. She has heard about roselle tea and wonders if it works. What complementary medicines might you suggest to Fatima? Is there anything else that she might do to help her condition?

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Create a timeline showing what you believe are the most important developments in medicine throughout history.
- Identify at least five current trends or changes in health care.
- Explain how discoveries in health care have led to the advancement of this field.

KEY TERMS

alternative therapies
biotechnology
complementary therapies
cost containment
energy conservation
geriatric care
holistic health care
home health care
nanotechnology
outpatient services
pandemic
telemedicine
wellness

NOTE: *To further emphasize the key terms, they appear in color within the chapter.*

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1:1 HISTORY OF HEALTH CARE

Why is it important to understand the historical significance of health care? Would you believe that some of the treatment methods in use today were also used in ancient times? In the days before drug stores, people used many herbs and plants as both food and medicine. Many of these herbs remain in use today. A common example is a medication called *morphine*. Morphine is made from the poppy plant and is used to manage pain. As you review each period of history, think about how the discoveries made in that period have helped to improve the health care you receive today. The timeline in **Figure 1–1** shows some of the developments in medicine throughout history.

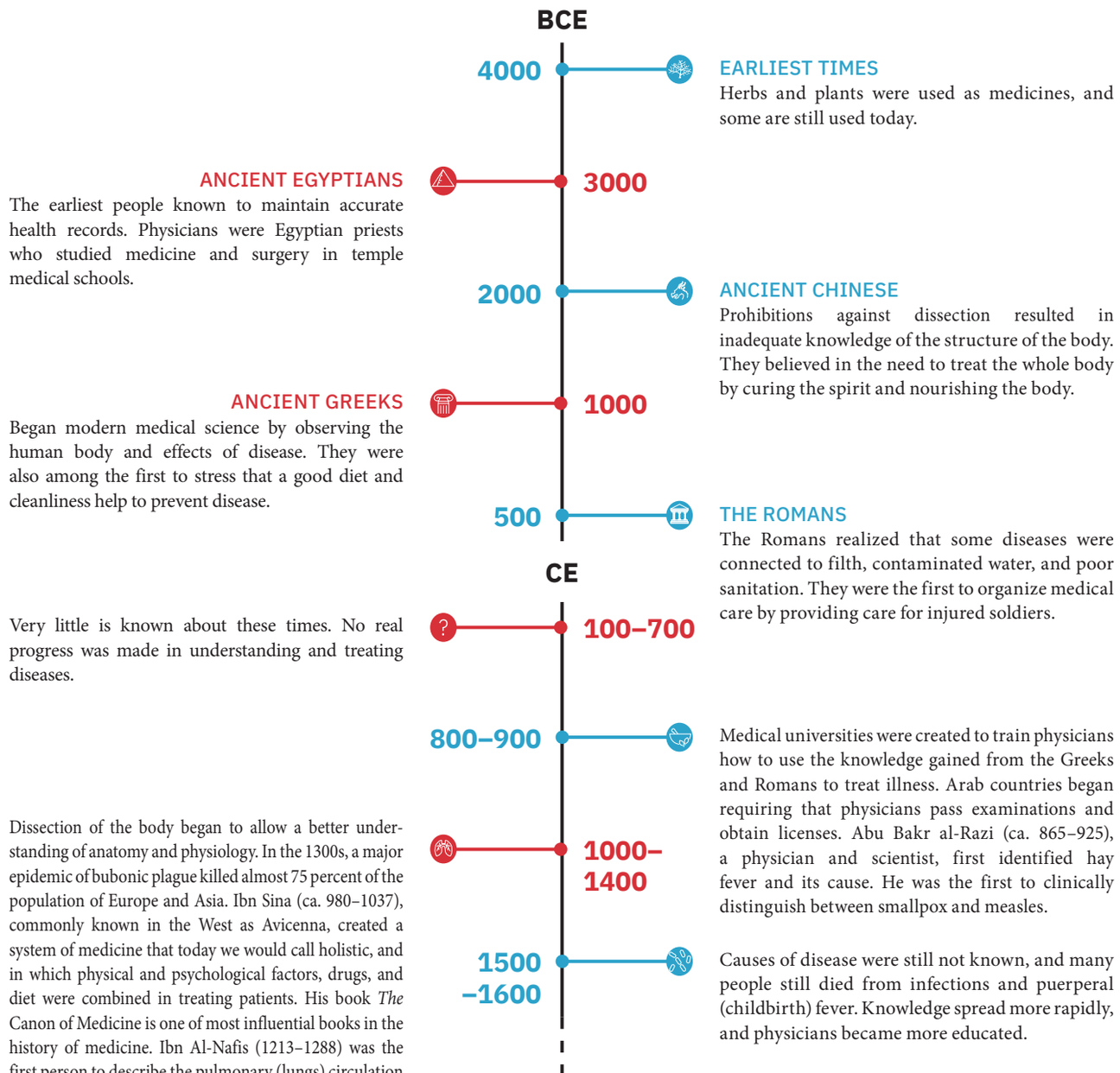


FIGURE 1–1 The development of medicine.

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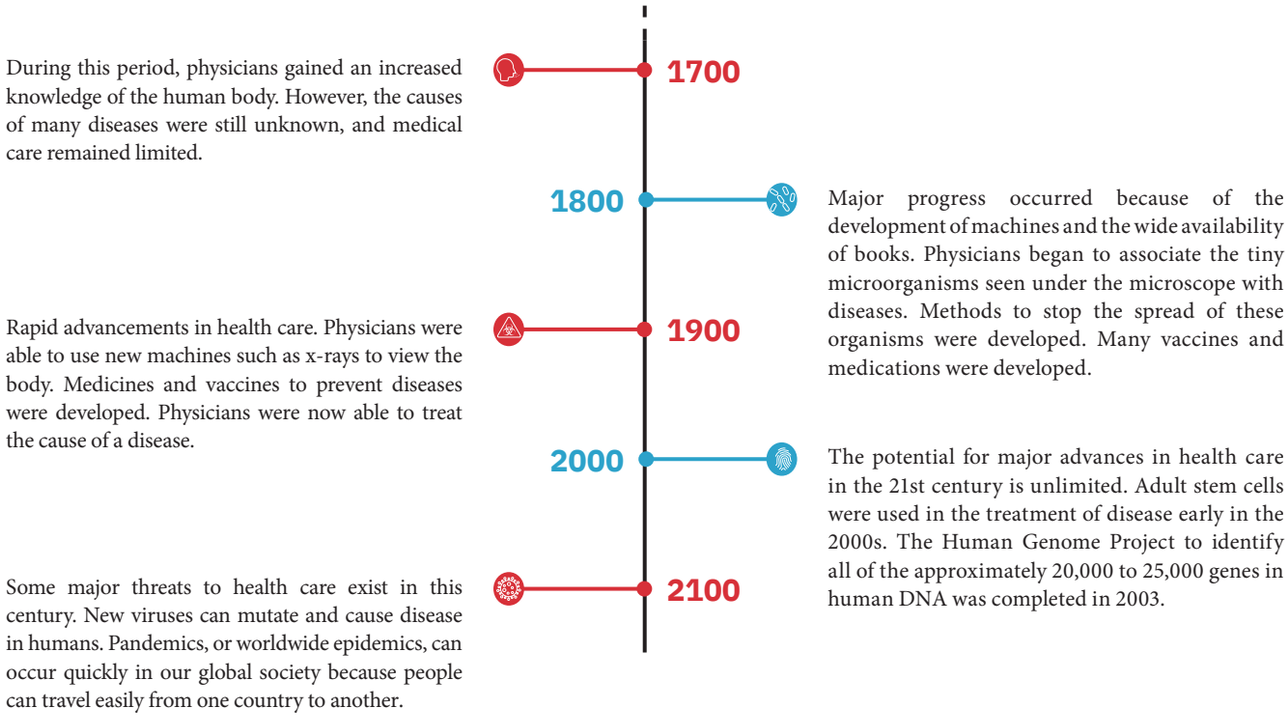


FIGURE 1–1 The development of medicine (*continued*).

checkpoint

1. What were the contributions of the ancient Greeks and the Romans to the development of medicine?
2. When was the Human Genome Project completed?

1:2 TRENDS IN HEALTH CARE

Health care has seen many changes during the past several decades, and many additional changes will occur in the years to come. Robotics and technology have increased the pace of new innovations in the medical field.

An awareness of such changes and trends is important for all health care professionals.

COST CONTAINMENT

Cost containment means trying to control the rising cost of health care and achieve the maximum benefit for every Saudi Riyal spent. Some reasons for high health care costs include:

- **Technological advances**, such as heart, lung, liver, or kidney transplants, artificial hearts, computers and technology that can examine internal body parts.

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- **The aging population**, caused by increases in lifespan, has had an effect on the type of health care needed by older people.

Some methods of cost containment include:

- **Combination of services** eliminates duplication. Laboratories, diagnostics centers and imaging departments are shared by multiple hospitals, clinics, and other health care providers among a "health cluster".
- **Outpatient services**, where patients receive care without being admitted to hospitals or other care facilities.
- **Mass or bulk purchasing**, where equipment and supplies are purchased in larger quantities at reduced prices.
- **Early intervention and preventive services**, such as patient education, immunizations, regular physical examinations to detect problems early, incentives for individuals to participate in preventive activities, and easy access for all individuals to preventive health care services.
- **Environmental protection**: A major expense is the correct disposal of the toxic waste that health care produces.
- **Energy conservation** by monitoring the use of energy to control costs and conserve resources and recycling is also a form of energy conservation, and most health care facilities recycle many different materials.

These are just a few examples of cost containment. It is important to note that the quality of health care should not be lowered simply to control costs. The Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) sets unified performance standards for all health care facilities operating in the Kingdom, assessing and granting accreditation to support all health care providers to comply with quality and patient safety standards. In addition, every health care worker must make every effort to provide quality care while doing everything possible to avoid waste and keep expenditures down. Health care consumers must assume more responsibility for their own care, become better informed of all options for health care services, and follow preventive measures to avoid or limit illness and disease. Everyone working together can help control the rising cost of health care.

HOME HEALTH CARE

Career

Home health care is increasing because diagnostic-related groups and shorter hospital stays have created a need for care in the home. Years ago, home care was the usual method of treatment. Doctors made house calls, private duty nurses cared for patients in the patients' homes, babies were delivered at home, and patients died at home. Current trends show a return to some of these practices. Home care is also another form of cost containment because it is usually less expensive to provide this type of care. All aspects of health care can be provided in the home, such as nursing care, physical and occupational therapy, respiratory therapy, social services, nutritional and food services.

GERIATRIC CARE

Career

Geriatric care, or care for the elderly, is another field that will continue to experience rapid growth in the future. This is caused in part by the large number of individuals who have longer life spans because of advances in health care. Many people now enjoy life spans of 80 years or more. Years ago, very few people lived to be 100 years old, but this experience is becoming more and more common.

TELEMEDICINE

Telemedicine involves the use of video, audio, and computer systems to provide medical and/or health care services (**Figure 1–2**). New technology now allows interactive services between health care providers even though they may be in different locations. Telemedicine allows medical professionals to diagnose and treat patients without unnecessary exposure to disease for either provider or patient. Practitioners can also spread information and take care of noncritical patients in a home setting.

EHR

Electronic health records (EHRs), also called electronic medical records (EMRs), help with rapid transmission of patient information. When physician offices, hospitals, and other health care providers have access to EMRs, a doctor, or anyone else who has permission, can obtain hospital laboratory results, radiology reports, and EHRs at any location. Patients can also access their EHRs to obtain information about their medical care.

The use of satellite and video technology also enhances medical care. Surgeons using a computer can guide a remote-controlled robotic arm to perform surgery on a patient many miles away. In other instances, one surgeon can direct the work of another surgeon by watching the procedure on video beamed by a satellite system.

Telephone apps enable patients to test their own blood sugar levels, oxygen levels, blood pressure measurements, and other vital signs and send the results to a health care provider. They can also monitor pacemakers, use online courses to learn how to manage their condition(s), schedule an appointment to talk with a health care provider, receive electronic reminders to take medications or perform diagnostic tests, and receive answers to specific health questions. In rural areas, where specialty care is often limited, telemedicine can provide a patient with access to specialists thousands of miles away. Telemedicine is an important way to deliver health care.



FIGURE 1–2 Telemedicine allows medical professionals to diagnose and treat patients remotely.

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WELLNESS

Career

Wellness is the state of being in optimum health with a balanced relationship between physical, mental, and social health. People are more aware of the need to maintain health and prevent disease because disease prevention improves their quality of life and saves costs. More individuals are recognizing the importance of exercise, good nutrition, weight control, and healthy living habits (**Figure 1–3**). This trend has led to the establishment of wellness centers, weight-control facilities, health food stores, nutrition services, stress reduction counseling, and habit cessation management.



FIGURE 1–3 Individuals are recognizing the importance of exercise and healthy living habits.

Wellness is determined by the lifestyle choices made by an individual and involves many factors. Some of the factors and ways to promote wellness include:

- **Physical wellness**: promoted by a well-balanced diet; regular exercise; routine physical examinations and immunizations; regular dental and vision examinations; and avoidance of environmental contaminants, and unhealthy habits such as tobacco smoking.
- **Emotional wellness**: promoted by understanding personal feelings and expressing them appropriately, accepting one's limitations, adjusting to change, coping with stress, enjoying life, and maintaining an optimistic outlook.
- **Social wellness**: promoted by showing concern, fairness, affection, tolerance, and respect for others; communicating and interacting well with others; sharing ideas and thoughts; and practicing honesty and loyalty.
- **Mental and intellectual wellness**: promoted by being creative, logical, curious, and open-minded; using common sense; continually learning; questioning and evaluating information and situations; learning from life experiences; and using flexibility and creativity to solve problems.
- **Spiritual wellness**: promoted by the teachings and values of Islamic ethics, morals, and practices to find meaning, direction, and purpose in life.

The trend toward wellness has led to **holistic health care**, or care that promotes physical, emotional, social, intellectual, and spiritual well-being by treating the

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FIGURE 1–4 Cupping.

whole body, mind, and spirit. Each patient is recognized as a unique person with different needs.

COMPLEMENTARY AND ALTERNATIVE METHODS OF HEALTH CARE

There is a trend toward the use of complementary and alternative (CAM) health care therapies as part of an integrative medicine approach. **Complementary therapies** are methods of treatment that are used in conjunction with conventional medical therapies. **Alternative therapies** are methods of treatment that are used in place of biomedical therapies. Even though the two terms are different, the term *alternative* is usually applied whether or not the therapy is used in place of, or in conjunction with, conventional medical therapies.

The National Center for Complementary and Alternative Medicine (NCCAM) serves as a national regulatory entity in all matters related to complementary and alternative medicine activities.

The interest in holistic health care has increased the use of CAM therapies. There are five CAM practices approved and licensed by the NCCAM. One of these is cupping (Hijama) (**Figure 1–4**). Heated cups are placed on the surface of the skin to create a local vacuum and draw fluids to the area.

More information about complementary therapies is available on the NCCAM website.

PANDEMIC

A **pandemic** exists when the outbreak of a disease occurs over a wide geographic area and affects a high proportion of the population. A major concern today is that worldwide pandemics will become more and more frequent as individuals can travel rapidly throughout the world.

The World Health Organization (WHO) is concerned about influenza pandemics occurring in the near future. Pandemics have happened throughout history.

- The "Spanish flu" pandemic of 1918, which killed 40 million people; the same virus (called H1N1) causes bird flu today.
- Middle East respiratory syndrome (MERS) was identified in 2012 and has killed approximately 35% of people with the virus, which lives in dromedary camels.
- Ebola virus was first discovered in 1976. It caused a widespread outbreak of disease in West African countries in 2014, when more than 70% of people who caught the virus dies of the disease.

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- In 2019, a new coronavirus that causes the disease COVID-19 spread from China to the rest of the world. WHO declared an international public health emergency and subsequently a pandemic. The first case in Saudi Arabia was identified in the Eastern region. The Kingdom quickly implemented measures to limit the spread of the disease. The region was put into lockdown and gatherings were prohibited. Social distancing, hand washing, and mask wearing were advised. As the disease spread, travel and large gatherings were limited across the Kingdom.

Many governments are creating pandemic influenza plans to protect their populations in the future. Components of most plans include the following:

- **Education**: Information about the pandemic and ways to avoid its spread must be given to the entire population.
- **Vaccine production**: In 2018, newly developed vaccines were freeze-dried for ease of transportation to remote areas. Patients may eventually be vaccinated not just by injection but also intranasally, orally, or in a patch.
- **Antiviral drugs**: Drugs that are currently available must be stockpiled so they will be ready for immediate use.
- **Development of protective public health measures**: Influenza and other viruses like COVID-19 must be diagnosed rapidly and accurately, strict infection control methods must be implemented to limit the spread of the virus, first responders and health care personnel must be immunized so they will be able to care for infected individuals, and quarantine measures must be used if necessary to control the spread of the disease.
- **International cooperation**: Countries must be willing to work with each other to create an international plan that will limit the spread of lethal viruses and decrease the severity of a pandemic.

In the near future, much effort will be directed toward identifying and limiting the effect of any organism that could lead to a pandemic. Health care providers must stay informed and be prepared to deal with the consequences of a pandemic. Cooperation to prevent pandemics must be a global effort. WHO and the governments of all countries must constantly be alert to the dangers that pandemics can present and be ready to act when one occurs.

BIOTECHNOLOGIES


Science

Biotechnology is the use of the genetic and biochemical processes of living systems and organisms to develop or modify useful products. Some of these developments include genomics, stem cell research, and nanotechnology.

- **Genomics** is the study of all the genes in the human genome, or the complete set of DNA within a single cell of an organism.

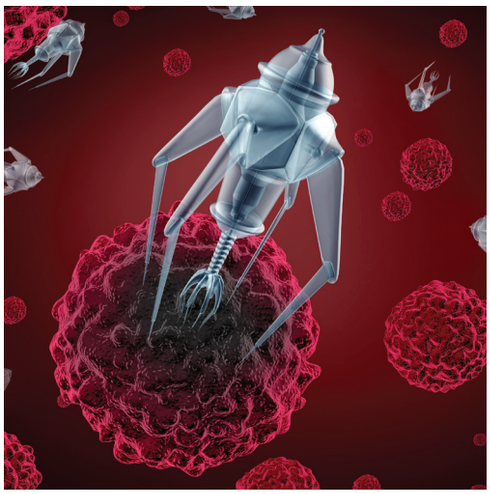


FIGURE 1–5 A group of microscopic nano robots could be programed to kill cancer cells.

- **Genomic (genetic) testing** is the use of specific tests to check for the presence of inherited genes known to cause disease.

These tests allow preventive methods and/or early diagnosis to eliminate or decrease the effects of the disease. Approved genetic tests are available for cancers such as breast and colorectal cancer, and for diseases such as Parkinson's disease, and hereditary hemochromatosis. In addition, prenatal screening tests can be performed for diseases such as cystic fibrosis.

- **Stem cell research** studies stem cells, or cells that are capable of becoming specialized cells in the body such as skin, muscle, or nerve cells.
- **Nanotechnology** uses a wide range of techniques to manipulate atoms and molecules to create new materials and devices. *Nanomedicine* is the use of nanotechnology for medical applications. A nanometer (nm) is a very small structure, one-billionth of a meter. To visualize this size, think of a nanometer as a marble; a meter would be the size of the Earth. Research using these small particles has led to the development of nanodevices that can deliver drugs in precise amounts to targeted body cells, such as the delivery of cancer drugs directly to a brain tumor (**Figure 1–5**). This decreases the side effects of drugs and damage to other body cells.

Biotechnologies will have a major impact on the future of medicine. The opportunities in this field are unlimited, and many new health care careers will develop as research continues. However, it is important to note that biotechnology research has also created bioethical concerns. For example, should an animal being be cloned using biotechnology? Solving bioethical issues is a major concern as science advances.

checkpoint

Identify five current trends in health care and what medical advances made each possible.

Case Study Investigation Conclusion

Research is currently insufficient to recommend using roselle (hibiscus) tea for controlling or lowering blood pressure. There are many modern medicines which have been found to treat high blood pressure. Should Fatima also consult her family doctor?

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CHAPTER 1 SUMMARY

- In ancient times, plants and herbs were used to treat disease.
- New discoveries throughout the centuries developed our modern view of disease and treatments.
- Modern technology has caused major changes in health care in the past century. Computers have accelerated the rate of these changes.
- Cost containment, home health care, geriatric care, telemedicine, wellness to prevent disease, complementary and alternative methods of health care, pandemic preparation, and biotechnologies are some current changes and trends in health care.

REVIEW QUESTIONS

1. List six (6) specific ways to control the rising cost of health care.

2. You are employed in a medical office with four physicians. Identify and sketch or construct a model of two (2) specific ways to conserve energy and protect the health care environment in the office.

3. What is a pandemic? List four (4) pandemics and the cause of each.

4. Choose one (1) of the biotechnological sciences and identify what you feel might be a bioethical concern. How do you think this issue should be resolved?

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CRITICAL THINKING

1. Write a brief essay describing how you maintain physical, emotional, social, mental, and spiritual wellness. Be sure to include specific examples for each type of wellness.

2. You and your team of three are in charge of pandemic disease plans for your country. Using news media and research identify four (4) main ways your government agency team can help prevent the spread of disease in your country during a pandemic.

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ACTIVITIES

1. Assemble in teams. After reading professional journals and watching news media about health care, use index cards and create a timeline for the history of health care, showing the twenty (20) events your team believes had the most impact on modern-day care. Record why your team believes these events are the most important. When complete, exchange cards with rival teams, and have a timeline assembly race.

2. Research and synthesize information found using news media and trade magazines to create a paper on the figure you believe is the most important in medical history. Include how this person's work or discoveries led to the advancement of health care. Be ready to defend your choice in a debate.

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Link to digital lesson

www.ien.edu.sa

CHAPTER

2 HEALTH CARE SYSTEMS

Case Study Investigation

Three patients presented to the emergency department. The first patient was complaining of fever, shortness of breath, and hemoptysis. The second has no complaints; he came simply for a blood lab workup to reassure him about his health. The third patient is a primigravid woman, pregnant after being married for 3 years with previous failure to conceive. She wants someone to check her baby's health after missing his movement for more than 12 hours. What kind of health care facility is suitable for the different needs of these three patients and where should you refer them to?

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Describe at least four (4) different types of health care facility.
- Describe at least three (3) services offered by voluntary or nonprofit agencies.
- Explain the purpose of organizational structures in health care facilities.
- Understand some of the emerging issues in health care.
- Analyze at least three (3) government health agencies and the services offered by each.

KEY TERMS

bioethics
clinics
dental offices
emergency care services
epidemiology
government health agencies
health clusters
health insurance plans
hospitals
laboratories
long-term care facilities
medical city
optical centers
organizational structure
Preferred Providers Networks (PPN)
technology
voluntary agencies

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2:1 HEALTH CARE FACILITIES

The Saudi health care system consist of many agencies, facilities, and personnel involved in the delivery of health care. According to Kingdom of Saudi Arabia Ministry of Health (MOH) 2020 statistics, the health care industry employs more than half a million workers in multiple different health care careers.

In the Ministry's 2030 Vision, the Health Sector Transformation Program's Workforce Initiative stressed that future focus will be on raising the ratio of clinical staff (especially nursing) to the general population, ensuring resources and expertise in the health sector, supporting professions such as finance, health economics, planning, and the legal field, and increasing the number of subsidized medical training locations for graduates.

Health care spending in the Kingdom has reached more than 79 billion SAR in 2021 or 7.82 percent of the total budget spend. To improve spending efficiency, the 2030 Vision aims to provide health care through a **health clusters** system, by integrating primary, secondary, and specialized care, and eliminating duplication of services. A health cluster is an integrated network of health care facilities under one administrative structure, each serving around one million people, with mobility of medical professionals within the system.

Many different health care facilities provide services that are a part of the industry called health care (**Figure 2–1**). A basic description of the various facilities will help provide an understanding of the many different types of services included under the umbrella of the health care industry.



FIGURE 2–1 Emergency care (A) and ambulance services (B) are among the many different health services provided in Saudi Arabia.

HOSPITALS AND HEALTH CARE CENTERS

Hospitals and health care centers are the major types of health care facilities. They vary in size and the types of services provided. Some health care centers are small and serve the basic needs of a community; these centers are commonly known as primary health care centers. Others are large, complex centers offering a wide range of services, including diagnosis, treatment, education, and research. Hospitals are also classified as private or proprietary (operated for profit), nonprofit or voluntary, and government, depending on the sources of income received by the hospital. There

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FIGURE 2–2 Treating a child at a specialty pediatric (children's) hospital.

are many different types of hospitals. Some of the more common ones include:

- **General hospitals**: treat a wide range of conditions and age groups. They usually provide diagnostic, medical, surgical, and emergency care services for acute care.
- **Specialty hospitals**: provide care for special conditions or age groups; examples include burn hospitals, oncology (cancer) hospitals, pediatric (children's) hospitals (**Figure 2–2**), OB/GYN hospitals (these hospitals specialize in the care of women during pregnancy and childbirth, and in the diagnosis and treatment of diseases of the female reproductive organs), psychiatric hospitals (dealing with mental diseases and disorders), orthopedic hospitals (dealing with bone, joint, or muscle diseases), cosmetic surgery, and rehabilitative hospitals (offering services such as physical and occupational therapy).
- **Government and military hospitals**: operated by local government and military forces agencies; this type of hospital includes the many facilities located throughout the world that provide care for government and armed forces service personnel and their dependents.
- **University or college medical centers**: provide hospital services as well as research and education; can be funded by private and/or governmental sources.

MEDICAL CITIES

A **medical city** is a tertiary care medical center with multifacility and multidisciplinary health care teams and administration, which provides advanced medical care and interventions. Each medical city includes most of the previously mentioned facilities. Examples of some medical cities include:

- King Abdulaziz Medical City.
- King Saud University Medical City.
- Prince Sultan Military Medical City.
- King Fahad Medical City.
- King Abdullah Medical City.

LONG-TERM CARE FACILITIES

Long-term care facilities mainly provide assistance and care for elderly patients, usually called residents. However, they also provide care for individuals with disabilities or handicaps, and individuals with chronic or long-term illnesses.

CLINICS

Clinics are health care facilities that can be found in many types of health care. Some clinics are composed of a group of medical or dental doctors and other personnel who share a facility. Other clinics are operated by private groups who provide special care. Examples include:

- **Specialty clinics**: provide care for specific field of medicine, such as dermatology, ophthalmology, or dental clinics.
- **Rehabilitation clinics**: offer physical, occupational, speech, and other similar therapies.
- **"One-day" surgical centers**: perform minor surgical procedures and some cosmetic surgeries; these clinics are called "one-day" surgical centers because patients are sent home immediately after they have recovered from their operations, usually on the same day.

DENTAL OFFICES

Dental offices vary in size from offices that are privately owned by one or more dentists to dental clinics that employ a group of dentists. In some areas, major retail or department stores operate dental clinics. Dental services can include general care provided to all age groups, or specialized care offered to certain age groups, or for certain dental conditions like orthodontics (teeth straightening).

OPTICAL CENTERS

Optical centers can be individually owned by an ophthalmologist or optometrist, or they can be part of a large chain of stores. They provide vision examinations, prescribe eyeglasses or contact lenses, and check for the presence of eye diseases or vision abnormalities.

EMERGENCY CARE SERVICES

Emergency care services provide special care after accidents or sudden (acute) illness. Facilities providing these services include ambulance services, both private and governmental; rescue squads, frequently operated by fire departments; emergency care clinics and centers; emergency departments operated by hospitals; and helicopter or airplane emergency services that rapidly transport patients to medical facilities for special care.

LABORATORIES

Laboratories are often a part of other facilities but can operate as separate health care services. Medical laboratories can perform special diagnostic tests such as blood or urine tests. Dental laboratories prepare dentures (false teeth) and many other devices used to repair or replace teeth. Medical and dental offices, small hospitals, clinics, and many other health care facilities frequently use the services provided by laboratories.

checkpoint

Name four different types of health care facility.

2:2 HEALTH SECTOR GOVERNANCE AND AGENCIES

Following the 2030 Vision, health governance is being radically reformed to advance the objective of improving the quality and value of care, in line with international best practices. As such, clear and distinct markers will differentiate the roles of health care regulator and monitor, provider, and financier.

The MOH is being redefined as the regulator and monitor of the health sector (**Figure 2–3**). Alongside the Ministry, **government health agencies** have roles in legislation, making sure that the rules are followed, and supervision. Some examples of government health agencies include:



FIGURE 2–3 Ministry of Health in Riyadh.

- **Healthcare Development Holding Company (HDH)**: approved by the Saudi Cabinet, HHC is committed to implementing a modern health care model that focuses on providing health care services via health clusters, a set of independent health companies that focus on providing health care services.
- **The National Health Insurance Center (NHIC)**: most health care facilities require a fee for services. NHIC purchases health services provided by the HHC or its subsidiaries and provides free insurance coverage for beneficiaries, including all Saudi citizens.
- **Public Health Authority (PHA)**: serves the public by working to monitor, measure, evaluate, control, and prevent any risk factors related to public health, including communicable and noncommunicable diseases, injuries, and other health challenges. PHA does this by presenting innovation and evidence-based solutions, preparing a generation of public health and

health education experts for practice, and acting as a resource for all the health initiatives intended to promote wellness in the Kingdom.

- **Saudi Food and Drug Authority (SFDA)**: is in charge of consumer awareness on all matters related to food, drugs and medical devices, and all other products and supplies. SFDA regulates, oversees, and controls food, drugs, and medical devices, as well as setting mandatory standards, whether the items are imported or locally manufactured. The control and/or testing activities can be conducted in the SFDA or other agency's laboratories (*sfda.gov.sa*).
- **Saudi Commission for Health Specialties (SCFHS)**: a scientific commission that regulates health care-related practices and practitioners accreditation at all levels in Saudi Arabia (*scfhs.org.sa*).
- **Council of Health Insurance (CHI)**: provides governance and regulation of the private health insurance sector. Enhances the effectiveness and efficiency of health services for beneficiaries, and enables stakeholders to achieve fairness, transparency, and excellence (*chi.gov.sa*).
- **National Unified Procurement Company for Medical Supplies (NUPCO)**: responsible for procurement, logistics and supply chain management for pharmaceutical, medical devices, and supplies for governmental hospitals in Saudi Arabia (*www.nupco.com*).
- **Saudi Health Council (SHC)**: sets regulations to ensure coordination and integration between health-related agencies to improve and enhance health care (*shc.gov.sa*).

checkpoint

1. Name three (3) ways that national government agencies provide services to the health care community.
2. What responsibilities does the Saudi Food and Drugs Authority have?

2:3 VOLUNTARY OR NONPROFIT AGENCIES

Voluntary agencies, frequently called nonprofit agencies, are supported by donations, membership fees, and fundraisers. They provide health services at national, regional, and local levels. Examples of nonprofit agencies include the:

- King Salman Humanitarian Aid and Relief Center (KSrelief), which provides humanitarian aid and relief to those in need outside of the Kingdom's borders (*ksrelief.org*).
- Zahra Breast Cancer Association (*zahra.org.sa*).
- ENAYAH – a charitable health society for patient care (*enayah.sa*).

- Saudi Cancer Society (*www.saudicancer.org*).
- Saudi ADHD Society (*adhd.org.sa*).
- Saudi Alzheimer's Disease Association (*alz.org.sa*).
- Naqa – Purity, anti-smoking charity (*www.naqa.org.sa*).
- Prince Fahad bin Salman Charity Association for Renal Failure and Patient Care (Kellana).

As indicated by their names, many such organizations focus on one specific disease or group of diseases. Each organization typically studies the disease, provides funding to encourage research directed at curing or treating the disease, and promotes public education regarding the information obtained through research. These organizations also provide special services to victims of disease, such as purchasing medical equipment and supplies, providing treatment centers, and supplying information regarding other community agencies that offer assistance.

Nonprofit agencies employ many health care workers in addition to using volunteers to provide services.

checkpoint

What is the King Salman Humanitarian Aid and Relief Center?

2:4 ORGANIZATIONAL STRUCTURE

All health care facilities must have some type of **organizational structure**. The structure may be complex, as in larger facilities, or simple, as in smaller facilities. Organizational structure always, however, encompasses a line of authority or chain of command. The organizational structure should indicate areas of responsibility and lead to the most efficient operation of the facility.

A sample organizational chart for a large general hospital is shown in **Figure 2–4**. This chart shows organization by department. Each department, in turn, can have an organizational chart similar to the one shown for the nursing department in the figure. A sample organizational chart for a small medical office is shown in **Figure 2–5**. The organizational structure will vary with the size of the office and the number of people employed.

In both organizational charts illustrated, the lines of authority are clearly indicated. It is important for health care workers to identify and understand their respective positions in a given facility's organizational structure so they will know their lines of authority and understand who are the immediate supervisors in charge of their work. Health care workers must always take questions, reports, and problems to their immediate supervisors, who are responsible for providing the necessary assistance. If immediate supervisors cannot answer the question or solve the problem, it is their responsibility

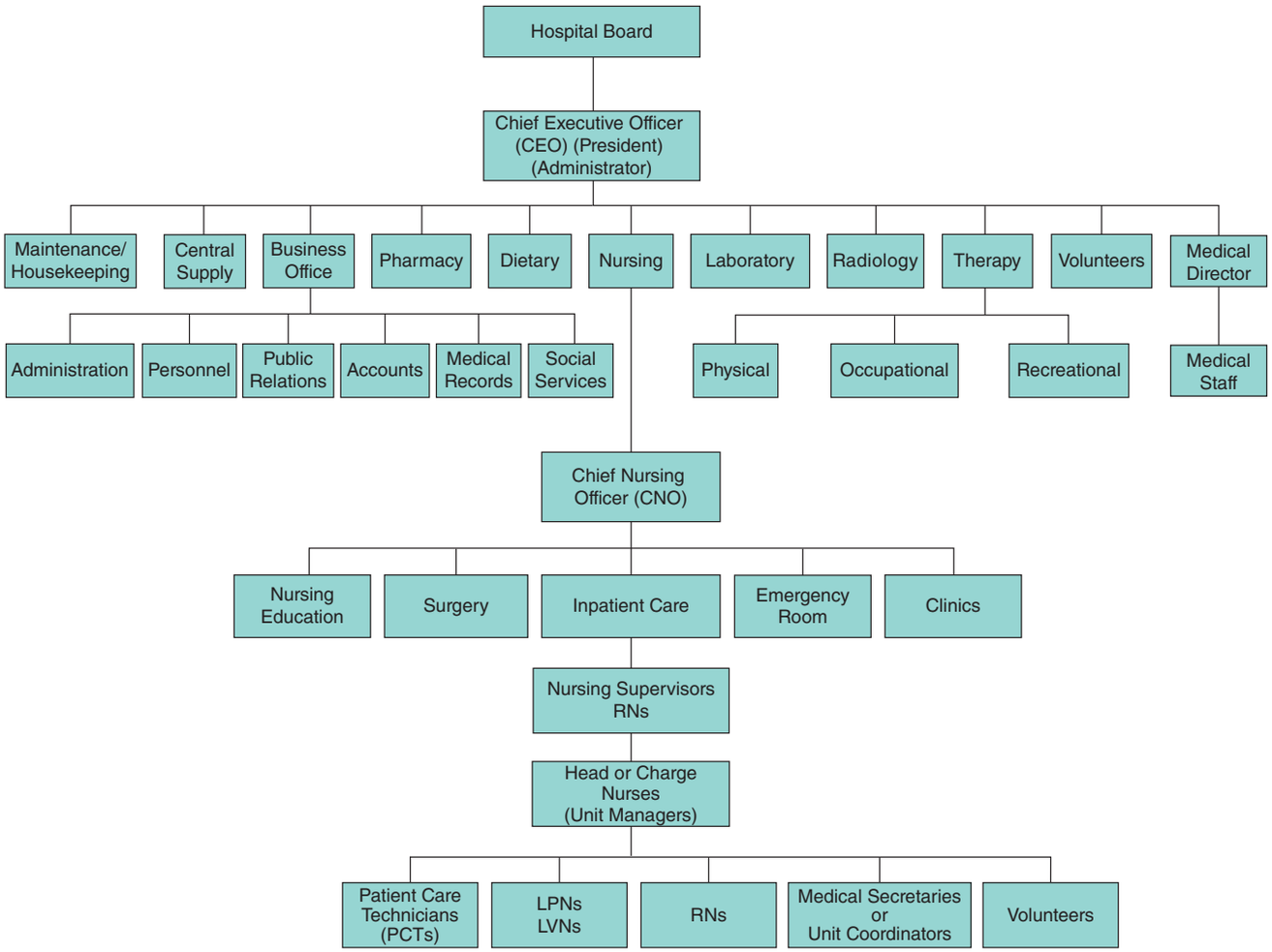


FIGURE 2–4 A sample hospital organizational chart.

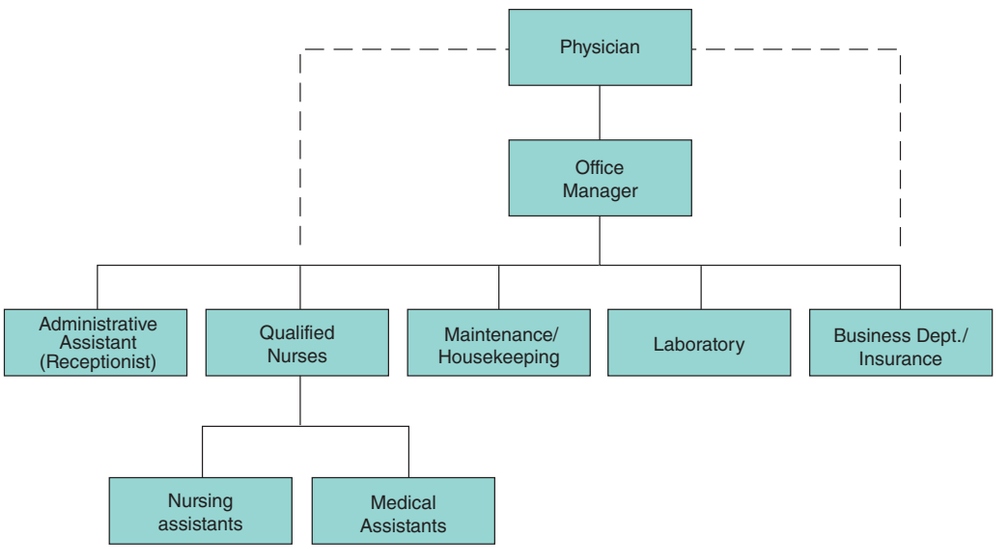


FIGURE 2–5 A sample medical office organizational chart.

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to take the situation to the next level in the organizational chart. It is also important for health care workers to understand the functions and goals of the organization.

checkpoint

1. What does organizational structure encompass?

2:5 HEALTH INSURANCE

The cost of health care is a major concern of everyone who needs health services. World Bank statistics show that the cost of health care is around 5.2 percent of Saudi Arabia's gross national product (GDP, the total amount of money the country's population spent on all goods and services). To pay for the costs of health care, most people rely on **health insurance plans**.

WHAT IS HEALTH INSURANCE?

Health insurance is a type of insurance whereby an individual's family pays a regular sum of money (a premium) to an insurance company, and in return the company pays some or all of the costs of their medical treatment. Without insurance, the cost of an illness can mean financial hardship for an individual or family.

- Having health insurance leads to increased attendance for medical check-ups in Saudi Arabia. By increasing the chances of a person going for a medical check-up, health insurance has the potential to save costs on curative health.
- Health insurance can lower inpatient and outpatient treatment costs and can reduce the severity of illness because people are treated earlier.

Health insurance plans are offered by either government or private agencies. The National Health Insurance Center (NHIC) is a government agency that provides free insurance coverage for beneficiaries, including all Saudi citizens. The Council of Health Insurance (CHI) approves private insurance companies to participate in the cooperative health insurance business, and third-party administrative companies to handle cooperative health insurance claims. Common insurance terms include:

- **Deductibles**: amounts that must be paid by the patient for medical services before the policy begins to pay.
- **Co-insurance**: requires that specific percentages of expenses are shared by the patient and insurance company; for example, in an 80–20 percent co-insurance plan, the company pays 80 percent of covered expenses, and the patient pays the remaining 20 percent.

- **Co-payment**: a specific amount of money a patient pays for a particular service.
- **Assignment of benefits**: an agreement that assigns the benefits of health insurance to a physician or health care facility so they can collect payment directly from the insurance company.

Many individuals have insurance coverage through their places of employment (called employer-sponsored health insurance or group insurance), where the premiums are paid by the employer. In most cases, the individual also pays a percentage of the premium. Private policies are also available for purchase by individuals.

A **Preferred Providers Network (PPN)** is a group of health service providers approved by the CHI and identified by the health insurance company to provide the service to the insured person. The CHI has developed seven key objectives for a health insurance policy to promote preventive therapy and enhance the quality and efficiency of health care services for health insurance beneficiaries. These objectives are:

- **Protection of beneficiaries**: early and exploratory examination, vaccines.
- **Health promotion**: women's and children's health, dentistry, psychological health.
- **Reduction of disease complications**: congenital malformations, acquired valvular heart disease, kidney dialysis, comprehensive diabetes program.
- **Improvement of beneficiaries' functions and capacities**: vision, rehabilitation, surgical procedures.
- **Facilitating beneficiaries access to services** for home care, telemedicine, insurance drug formulary.
- **Empowerment of beneficiaries**: hospitalization, outpatient clinics visits, emergency treatment.
- **Enhancement of the quality and efficiency of the service**: medical equipment, chronic diseases.

Consumer responsibility for health care costs continues to increase as both consumers and health care plans struggle to control cost. It is essential for individuals to take an active role and become responsible consumers of health care. Some ways consumers can meet this responsibility include:

- **Take an active role in maintaining good health**: Maintain a healthy lifestyle by eating a healthy diet, exercising regularly, getting adequate rest, avoiding tobacco and drugs, getting immunizations to prevent disease, practicing wellness, and obtaining screening tests for early detection of disease.
- **Evaluate different health care plans**: Compare different plans based on cost, benefits, and quality of care and choose the plan that will provide quality care at the most reasonable cost.

- **Research quality of care**: Use resources available on the Internet and media to see which health care providers are rated high for quality care, and try to use these providers whenever possible; seek recommendations from friends and family and check credentials for any health care provider.
- **Make informed decisions regarding health care**: Ask questions regarding different treatments and choose care based on their own values and beliefs; choose health care providers who make every effort to provide information about choices available and the risks and benefits of each choice.
- **Use health care plan benefits wisely**: Be informed about what co-insurance, deductibles, and other costs are with any plan and try to minimize these costs; for example, a visit to an urgent care center is usually much cheaper than a visit to an emergency room for many acute illnesses.
- **Make every effort to save money on health care costs**: Use in-network physicians and facilities whenever possible; price medications to see if a generic equivalent- or lower-priced mail-order is available; check medical bills carefully for accuracy, and question any charges that do not seem appropriate.
- **Help prevent medical errors**: Question any care that does not seem appropriate; keep track of test results, and ask for explanations about abnormal results; check medications to ascertain they are correct.

It is essential to remember that all health care consumers have the right and responsibility to fully participate in all decisions related to their health care, and if they are unable to participate, they have the right to be represented by parents, family members, or guardians.

checkpoint

1. What do the initials NHIC stand for?
2. What is a Preferred Providers' Network?

Today's Research | **Tomorrow's** Health Care

Nature as a Pharmacy?

Throughout history, many medicines have been derived from natural resources. Examples include aspirin, which comes from willow bark; penicillin, which comes from fungus; and the cancer drug paclitaxel, which comes from the Pacific yew tree. Recognizing this, many scientists believe that nature is a pharmaceutical gold mine and are exploring the vast supply of materials present in the oceans and on the earth.

One compound, halichondrin B, labeled "yellow slimy" by researchers, is an extract taken from a deep-sea sponge found in New Zealand (**Figure 2–6**). Scientists created a synthetic version of the active component in halichondrin B, called E7389. After extensive testing, the drug eribulin, which was created from this compound, was approved as a treatment for metastatic breast cancer. By creating synthetic versions of the compounds, scientists are preserving natural resources while also benefiting from them.

Other natural products are now being tested and modified. As scientists continue to explore all that nature has to offer, it is possible they will find cures for many cancers, diseases, and infections.



FIGURE 2–6 The drug eribulin has been created from a marine sea sponge.

2:6 IMPACT OF EMERGING ISSUES ON DELIVERY SYSTEMS

Technology, applying scientific knowledge for practical purposes to find answers and fix problems, has brought about a massive and welcome change to the health care industry. Patients now have access to some of the best diagnostic tools and new cutting-edge treatments:

- The digitalization of health records has made for quick, secure, and accessible information to remote providers.
- Mobile app technology allows patients to easily obtain accurate information and track their own health status over time.
- Another example of technology in health care is 3-D printing, which is used to create prosthetics, hearing aids, and more (**Figure 2–7**).
- Virtual reality devices help depression and isolation in older patients.
- Developments in technology are constantly streamlining and improving how patients interact with their health care providers.

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Epidemiology is the study of disease in populations. Epidemiological methods are used for disease surveillance to identify which health hazards are the most important. They also identify risk factors that may represent critical control points in health and food/drug production systems.

Bioethics aims to investigate and study how health care decisions are made. It is a core component of ensuring that medical practices and procedures benefit society as a whole. Deciding who gets what is a main task for medical ethics. Should scarce health care resources be divided according to need, ability to pay, potential for economic productivity, or some other criteria? Should doctors at the bedside be the gatekeepers, or should financial managers or others make the rules from a distance?

checkpoint

What is epidemiology?

Case Study Investigation Conclusion

These patients each presented to the emergency department of a general hospital. The first patient was complaining of fever, shortness of breath, and hemoptysis. She has acute symptoms for infection, so she needs emergency care and intervention, and close follow-up. The second patient only wants an annual check-up, which should be done at the primary care center's clinic. The third patient needs to be checked as an emergency, with ultrasound and labs, then referral for close OBGYN care.

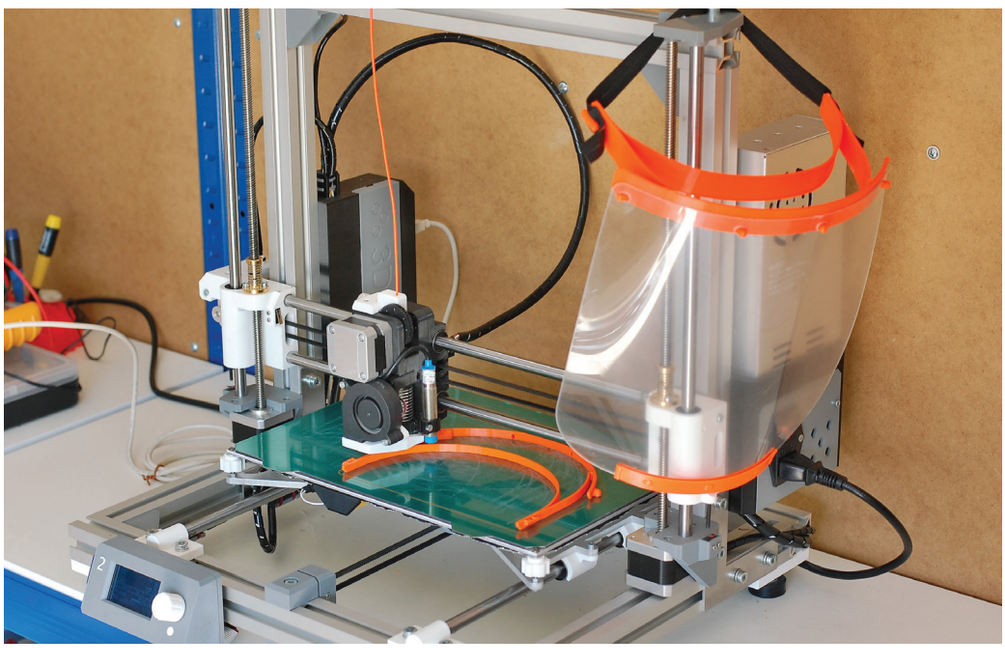


FIGURE 2–7 Plastic face shields can be manufactured using a 3-D printer.

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CHAPTER 2 SUMMARY

- Health care encompasses many different types of facilities. These include hospitals, long-term care facilities, medical and dental offices, clinics, laboratories, and many others.
- Government, nonprofit, and voluntary agencies also provide health care services. All health care facilities require different health care providers at all levels of training.
- Many types of health insurance plans are available to help pay the costs of health care. It is important for consumers to be aware of the types of coverage provided by their respective insurance plans.
- Emerging issues such as technology, epidemiology, and bioethics, have an impact on health care delivery systems.

REVIEW QUESTIONS

1. Differentiate between private, nonprofit, and government types of hospitals.

2. Give three (3) examples of the use of technology in health care.

3. What does the term deductible mean in regard to health insurance policies? *Co-insurance? Co-payment? Premium? Assignment of benefits?*

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4. Describe three (3) services offered by voluntary or nonprofit agencies.

CRITICAL THINKING

1. Identify five (5) ways in which an individual can become a responsible consumer of health care to help control the cost of health care. Why do you think they are important?

2. What is the value of a medical city in the health care system?

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ACTIVITIES

1. In a group of three, create a medium-sized one-day surgical center. Determine a mission statement. Based on what you have learned, create an organizational chart that will reflect the function and goals of your rehabilitation clinic.

2. With a partner, compare and contrast the Saudi Arabia health care delivery system with those of two other countries that have high efficiency scores in health care as rated by agencies like the World Health Organization (see *www.who.int*). Create a chart along with a report for your team presentation.

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CHAPTER

3 CAREERS IN HEALTH CARE

Case Study Investigation

A 7-year-old boy, Fahad, and his 5-year-old sister, Lateen, were riding their bicycles in the backyard of their home. Fahad lost control of his bike and crashed into his sister's bike, and landed on his shoulder, with Lateen crashing head-first into the wall. The two children were taken by ambulance to the local hospital ER. Fahad is complaining of pain when moving his shoulder, and has visible bruising and swelling on his clavicle. An x-ray showed a fracture in the middle third of the clavicle. Lateen was knocked out and is now dizzy and vomiting. She has a 2-cm laceration superior to her right eye that requires cosmetic stitching. At the end of the chapter, you will be asked to identify the health careers that might be involved in the care of Fahad and Lateen.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Compare the educational requirements for various medical careers.
- Contrast certification, registration, and licensure.
- Describe at least five different health care careers by including a definition of the career, three duties, the educational requirements, and employment opportunities.

KEY TERMS

accreditation
associate's degree
bachelor's degree
certification
continuing medical education
entrepreneur
doctorate/doctoral degree
licensure
master's degree
registration
scope of practice

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3:1 INTRODUCTION TO HEALTH CARE CAREERS



Educational requirements for health care careers depend on many factors. Basic preparation begins in high school (secondary education) and should include the sciences, social studies, English, and mathematics. Computer applications and accounting skills are also used in most health care careers. Secondary health science education (HSE) programs can prepare a student for immediate employment in many health care careers or for additional education after graduation. Postsecondary education (after high school) can include training in a career/technical school, college, university, or an accredited online program. Some careers require an **associate's degree**, which is awarded by a career/technical school or a community college after completing a prescribed two-year course of study. Other careers require a **bachelor's degree**, which is awarded by a college or university after a prescribed course of study that usually lasts for four or more years. In some cases, a **master's degree** is required. This degree is awarded by a college or university after completion of one or more years of work beyond a bachelor's degree. Other careers require a **doctorate** or **doctoral degree**, which is awarded by a college or university after completion of two or more years of work beyond a bachelor's or master's degree. Some doctorates can require four to six years of additional study.

The Saudi Arabia Ministry of Education has developed a new Flexible Learning Pathways Initiative education system, which has five main academic and career paths: General; computer and engineering sciences; health and life; business administration; and Shariah. The health and life science career pathway allows a student to see how early career awareness and exploration provide the foundation for making informed choices to prepare for a career in health care. Detailed information and guidance on specific careers can be found on the Saudi Commission for Health Specialties (SCFHS) website (*scfhs.org.sa*).

CERTIFICATION, REGISTRATION, AND LICENSURE

Three other terms associated with health care careers are *certification*, *registration*, and *licensure*. These are methods used to ensure the skill and competency of health care personnel and to protect the consumer or patient.

Certification means that a person meets the standards and qualifications established by the professional association or government agency that regulates a particular career. A certificate or statement is issued by the appropriate association. Examples of certified positions include certified dental assistant, and certified laboratory technician.

Registration is performed by a regulatory body (professional association or government board) that administers examinations and maintains a current list ("registry") of qualified personnel in a given health care area.

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Examples of registered positions include registered dietitian, and registered respiratory therapist.

Licensure authorizes individuals to work in a given occupation. The license defines the **scope of practice** or actions that health care providers are legally permitted to perform in keeping within the terms of their professional license. Obtaining and retaining licensure usually requires that a person complete an approved educational program, pass the SCFHS exam, and maintain certain standards. Examples of licensed positions include physician, registered nurse, and licensed practical/vocational nurse.

ACCREDITATION

Accreditation ensures that the program of study meets the established quality competency standards and prepares students for employment in the health care career. It is important for a student to make sure that a technical school, college, or university offers accredited programs of study before enrolling. The major accrediting agency for health care programs in the Kingdom is the SCFHS.

CONTINUING MEDICAL EDUCATION HOURS

Legal

Continuing medical education (CME) hours are required to renew licenses or maintain certification or registration in the Kingdom (**Figure 3–1**). An individual must obtain additional hours of education in the specific health care career area during a specified period and should be aware of the requirements regarding CME for their given career.

PROFESSIONAL ORGANIZATIONS

Professional organizations are an important component of many health care careers. Most provide the following benefits:

- **Professional development**: publications, seminars, conferences to keep members updated with information relating to the career.
- **Career information**: information, networking, and educating the public about their career.
- **Code of ethics**: standard of conduct or code of behavior for the profession.



FIGURE 3–1 Continuing medical education hours may be required to renew licenses or maintain certification or registration.

EDUCATION LEVELS, TRENDS, AND OPPORTUNITIES

Training for most health care careers takes many years of study, as shown in **Table 3–1**.

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TABLE 3–1 Education and Levels of Training

Profession	Educational Requirement
Doctor of Medicine	6 or more years of a bachelor's degree
Dentist	6 or more years of a bachelor's degree
Pharmacist	5 or more years of a bachelor's degree
Specialist	4 or more years of a bachelor's degree
Technician	1 or more years of a clinical diploma or SCFHS certified technician course post-secondary education

A common trend in health care is the multicompetent or multiskilled health care provider who can perform a variety of health care tasks. For example, a health care provider may be hired to perform the tasks of both an electrocardiograph (ECG) technician (who records electrical activity of the heart) and an electroencephalographic (EEG) technologist (who records electrical activity of the brain).

Another opportunity available in many health care careers is that of entrepreneur. An **entrepreneur** is an individual who organizes and manages a business and assumes its risks. Some health care careers allow an individual to work as an independent entrepreneur, while others encourage the use of groups of cooperating individuals. A common example is combining a bachelor's degree in a specific health care career with a master's degree in business. Some health care providers who may be entrepreneurs include dental laboratory technicians, respiratory therapists, and optometrists.

checkpoint

1. With a partner, create a chart that compares the educational requirements for associate's, bachelor's, master's and doctorate degrees.
2. Compare and contrast certification, registration, and licensure.

3:2 THERAPEUTIC SERVICES CAREERS

Providers in the therapeutic services use a variety of treatments to help patients who are injured, physically or mentally disabled, or emotionally disturbed, to function at their maximum capacity.

Places of employment include rehabilitation facilities, mental health facilities, and government agencies.

DENTAL CAREERS

Dental providers focus on the health of the teeth and the soft tissues of the mouth. Care is directed toward preventing dental disease, repairing or replacing diseased or damaged teeth, and treating the gingiva (gums) and other supporting structures of the teeth.

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Most dental professionals work in general dentistry. Some, however, work in specialty areas such as the following:

- **Endodontics**: treatment of diseases of the pulp, and roots of the teeth; often called root canal treatment.
- **Orthodontics**: alignment or straightening of the teeth.
- **Oral Surgery**: surgery on the teeth, mouth, jaw, and facial bones; often called *maxillofacial surgery.*
- **Pedodontics**: dental treatment of children and adolescents.
- **Periodontics**: treatment and prevention of diseases of the gums, bone, and structures supporting the teeth.
- **Prosthodontics**: replacement of natural teeth with artificial teeth or dentures.

Levels of providers in dentistry include dentist, dental hygienist, dental laboratory technician, and dental assistant.

- *Dentists* are doctors who examine teeth and mouth tissues to diagnose and treat disease and abnormalities. They perform corrective surgery on the teeth, gums, tissues, and supporting bones; and work to prevent dental disease.
- *Dental hygienists* help patients to develop and maintain good dental health, remove stains and deposits from teeth, and perform other preventive services.
- *Dental laboratory technicians* make and repair a variety of dental prostheses (artificial devices) such as dentures, crowns, bridges, and orthodontic appliances according to the specifications of dentists.
- *Dental assistants* prepare patients for examinations, pass instruments, prepare dental materials for impressions and restorations, take and develop radiographs, teach preventive dental care, sterilize instruments, and/or perform dental receptionist duties.

EMERGENCY MEDICAL SERVICES CAREERS

Emergency medical services personnel (**Figure 3–2**) provide emergency, prehospital care to victims of accidents, injuries, or sudden illnesses.

Places of employment include fire and police departments, rescue squads, ambulance services, and the military.

- An *emergency medical responder* is the first person to arrive at the scene of a sudden illness or accident. The first responder interviews and examines the patient or victim to identify the illness or cause of injury, calls for emergency medical assistance as needed, maintains safety and infection control at the scene, and provides basic emergency medical care.

- *Emergency medical technicians* provide care for a wide range of illnesses and injuries including medical emergencies, basic life support, emergency childbirth, rescue of trapped persons, and transport of patients.
- *Paramedics* perform all the same basic duties plus in-depth patient assessment, provision of advanced cardiac life support, ECG interpretation, endotracheal intubation, drug administration, and operation of complex equipment.



FIGURE 3–2 Emergency medical technicians (EMTs) provide emergency, prehospital care to victims of accidents, injuries, or sudden illness.

MEDICAL CAREERS

Medical careers is a broad category encompassing physicians and other individuals who work in any of the varied careers under the supervision of physicians. All such careers focus on diagnosing, treating, or preventing diseases and disorders of the human body.

Places of employment include private practices, clinics, hospitals, public health agencies, research facilities, the Council of Health Insurance, government agencies, and colleges or universities.

- *Physicians* examine patients, obtain medical histories, order tests, make diagnoses, perform surgery, treat diseases/disorders, and teach preventive health, as noted in **Table 3–2**.
- *Physician assistants (PAs)*, take medical histories; perform routine physical examinations and basic diagnostic tests; make preliminary diagnoses; treat minor injuries; and prescribe and administer appropriate treatments. *Pathology assistants* perform both gross and microscopic autopsy examinations.
- *Medical assistants* prepare patients for examinations, take medical histories, assist with procedures and treatments, prepare and maintain equipment and supplies, and/or perform secretarial-receptionist duties (**Figure 3–3**).

MENTAL HEALTH AND SOCIAL SERVICES CAREERS

Mental health services professionals focus on helping people who have mental or emotional disorders or those who are developmentally delayed or mentally impaired. Social workers help people deal with illnesses, employment, or community problems.

Places of employment include hospitals, psychiatric hospitals or clinics, home health care agencies, public health departments, government agencies, crisis or counseling centers, drug and alcohol treatment facilities, prisons, educational institutions, and long-term care facilities.

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TABLE 3–2 Medical Specialties

Physician's Title	Specialty
Anesthesiologist	Administration of medications to cause loss of sensation or feeling during surgery or treatments
Cardiologist	Diseases of the heart and blood vessels
Dermatologist	Diseases of the skin
Diabetologist	Diagnosis and treatment of diabetes mellitus
Emergency Physician	Acute illness or injury
Endocrinologist	Diseases of the endocrine glands
Family Physician	Promote wellness, treat illness or injury in all age groups
Gastroenterologist	Diseases and disorders of the stomach and intestine
Geriatrician	Diseases of older individuals
Gynecologist	Diseases of the female reproductive organs
Hospitalist	Provides care to patients who are in a hospital
Infectious Disease Physician	Diseases and conditions caused by a pathogenic agent such as a bacteria or virus
Internist	Diseases of the internal organs (lungs, heart, glands, intestines, kidneys)
Nephrologist	Diseases of the kidneys
Neurologist	Disorders of the brain and nervous system
Obstetrician	Pregnancy and childbirth
Oncologist	Diagnosis and treatment of tumors (cancer)
Ophthalmologist	Diseases and disorders of the eye
Orthopedist	Diseases and disorders of muscles and bones
Otolaryngologist	Diseases of the ears, nose, and throat
Pathologist	Diagnosis of diseases by studying changes in organs, tissues, and cells
Pediatrician	Diseases and disorders of children
Physiatrist	Physical medicine and rehabilitation
Plastic Surgeon	Corrective surgery to repair injured or malformed body parts
Psychiatrist	Diseases and disorders of the mind
Pulmonologist	Diseases and disorders of the lungs
Radiologist	Use of X-rays and radiation to diagnose and treat disease
Sports Medicine	Prevention and treatment of injuries sustained in athletic events
Surgeon	Surgery to correct deformities or treat injuries or disease
Thoracic Surgeon	Surgery of the lungs, heart, or chest cavity
Urologist	Diseases of the kidney, bladder, or urinary system



FIGURE 3–3 Medical assistants prepare patients for examinations and assist with the examinations.

Mental health services professionals include:

- *Psychiatrists* physicians who specialize in diagnosing and treating mental illness.
- *Psychologists* study human behavior and help individuals deal with problems of everyday living.
- *Psychiatric/mental health technicians* help patients and their families follow treatment and rehabilitation plans. They assist with physical care, observe and report behavior, and help teach patients constructive social behavior.
- *Social workers*, also called case managers, or counselors (**Figure 3–4**), aid people who have difficulty coping with various problems to make adjustments in their lives by referring them to community resources for assistance.
- *Genetic counselors* provide information about genetic diseases or inherited conditions to individuals and families.



FIGURE 3–4 Social workers help people make life adjustments and refer patients to community resources for assistance.

NURSING CAREERS

Nurses provide care for patients focusing on the mental, emotional, and physical needs of the patient.

Hospitals are the major places of employment, but nurses are also employed in long-term care facilities, rehabilitation centers, physicians' offices, clinics, public health agencies, home health care agencies, the Council of Health Insurance, schools, government agencies, and industry.

Qualified nurses (**Figure 3–5**) provide total care to patients. The nurse observes patients, assesses patients' needs, reports to other health care personnel, administers prescribed medications and treatments, and supervises other nursing personnel. Nurses with an advanced education can specialize. Examples of advanced practice nurses include midwives, who provide total care for normal pregnancies, and refer any problems to a physician.

- *Nurse assistants* work under the supervision of qualified nurses. They provide patient care such as baths, bed making, and feeding; assist in transfer and ambulation; and administer basic treatments.



FIGURE 3–5 Qualified nurses administer prescribed medications to patients.

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- *Geriatric aides/assistants* care for older patients in nursing homes, retirement centers, and adult day care facilities.
- *Home health care assistants* work in the patient's home and perform duties such as meal preparation or cleaning.

NUTRITION AND DIETARY SERVICES CAREERS

Individuals employed in the nutrition and dietary services promote wellness and optimum health by providing dietary guidelines used to treat various diseases, teaching proper nutrition, and preparing foods for health care facilities.

Places of employment include hospitals, long-term care facilities, child and adult day care facilities, wellness centers, and schools.

VETERINARY CAREERS

Veterinary careers focus on providing care to all types of animals—from house pets to livestock to wildlife.

Places of employment include animal hospitals, veterinarian offices, laboratories, zoos, farms, animal shelters, aquariums, drug or animal food companies, and fish and wildlife services.

- *Veterinarians* (**Figure 3–6**) prevent, diagnose, and treat diseases and injuries in animals. Specialties include surgery, small-animal care, livestock, fish and wildlife, and research.
- *Veterinary technologists/technicians*, also called *animal health technicians*, assist with the handling and care of animals, collect specimens, assist



FIGURE 3–6 Veterinarians work to prevent, diagnose, and treat diseases and injuries in animals.

with surgery, perform laboratory tests, take and develop radiographs, administer prescribed treatments, and maintain records.

- *Veterinary assistants*, also *called animal caretakers*, feed, bathe, and groom animals; exercise animals; prepare animals for treatment; assist with examinations; clean and sanitize cages, examination tables, and surgical areas; and maintain records.

OTHER THERAPEUTIC SERVICES CAREERS

- *Occupational therapists* (**Figure 3–7**) help people who have physical, developmental, mental, or emotional disabilities adjust to their particular problems. Treatment is directed toward helping patients acquire independence, regain lost functions, and adapt to disabilities.
- *Pharmacists* (**Figure 3–8**) dispense medications written by health care professionals authorized to prescribe medications and provide information about drugs. They also order and dispense other health care items such as surgical supplies.
- *Pharmacy technicians* help prepare medications for dispensing to patients, label medications, perform inventories and order supplies, prepare intravenous solutions, and help maintain records.
- *Physical therapists* (**Figure 3–9**) provide treatment to improve mobility and prevent or limit permanent disability of patients who have joint, bone, muscle, and/or nerve injuries or diseases. Treatment may include exercise, massage, and applications of heat, cold, or ultrasound.
- *Physical therapist assistants* help carry out prescribed plans of treatment. They perform exercises and massages; administer applications of heat or cold, assist patients to walk with canes, crutches, or braces; and provide ultrasound or electrical stimulation treatments.



FIGURE 3–7 Occupational therapists help patients who have disabilities overcome, correct, or adjust to the disabilities.



FIGURE 3–8 Pharmacists dispense medications and provide information about drugs.



FIGURE 3–9 Physical therapists provide treatment to improve mobility of patients who have disabling injuries or diseases.

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FIGURE 3–10 Respiratory therapists provide treatments to patients with heart and lung diseases.



FIGURE 3–11 Surgical technologists assist by passing instruments and supplies to the surgeon.



FIGURE 3–12 Athletic trainers apply tape or padding to players to protect body parts or treat minor injuries.

- *Respiratory therapists* help treat patients with heart and lung diseases by administering oxygen, gases, or medications; using exercise to improve breathing; monitoring ventilators; and performing diagnostic respiratory function tests (**Figure 3–10**).
- *Respiratory therapy technicians* administer respiratory treatments, perform basic diagnostic tests, clean and maintain equipment.
- *Surgical technologists/technicians*, also called *operating room technicians* (**Figure 3–11**), prepare patients for surgery; set up instruments, equipment, and sterile supplies in the operating room; assist during surgery by passing instruments and supplies to the surgeon.
- *Speech-language pathologists*, also called *speech therapists* or *speech scientists*, identify, evaluate, and treat patients with speech and language disorders.
- *Audiologists* test hearing, diagnose problems, and prescribe treatment. They also test noise levels in workplaces and develop hearing protection programs.
- *Athletic trainers* prevent and treat athletic injuries and provide rehabilitative services to athletes (**Figure 3–12**).
- *Dialysis technicians*—also called *renal dialysis technicians*, *hemodialysis technicians*, or *nephrology technicians*—operate the kidney hemodialysis machines used to treat patients with limited or no kidney function.

checkpoint

Name five (5) career opportunities in therapeutic services and what education is required.

3:3 DIAGNOSTIC SERVICES CAREERS

Individuals employed in diagnostic services perform tests or evaluations that aid in the detection, diagnosis, and treatment of disease, injury, or other physical conditions.

Many team members are employed in hospital laboratories, but others work in private laboratories, outpatient centers, physicians' offices, clinics, public health agencies, pharmaceutical (drug) firms, and research or government agencies.

- *ECG (electrocardiography) technicians* operate ECG machines, which record electrical impulses that originate in the heart to help diagnose heart disease and to note changes in the condition of a patient's heart. *ECG* or *cardiographic technicians* with more advanced training perform stress tests which record the action of the heart during physical activity (**Figure 3–13**).
- An *electroencephalographic technologist* operates an *electroencephalograph*, which records the electrical activity of the brain. The record produced, an *electroencephalogram*, is used by neurologists (physicians specializing in nerve and brain diseases), to diagnose and evaluate diseases and disorders of the brain such as brain tumors, strokes, epilepsy, and sleep disorders.
- *Medical laboratory technologists*, also called *clinical laboratory scientists*, work under physicians called *pathologists*. They study tissues, fluids, and cells to help determine the presence and/or cause of disease (**Figure 3–14**). In small laboratories, technologists perform many types of tests. In larger laboratories, they may specialize. Examples of specialization include:
  - **Blood bank technology**: collection and preparation of blood and blood products for transfusions.
  - **Cytotechnology**: study of human body cells and cellular abnormalities.
  - **Hematology**: study of blood cells.



FIGURE 3–13 Cardiographic technicians perform stress tests to aid in the diagnosis of heart disease.



FIGURE 3–14 Medical laboratory technologists perform tests to help determine the presence and/or cause of disease.



FIGURE 3–15 Phlebotomists collect blood and prepare it for testing.

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  - **Histology**: study of human body tissue.
  - **Microbiology**: study of bacteria and other microorganisms.

- *Medical laboratory technicians* perform many of the routine tests (**Figure 3–14**) that do not require the advanced knowledge held by a medical technologist.
- *Medical laboratory assistants* perform basic laboratory tests, prepare specimens for examination or testing, and perform other laboratory duties such as cleaning and helping to maintain equipment.
- *Phlebotomists* (**Figure 3–15**), or *venipuncture technicians*, collect blood and prepare it for testing.
- *Ophthalmologists* are doctors specializing in diseases, disorders, and injuries of the eyes. They diagnose and treat disease, perform surgery, and correct vision problems or defects.
- *Optometrists*, doctors of optometry, examine eyes for vision problems and defects, prescribe corrective lenses or eye exercises. If eye disease is present, the optometrist refers the patient to an ophthalmologist.
- *Ophthalmic medical technologists and technicians* obtain patient histories, perform routine eye tests and measurements, fit patients for contact lenses, administer prescribed treatments, assist with eye surgery, perform advanced diagnostic tests, administer prescribed medications.
- *Ophthalmic assistants* prepare patients for examinations, measure visual acuity (how well a person can see), perform receptionist duties, help patients with frame selections and fittings, order lenses, perform minor adjustments and repairs of glasses, and teach proper care and use of contact lenses.
- *Opticians* make and fit the eyeglasses or lenses prescribed by ophthalmologists and optometrists. Some specialize in contact lenses.
- *Ophthalmic laboratory technicians* cut, grind, finish, polish, and mount the lenses used in eyeglasses, contact lenses, and other optical instruments such as telescopes and binoculars.
- *Radiologic technologists* use x-rays, radiation, nuclear medicine, ultrasound, and magnetic resonance to diagnose and treat disease. Radiologic technologists use different types of scanners to produce images of body parts. Examples include x-ray machines, fluoroscopes, ultrasonic scanners, computed tomography (CT) scanners, magnetic resonance imagers (MRI), and positron emission tomography (PET) scanners. Many radiologic technologists also provide radiation treatment.

Specific job titles exist for technologists who specialize:

- **Radiographers**: take x-rays of the body for diagnostic purposes.
- **Radiation therapists**: administer prescribed doses of radiation to treat disease (usually cancer).



FIGURE 3–16 Radiologic technologists may use a computed tomography (CT) scanner to obtain cross-sectional images of body tissues, bones, and organs.

- **Ultrasound technologists or diagnostic medical sonographers**: use equipment that sends high-frequency sound waves into the body. As the sound waves bounce back from the part being examined, an image of the part is viewed on a screen. Ultrasound is frequently used to examine the fetus (developing infant) in a pregnant woman and is also used for neurosonography (the brain), vascular (blood vessels and blood flow), and echocardiography (the heart) examinations.
- **CT technologists**: use a CT scanner to obtain cross-sectional images of body tissues, bones, and organs (**Figure 3–16**). CT scans help locate tumors and other abnormalities.
- **MRI technologists**: use superconductive magnets and radio waves to produce detailed images of internal anatomy. Examples of MRI uses include identifying multiple sclerosis and detecting hemorrhaging (bleeding) in the brain.
- **PET technologists**: inject a slightly radioactive substance into the patient and then operate the PET scanner, to create a three-dimensional image of body parts and to scan the body for disease processes. This allows physicians to see an organ or bone from all sides, similar to a three-dimensional model.

checkpoint

How do diagnostic and therapeutic services work together for positive patient outcomes?



FIGURE 3–17 Health information (medical records) technicians organize and code patients' records.

3:4 HEALTH INFORMATICS CAREERS

Health informatics providers are involved with documentation of patient records and health information. Because of the increase in the use of electronic health records (EHRs), the job responsibilities of these providers have increased. Maintaining security, using EHR software programs, analyzing information, and creating networks for health information are critical components of health informatics careers.

Places of employment include hospitals, clinics, research centers, health departments, long-term care facilities, colleges, law firms, the Council of Health Insurance, and insurance companies.

- *Health information (medical records) administrators* develop and manage the systems for storing and obtaining information from records.
- *Health information (medical records) technicians* (**Figure 3–17**) organize and code patient records, gather statistical or research data, record information on patient records, monitor electronic and paper-based information to ensure confidentiality.
- *Medical coders*, or *coding specialists*, identify diagnoses, procedures, and services shown in a patient's health care record and assign specific codes to each of them.
- *Clinical account technicians* assist patients that have questions about their bill or need help to make payment arrangements.
- *Admitting officers/clerks* work in the admissions department of a health care facility. They are responsible for obtaining all necessary information when a patient is admitted to the facility, assigning rooms, maintaining records, and processing information when the patient is discharged.
- *Medical administrative assistants* perform general administrative duties as well as tasks that are specific to the health care industry.
- *Medical secretaries*, or *health unit coordinators*, record information in records, schedule procedures or tests, answer telephones, order supplies, and work with computers to record or obtain information.
- *Health educators* teach people the behaviors that promote wellness. They evaluate, design, present, recommend, and disseminate culturally appropriate health education information and materials.
- *Epidemiologists* identify and track diseases as they occur in a group of people. They determine risk factors that make a disease more likely to

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occur, evaluate situations that may cause occupational exposure to toxic substances, develop methods to prevent or control the spread of new diseases, and evaluate statistics and data to help governments, health agencies, and communities deal with epidemics and other health issues.

- *Medical librarians*, also called *health sciences librarians*, organize books, journals, and other print materials to provide health information to other health care professionals.

checkpoint

How are health informatics and cybersecurity interrelated?

3:5 SUPPORT SERVICES CAREERS

Support services providers are personnel who operate the support departments such as administration, the business office, the admissions office, sterile supply, plant operations, equipment maintenance, and housekeeping.

Places of employment include hospitals, clinics, long-term care facilities, the Council of Health Insurance, and public health or governmental agencies.

- *Health care administrators* plan, direct, coordinate, and supervise delivery of health care and manage the operation of health care facilities.
- *Biomedical/clinical engineers* design and build systems that can be used to monitor patients, and monitor and maintain the operation of the technologic systems.
- *Biomedical equipment technicians* work with machines used to diagnose, treat, and monitor patients (**Figure 3–18**). They install, test, service, and repair equipment.
- *Industrial hygienists* identify and analyze workplace hazards.
- *Environmental services facilities managers* oversee buildings, grounds, equipment, and supplies to make sure that the building meets the needs of the people that work there.
- *Sterile service/supply technicians*, also called *sterile processing technicians*, are involved in ordering, maintaining, and supplying all the equipment and supplies used by other departments in a health



FIGURE 3–18 Biomedical equipment technicians (BETs) work with the many different machines used to diagnose, treat, and monitor patients.

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care facility. They sterilize instruments or supplies, maintain equipment, inventory materials.

- *Housekeeping workers/sanitary managers*, also called *environmental service workers*, maintain the cleanliness of the health care facility and observe all principles of infection control to prevent the spread of disease.
- *Transport technicians* transport patients by assisting them to move in and out of vehicles, ambulances and helicopters.

checkpoint

List at least one (1) example of how support services impacts every other career area.

3:6 BIOTECHNOLOGY RESEARCH AND DEVELOPMENT CAREERS

Biotechnology career providers are involved with using living cells and their molecules to make useful products. They work with cells and cell products from humans, animals, plants, and microorganisms. Through research and development, they help produce new diagnostic tests, forms of treatment, medications, vaccines to prevent disease, methods to detect and clean up environmental contamination, and food products.

- *Biological (medical) scientists* assist in the development of vaccines, medicines, and treatments for diseases; evaluate the relationships between organisms and the environment; and administer programs for testing food and drugs.
- *Biomedical/clinical engineers* design devices such as cardiac pacemakers, blood oxygenators, and defibrillators that aid in the diagnosis and treatment of disease.
- *Biomedical/clinical technicians* assist in the study of living organisms. They perform many of the laboratory experiments used in medical research on diseases such as cancer. They also assist in the development, testing, and manufacturing of pharmaceuticals or medications (**Figure 3–19**).
- *Quality control technicians* test materials and products before, during, and after production to make sure the characteristics of the material or product are correct and to ensure they conform to specifications.
- *Forensic science technicians*, also called *criminalists*, investigate crimes by collecting and analyzing physical evidence at a crime scene.
- *Geneticists* study genes and how they are inherited, mutated, and activated, or inactivated.



FIGURE 3–19 Biomedical technicians perform many of the laboratory experiments used for medical research.

- *Pharmacologists* are medical researchers who test and evaluate effectiveness as well as safety of new drugs.
- *Toxicologists* design, plan, and conduct experiments and trials to study the safety and biological effects of chemical agents, drugs, and other substances on the body.

checkpoint

List three (3) characteristics needed by professionals in the biotechnology research and development field.

Case Study Investigation Conclusion

What careers can you identify that might be involved in the transport, assessment, diagnosis, and treatment of Fahad and Lateen? It may seem obvious that they need to see a physician, but who performs the field assessment and safe transport to the emergency room? What support staff provide a clean welcoming environment? What careers are involved in the diagnosis and treatment? With a partner, formulate a probable list of medical providers that were involved in the care of these individuals.

CHAPTER 3 SUMMARY

More than 250 different careers in health care provide individuals with opportunities to find occupations they enjoy.

- Professional health care careers have specific educational requirements. Most also require certification, registration with a professional body, and/or licensure.
- Therapeutic service careers include doctors, dentists, emergency medicine, mental health and social services, nursing, dietitians and veterinary specialists.
- Those following a diagnostic service career perform tests and evaluations that aid in diagnosis and treatment.
- Health informatics involves the documentation of patient and medical information.
- Support services include all the administrative roles that enable the medical services to function, such as administration, equipment maintenance and housekeeping.
- Biotechnology careers involve the use of living cells and their molecules to create useful products.

REVIEW QUESTIONS

1. Explain the similarities and differences between secondary and post-secondary health care education.

2. For each of the degrees listed, state how many years of education are required to obtain the degree.

a. Bachelor's degree. **b.** Master's degree. **c.** Doctorate.

3. What are CME hours? Why are they required in many health care careers?

4. Name at least four (4) specific careers within the health system.

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5. Choose one (1) health care career in which you have an interest. Use references or search the Internet to identify three (3) different schools that offer accredited programs in the career.

CRITICAL THINKING

1. Prepare a paper for one (1) occupation in each of the health science careers. Use and document at least two (2) online resources. Each career paper must include:

- Job description with roles and responsibilities.
- The knowledge and skills needed for the career.
- Track the pathway of education or study from high school through post-secondary; include employment opportunities.
- Traits required to excel in the career.
- Licensure or credentialing requirements.
- Non-educational requirements, i.e., age, physical fitness testing.
- Include between one (1) to three (3) photographs to illustrate this career.

2. Write a brief report comparing each of the five (5) careers you investigated and conclude which would be for you.

ACTIVITIES

1. With a partner, conduct an interview with a health care provider in one (1) of the pathways to a health science career. Create a video. The video should include information about how this individual became employed in this field and the pros and cons of working in this field.

2. With a partner, investigate a career in the medical field. Prepare your display and present it to your class.

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CHAPTER

4

PERSONAL AND PROFESSIONAL QUALITIES OF A HEALTH CARE TEAM MEMBER

Case Study Investigation

Salem, a 50-year-old owner of a large restaurant chain who has a family history of high cholesterol, has come to your hospital for cardiac bypass surgery. The surgeon and anesthesiologist are both members of different multispecialty physician groups.

The hospital has recently purchased a new piece of equipment for blood administration during a surgical procedure. The anesthesiologist is the only one that has been trained on this equipment and has used it successfully in five surgical cases. Two units of blood have been administered during the case using it. As the anesthesiologist administers the last unit of blood, the patient suddenly goes into cardiac arrest. CPR is undertaken successfully. Over the next few days, it is clear Salem has suffered brain injury due to lack of oxygen. He is discharged to a skilled nursing facility with little prospect of returning to work.

Root cause analysis suggests that there were several causes but identifies a breakdown in communication between the anesthesiologist, perfusionist, and surgeon, along with a lack of familiarity with the new equipment.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Demonstrate the personal characteristics and standards of a appearance of a health care professional.
- Identify factors that interfere with communication.
- Explain the importance of listening, nonverbal behavior, reporting, and recording in communication.
- Differentiate between the positive and negative effects of relationships on emotional, physical, and mental health.
- Identify why teamwork is beneficial.
- Differentiate between positive and negative stressors by identifying the emotional response.
- Explain how time management, problem solving, and goal setting reduce stress.

KEY TERMS

communication
cultural diversity
empathy
feedback
goal
interpersonal relationships
leader
leadership
listening
nonverbal communication
stress
team
teamwork
time management

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INTRODUCTION

Although health care team members are employed in many different career areas and in a variety of facilities, certain personal/professional characteristics, attitudes, and rules of appearance apply to all health care providers.

4:1 PERSONAL APPEARANCE

As a team member in any health care career, it is important to present an appearance that inspires confidence and a positive self-image. Although the rules of suitable appearance may vary, certain professional standards apply to most health care careers and should be observed to create a positive impression (**Figure 4–1**).

GOOD HEALTH

Health care involves promoting health and preventing disease. Therefore, health care team members should present a healthy appearance. Six factors contribute to good health:

- **Diet**: Eating well-balanced meals and nutritious foods.
- **Rest**: Adequate rest and sleep.
- **Exercise**: Exercise maintains circulation, improves muscle tone, enhances mental attitude, aids in weight control, and contributes to more restful sleep.
- **Good posture**: Good posture helps prevent fatigue.
- **Avoid use of tobacco, and drugs**: The use of tobacco, and drugs can seriously affect good health.
- **Preventative screenings**: Routine medical exams and dental screenings promote good health and prevent disease.



FIGURE 4–1 Health care team members must make every effort to maintain a neat, clean, and professional appearance.

PROFESSIONAL APPEARANCE

When you obtain a position in a health care field, it is important to learn the rules or standards of dress and personal appearance. Abide by the rules and make every effort to maintain a neat, clean, and professional appearance:

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- Uniform
- Clothing
- Name badge or identification tag
- Suitable shoes
- Personal hygiene

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What six (6) main factors contribute to good health?

4:2 PERSONAL CHARACTERISTICS

As a health care team member, you may care for people of all ages—from the newborn infant to the elderly adult. To be successful, you must care about others and be able to communicate and work with them (**Figure 4–2**). Understanding the needs of people and learning effective communication techniques is one way to develop **empathy**. Some important characteristics that a health care worker needs include:

- Honesty
- Dependability
- Willingness to learn
- Patience
- Acceptance of criticism
- Enthusiasm
- Self-motivation
- Tact
- Competence
- Responsibility
- Discretion
- Professionalism

In any health care field, you will become part of a **team**. It is essential that you become a team player and learn to work well with others. Each member of a health care team will have different responsibilities, but each member must do his or her part to provide the patient with quality care.



FIGURE 4–2 An empathetic health care provider tries to help a child who is frightened about a medical procedure.

Each of the characteristics and attitudes mentioned here, which are essentially characteristic of Saudi morality, must be practiced and learned. By being aware of these characteristics and striving constantly to improve, you will provide good care and be a valuable asset to your employer and other members of the health care team.

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What are ten (10) characteristics of a health care team member?

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4:3 EFFECTIVE COMMUNICATIONS


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The health care team member must be able to relate to patients and their families, to fellow team members, and to other professionals. An understanding of communication skills will assist the health care team member who is trying to relate effectively.

Communication is the exchange of information, thoughts, ideas, and feelings through *verbal* means (spoken words), written communications, and *nonverbal* behavior such as facial expressions and body language. While all types of communication are important, research has shown that a large percentage of human communication is nonverbal, so it is very important to remember that facial expressions and body language have a large impact on the communication process.

COMMUNICATION PROCESS

The communication process involves three essential elements:

- **Sender**: an individual who conveys information or an idea to another person.
- **Message**: the information, ideas, or thoughts.
- **Receiver**: an individual who receives the message from the sender.

Without a sender, message, and receiver, communication cannot occur.

Feedback determines whether a communication was successful. This occurs when the receiver responds to the message. Feedback allows the original sender to evaluate how the message was interpreted and to make any necessary adjustments or clarification. Feedback can be verbal or nonverbal.

Even though the communication process seems simple, many factors can interfere with the process. Important elements of effective communication include:

- The message must be clear (**Figure 4–3**).
- The sender must deliver the message in a clear and concise manner.
- The receiver must be able to hear and receive the message.
- The receiver must be able to understand the message.
- Interruptions or distractions must be avoided.

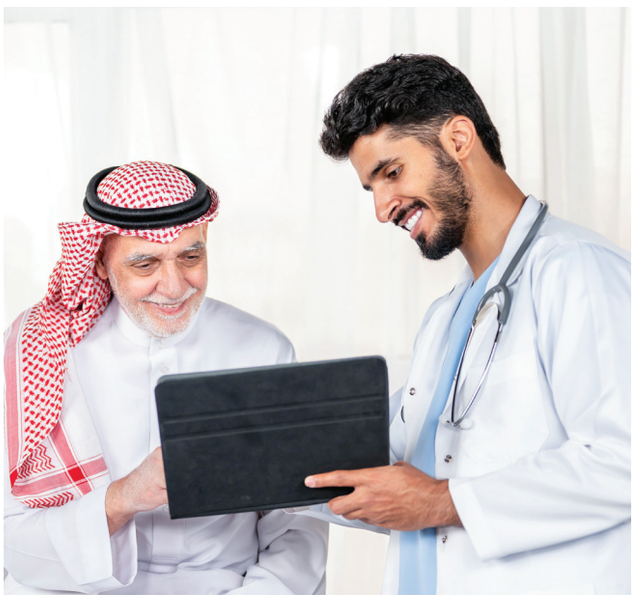


FIGURE 4–3 Communication works best when terminology is used that is understood by people who are not employed in health care.

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LISTENING

Listening means paying attention to and making an effort to hear what the other person is saying. Techniques that can be used to learn good listening skills include:

- Show interest and concern for what the speaker is saying.
- Be alert and maintain eye contact with the speaker.
- Avoid interrupting the speaker.
- Pay attention to what the speaker is saying.
- Try to eliminate your own prejudices and see the other person's point of view.
- Eliminate distractions by moving to a quiet area.
- Reflect statements back to the speaker to let the speaker know that statements are being heard.
- Ask for clarification if you do not understand part of a message.
- Maintain a positive attitude.

NONVERBAL COMMUNICATION

Nonverbal communication involves the use of facial expressions, body language, gestures and eye contact to convey messages or ideas (**Figure 4–4**).

BARRIERS TO COMMUNICATION

A communication barrier is something that gets in the way of clear communication. Three common barriers are physical disabilities, psychological attitudes and prejudices, and cultural diversity.



FIGURE 4–4 What aspects of listening and nonverbal behavior can you see in this picture?

Physical and Sensory Disabilities

- Deafness or hearing loss.
- Blindness or impaired vision.
- Aphasia or speech impairments.
- Cognitive impairments.

Psychological Barriers

Psychological barriers to communication are often caused by bias, prejudice, stereotyping, attitudes, and personality. Examples include closed-mindedness, judging, preaching, moralizing, lecturing, overreacting, arguing, advising, and prejudging. Health care team

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members must learn to put prejudice aside and show respect to all individuals. It is important to respect everyone as an individual and to remember that each person has the right to good care and considerate treatment. At times, this can be extremely difficult, and patience and practice are essential. When individuals have negative attitudes or constantly complain or criticize your work, it can be difficult to show them respect. The health care team member must learn to see beyond the surface attitude to the human being underneath.

Frequently, fear is the cause of anger or a negative attitude. Allow patients to express their fears or anger, encourage them to talk about their feelings, avoid arguing, remain calm, and talk in a nonthreatening tone of voice. If other health care team members seem to be able to communicate more effectively with patients, watch these team members to learn how they handle difficult or angry patients. This is often the most effective means of learning good communication skills.

Cultural Diversity

Cultural diversity is another possible communication barrier. Culture consists of the values, beliefs, attitudes, and customs shared by a group of people and passed from one generation to the next. The main barriers created by cultural diversity include:

- Beliefs and practices regarding health and illness.
- Language differences.
- Eye contact.
- Etiquette differences.
- Ways of dealing with terminal illness and/or severe disability.
- Physical contact.

Respect for and acceptance of cultural diversity is essential for any health care team member. By making every attempt to learn about cultural differences and by showing respect for an individual's right to cultural beliefs, a health care team member can provide *transcultural health care*.

RECORDING AND REPORTING

In health care, an important part of effective communication is reporting or recording all observations while providing care. To do this, it is important not only to listen to what the patient is saying but also to make observations about the patient. Urgent abnormal observations should be both orally reported to the immediate supervisor and recorded in the chart. Most senses are used to make observations:

- **Sense of sight**: notes the color of skin, swelling or edema, the presence of a rash or sore, the color of urine or stool, the amount of food eaten, and other similar factors.

- **Sense of smell**: alerts a health care team member to body odor or unusual odors of breath, wounds, urine, or stool.
- **Sense of touch**: used to feel the pulse, dryness or temperature of the skin, perspiration, and swelling.
- **Sense of hearing**: used while listening to respirations, abnormal body sounds, coughs, and speech.

By using all senses, the health care team member can learn a great deal about a patient's condition and be able to report observations accurately.

Abnormal observations should verbally be reported promptly to an immediate supervisor. There are two types of observations:

- **Subjective observations**: These cannot be seen or felt, and are commonly called *symptoms*. They are usually statements made by the patient. They should be reported in the exact words the patient used.
- **Objective observations**: These can be seen or measured, and are commonly called *signs*. A bruise, cut, rash, or swelling can be seen. Blood pressure and temperature are measurable.

WRITTEN COMMUNICATION


EHR

In most health care facilities, observations are recorded in a patient's health care record using a computer to access the patient's electronic health record. Effective communication requires these written observations to be precise, accurate, concise, and complete (**Figure 4–5**). Spelling and grammar should be correct, and objective observations should be noted.

Incident reports are an important part of written communications. An incident is any unplanned or unintended event or situation that could have resulted in or did result in harm to a patient, or any situation that affects the health, safety, and welfare of others. Facilities have a specific form to fill out and document these occurrences.



FIGURE 4–5 Information recorded on health care records must be accurate, concise, and complete.

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CONFIDENTIALITY

The Saudi Commission for Health Specialties (SCFHS) has established strict standards for maintaining the confidentiality of health care records. Knowledge of the health practitioner about patient information does not authorize the practitioner to disclose the contents in any form, except in the following exceptional circumstances:

- If the disclosure is to protect the patient's contacts from being infected or harmed.
- If the disclosure is necessary to protect society as a whole or prevent harm to the greater population.
- If the patient has consented to disclosure to his or her family or others for a better treatment outcome.
- If the disclosure is necessary for the education of other health care team members, with the insurance of limited data exposure to ensure the anonymity of patient identity.

It is important for health care providers to be aware of all parts of this act and to make every effort to protect the privacy and confidentiality of the patient's health care records.

checkpoint

1. List three (3) barriers to communication.
2. Define objective and subjective observations. List two (2) examples for each type of observation.

4:4 HEALTHY INTERPERSONAL RELATIONSHIPS

Interpersonal relationships are relationships between different groups of people such as family, friends, individuals at school or work, neighbors, members of the community, and new acquaintances. Some interactions may be positive, but some may be negative. However, every interaction can have an effect on the physical, mental, and emotional health of the individual.

Healthy interpersonal relationships can provide the following benefits:

- Provide a sense of belonging and self-worth.
- Allow an individual to learn to trust and respect others.
- Encourage participation in new ideas or activities.
- Encourage personal growth.

- Support ambitious career goals.
- Increase self-confidence.
- Offer safety and security.
- Improve physical health by decreasing stress.
- Provide support during tough times.
- Share celebrations of good times.
- Make life more enjoyable.

At the same time, poor or negative relationships can have adverse effects including:

- Contributing to low self-esteem.
- Contributing to feeling powerless or worthless.
- Creating suspicion about the sincerity of other relationships.
- Feeling isolated and hesitant to participate in social activities.
- Creating stress.
- Weakening or interfering with your career goals.
- Distracting your attention from workplace duties.
- Increasing depression and withdrawal from others.
- Causing physical illnesses such as headaches, digestive disorders, hypertension (high blood pressure), and insomnia.

Effectively communicating needs, wants, and emotions can be a learned skill. Strategies to build healthy relationships include:

- Maintaining a positive attitude.
- Being friendly and cooperating with others.
- Assisting others when you see that they need help.
- Listening carefully when other people share ideas or beliefs.
- Respecting the opinions of others even if they differ from yours.
- Being open-minded and willing to compromise.
- Avoiding the criticism of others.
- Learning good communication skills so you can share ideas, concepts, and knowledge.
- Supporting and encouraging others.

It is also important to evaluate your own relationships. Because you do not have control over what other people say or do, you have to think about protecting and caring for yourself. Maximize positive relationships as this can result

in better health care for everyone. Research has shown that individuals who have a network of positive relationships are healthier, experience less anxiety, manage stress and conflict more appropriately, are less likely to be depressed, and tend to live longer, happier lives.

checkpoint

List three (3) benefits of good interpersonal relationships.

4:5 TEAMWORK

Teamwork consists of many professionals—with different levels of education, ideas, backgrounds, and interests—working together for the benefit of the patient. For example, a surgical team might include the following people:

- **Admitting clerk**: collects admission information.
- **Insurance representative**: (in the private sector) obtains approval for the surgery.
- **Nurses or patient care technicians**: prepare the patient for surgery.
- **Surgeons**: perform the operation.
- **Anesthesiologist**: administers anesthetics.
- **Operating room nurses**: assist the surgeon.
- **Surgical technicians**: prepare and pass instruments.
- **Housekeepers**: clean and sanitize the area.
- **Sterile supply personnel**: sterilize the instruments.
- **Recovery room personnel**: care for the patient after surgery.

After surgery, a dietitian, social worker, physical therapist, occupational therapist, home health care personnel, and other team members might be needed to assist the patient as they recuperate. Each team member has an important job to do so the patient receives quality care.


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Teamwork improves communication and continuity of care. All team members can help to identify the needs of the patient, participate in decisions about care options, and suggest additional professionals who might be able to assist with specific needs.

For a team to function properly, everyone must understand the role of each team member. Effective teams have the following attributes: active participation, commitment, common goals, cultural sensitivity, flexibility, being open to feedback, positive attitude, reliability, trust, and a respect for individual contributions. Most teams have frequent patient care conferences,



FIGURE 4–6 No team member should ever perform a duty that is beyond the range of duties legally permitted.

where the patient is an active participant. Opinions are shared, options are discussed, and goals are established.

Conflict among individuals with different personalities is a problem that can occur when a group of people are working as a team. When conflict occurs, it is essential for each person to deal with the conflict in a positive way by meeting to identify the problem, listen to the other person's point of view, try to resolve the problem in a cooperative manner, and put the agreed solution into action. If two people do not feel comfortable talking privately with each other, a mediator may be able to assist with finding a solution to the problem. Some health care facilities also have grievance committees to assist with conflicts that may occur. These committees gather facts to determine the details of the tension and set clear expectations for a resolution. Assertive communication is the ability to express your ideas in a clear and confident way. This type of communication is essential in dispute resolution if conflict is to be resolved.



Legal

Each team member must be aware of the legal limitations on duties that can be performed and must function within legal boundaries. No team member should ever perform a duty that is beyond the range of duties legally permitted.

Effective teams are the result of hard work, patience, commitment, and practice. When individuals participate fully in teams, healthy relationships result and, the team achieves success (**Figure 4–6**).

checkpoint

List two (2) results of forming an effective team.

4:6 PROFESSIONAL LEADERSHIP

Leadership is defined by Haroun and Mitchell (2012) in *Introduction to Health Care* as "the skill or ability to encourage people to work together and do their best to achieve common goals". A **leader** is frequently defined as an individual who guides others, or who is in charge or in command of others. Leaders define clear goals, and share them with the group, help provide the information and knowledge the group needs to work toward the goals, adapt or revise the goals based on the input of others, and allow the group to achieve the goals. In a group, every member who makes a contribution to an idea can be considered a leader. Leadership in the group passes from person to person as each individual contributes to the achievement of the group's goals.

Different characteristics are assigned to leaders. Some common leadership characteristics may include:

- Respects the rights, opinions, and abilities of others.
- Understands the principles of Shura, the process of decision making by consultation and deliberation.
- Works with a group and guides the group toward a goal.
- Inspires and motivates others.
- Participates in continuing education and professional development and understands the concept of lifelong learning.
- Understands own strengths and weaknesses.
- Displays self-confidence and willingness to take a stand.
- Communicates effectively and verbalizes ideas clearly.
- Thinks creatively and asks "What if?"
- Shows initiative, a willingness to work, and completes tasks.
- Shows optimism, is open-minded, and can compromise.
- Praises others and gives credit to others.

checkpoint

List six (6) characteristics of an effective leader.

4:7 STRESS

Stress is defined as the body's reaction to any stimulus that requires a person to adjust to a changing environment. The stimuli to change, alter behavior, or adapt to a situation are called *stressors.* Stressors can be situations, events, or concepts and may be external or internal forces. For example, a heart attack is an internal stressor, and a new job is an external stressor.

Everyone experiences a certain degree of stress on a daily basis. The amount of stress felt usually depends on the individual's reaction to and perception of the situation causing stress. Many different things can cause stress. Examples include:

- Relationships with family, friends, and team members.
- Job or school demands.
- Illness.
- Lifestyle.
- Financial problems.
- Family events such as birth, death, marriage, or divorce.
- Overwork or excessive activities.
- Boredom and negative feelings.
- Time limitations (too much to do and not enough time to do it).

The first step in learning how to control stress is to identify stressors. Stressors are problems that must be solved or eliminated. One way to do this is to use the *problem-solving method.* It consists of the following steps:

- Gather information or data.
- Identify the problem.
- List possible solutions.
- Make a plan.
- Act on your solution.
- Evaluate the results.
- Change the solution.

Learning to manage a stress reaction is another important way to deal with stressors. Use the following four-step plan to gain control:

- **Stop**: Immediately stop what you are doing to break out of the stress response.
- **Breathe**: Take a slow deep breath to relieve the physical tension you are feeling.
- **Reflect**: Think about the problem and the cause of the stress.
- **Choose**: Determine how you want to deal with the stress.

Many other stress-reducing techniques can be used to manage stress, including:

- **Live a healthy life**: Eat balanced meals, get sufficient amounts of rest and sleep, and exercise on a regular basis (**Figure 4–7**).
- **Take a break from stressors**: Sit in a comfortable chair with your feet up.
- **Relax**: Take a warm bath.
- **Escape**: Listen to quiet, soothing ambient sounds or any other favorite relaxing audible forms.
- **Relieve tension**: Shut your eyes, take slow deep breaths, and concentrate on relaxing each tense muscle.
- **Rely on others**: Talk with a friend and reach out to your support system.
- **Meditate**: Think about your values or beliefs in a higher power.
- **Use imagery**: Close your eyes and use all your senses to place yourself in a scene where you are at peace and relaxed.
- **Enjoy yourself**: Find an enjoyable leisure activity or hobby to provide "time-outs."
- **Renew yourself**: Learn new skills, take part in a professional organization, participate in community activities, and make every effort to continue growing as an individual.
- **Think positively**: Reflect on your accomplishments and be proud of yourself.
- **Develop outside interests**: Provide time for yourself; do not allow a job to dominate your life.



FIGURE 4–7 Exercising on a regular basis is one way to reduce stress.

- **Seek assistance or delegate tasks**: Ask others for help or delegate some tasks to others. Remember that no one can do everything all of the time.
- **Avoid too many commitments**: Learn to say "no."

checkpoint

List six (6) stress-reducing techniques that can be beneficial. State why they help reduce stress.

4:8 TIME MANAGEMENT

Time management is a system of practical skills that allows an individual to use time in the most effective and productive way possible. Time management helps reduce stress by putting the individual in charge, keeping things in perspective when events are overwhelming, increasing productivity, using time more effectively, improving enjoyment of activities, and providing time for relaxing and enjoying life.

Important projects or tasks can be scheduled during the periods of the day when energy levels are high. Rest or relaxation periods can be scheduled when energy levels are low.

SETTING GOALS

A **goal** can be defined as a desired result or purpose toward which one is working. Goals can be compared with maps that help you find your direction and reach your destination.

Everyone should have both short- and long-term goals. *Long-term goals* are achievements that may take years or even a lifetime to accomplish. *Short-term goals* usually take days, weeks, or months to accomplish. They are the smaller steps that are taken to reach the long-term goal. For example, a long-term goal might be to graduate from college with a health care degree.

If the person with this goal is starting high school, short-term goals might include:

- Research and learn about the wide variety of health care careers.
- Job-shadow health care professions that seem most interesting.
- Talk with people in different health care professions to find out about the professions.
- Complete job interest surveys to determine how your own skills and interests match requirements for different health care professions.
- Discuss career opportunities with a guidance or career counselor.

- Attend job fairs or career planning days to obtain information about specific health care professions.
- Research health care professions on the Internet.
- Narrow your career choices to the health care professions that you like best.
- Investigate high school courses you can take to meet college entry requirements for these health care professions.
- Explore the career and technology programs offered by your high school.
- Enroll in a health science education (HSE) program if one is available.
- Join a student club that allows HSE students to network with peers who share similar interests.
- Volunteer in different health care areas to determine which career you like best.
- Research and visit different colleges or technical schools to learn about course offerings and entry requirements.

When this person is in the junior or senior year of high school, short-term goals might include:

- Complete all required high school courses and maintain high grades.
- Confer with guidance or career counselors to obtain information about career planning and college life.
- Apply to several universities or technical colleges that have accredited programs in the chosen health field.
- Check living arrangements at the college campuses if living away from home will be necessary.
- After being accepted by colleges or technical schools, evaluate each individually to choose the school you will attend.
- Notify the school you have selected before the established deadline for enrollment.

These short-term goals are basic suggestions. It is important to remember that short-term goals will change constantly as one set is completed and a new set is established. The completion of a goal, however, will lead to a sense of satisfaction and accomplishment and provide motivation to attempt other goals. To set goals effectively, you must observe certain points, including:

- **State goals in a positive manner**: Use words such as "accomplish" rather than "avoid."
- **Define goals clearly and precisely**: If possible, set a time limit to accomplish the goal.

- **Prioritize multiple goals**: Determine which goals are the most important, and complete them first.
- **Write goals down**: This makes the goal seem real and attainable.
- **Make sure each goal is at the right level**: Goals should present a challenge but not be too difficult or impossible to complete.

TIME MANAGEMENT PLAN

Time management is used to ensure success in meeting established goals. A daily planner, calendar, or computerized calendar and schedule are essential tools. These tools allow an individual to record all activities and obligations, organize all information, become aware of conflicts (two things to do at the same time), and provide an organized schedule to follow. An effective time management plan involves the following seven steps:

- Analyze and prioritize.
- Identify habits and preferences.
- Schedule tasks.
- Make a daily "to do" list.
- Plan your work.
- Avoid distractions.
- Take credit for a job well done.

checkpoint

Differentiate between short-term and long-term goals.

Case Study Investigation Conclusion

What fundamentally went wrong in this case? Was lack of leadership at fault? What communication improvement might best have contributed to this critical situation? What professional characteristics may have improved Salem's outcome from this surgery? With a partner, list three policies or procedures that might be implemented to avoid this type of outcome for future patients.

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CHAPTER 4 SUMMARY

- Certain personal characteristics, attitudes, and rules of appearance apply to health care team members in all health care careers.
- Effective communication is an important aspect of helping individuals through stages of growth and development and in meeting their emotions, wants, and needs.
- Barriers such as physical and sensory disabilities, psychological barriers, and cultural diversity interfere with effective communication.
- Developing good interpersonal relationships is important for the physical, mental, and emotional health of an individual.
- Teamwork is important in any health care career. A team needs a qualified leader, good interpersonal relationships, ways to avoid or deal with conflict, positive attitudes, and respect for legal responsibilities.
- Leadership is a skill that can be learned.
- Stress is a component of every individual's life.
- Time management is a system of practical skills that allows an individual to use time in the most effective and productive way possible.

REVIEW QUESTIONS

1. Three-year-old Layla fell off the swing. She is crying, rubbing her head, and holding her abdomen. What are the nonverbal and verbal cues Layla is displaying? What message is being conveyed? Why is it important to observe both verbal and nonverbal communication?

2. Identify at least one (1) major stressor in your life. List the steps of the problem-solving method, and then apply each of these steps to the stressor you have chosen. Identify at least three (3) courses of action that you can take.

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3. What are the main goals of time management? Using what you have learned, why does time management result in less stress?

CRITICAL THINKING

1. Amal is admitted to a hospital to give birth to her premature baby. Identify at least 10 health care team members who may be on the team that provides her care. Review the careers in Chapter 3 to prepare your list. Why do you think teamwork is important in this scenario? How do healthy professional relationships promote a healthy community?

2. After a building fire, EMS delivers 22 critically injured patients to a hospital emergency room. Which characteristics of a leader do you think would be most effective in directing the group of emergency room personnel? Why?

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3. Based on the information in question 2, with a partner, identify four (4) barriers to communication that may arise during this disaster response and how you would use therapeutic communication to overcome them.

ACTIVITIES

1. With a partner, sit back to back. Student A draws a figure, then describes it to Student B to draw. When they have finished, they turn around and compare figures. Why is listening important? Is accurate recording important? What are four (4) factors that may be a barrier in communicating the desired figure?

2. In a small group, create a medical scene involving communication between two (2) different age groups or two (2) different cultures. Exchange your scenario with another group. Using consensus-building techniques, plan how to role play the new scene using effective communication techniques for five (5) minutes. Present to the class.

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CHAPTER

5

LEGAL AND ETHICAL RESPONSIBILITIES

Case Study Investigation

You are a doctor in your hometown main hospital. Your neighbor called you to tell you that his daughter was proposed to by one of your acquaintances. The father is asking you whether you can provide information about the health status of his daughter's possible future husband. Can you disclose this private information? What information can a doctor disclose?

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Provide one example of a situation that might result in legal action for each of the following: malpractice, negligence, assault and battery, invasion of privacy, false imprisonment, abuse, and defamation.
- Describe how contract/consent laws affect health care.
- Define *privileged communications* and explain how electronic health care records impact confidentiality.
- State the legal regulations that apply to health care records.
- List at least six basic rules of ethics for health care providers.
- List at least six rights of the patient who is receiving health care.
- Justify at least six professional standards by explaining how they help meet legal/ethical requirements.

KEY TERMS

abuse
assault and battery
Bill of Rights and Responsibilities
confidentiality
contract
defamation
ethics
expressed consents
implied consents
informed consent
negligence
patients' rights
privileged communications

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5:1 LEGAL RESPONSIBILITIES

INTRODUCTION

Legal responsibilities are those that are authorized or based on law. A law is a rule that must be followed. Laws are created and enforced by governments. Health care providers must follow laws that affect health care. In addition, health care professionals/providers are also required to know and follow laws that regulate their respective licenses or registrations and the standards for their respective professions.

There are different types of laws that affect health care providers, such as criminal and civil laws.

- **Criminal law**: deals with crimes or wrongs against a person, property, or society; examples include practicing in a health profession without having the required license, illegal possession of drugs, misuse of narcotics, theft, sexual assault, and murder.
- **Civil law**: focuses on the legal relationships between people and the protection of a person's rights; in health care, civil law usually involves torts and contracts. The penalty for criminal crimes is usually incarceration. The penalty for civil violations is usually fines, but sometimes incarceration.

TORTS

A *tort* is a civil wrong that does not involve a contract. A tort occurs when a person is harmed or injured because a health care provider does not meet the established or expected standards of care. These offenses may be quite complex and may lead to legal action, such as:

- **Malpractice**: is commonly called "professional negligence." It is the failure of a professional to use the degree of skill and learning commonly expected in that individual's profession, resulting in injury, loss, or damage to a person receiving care. For example, a nurse performing minor surgery without having any training.
- **Negligence**: Negligence is the failure to provide care that is normally expected of a person in a particular position, resulting in injury to another



FIGURE 5–1 A health care professional could be found to be negligent if a patient is injured because he or she forgot to lift the protective side on the bed and the patient fell out.

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person (**Figure 5–1**). Examples include falls and injuries that occur when side rails are left down, using defective equipment, and burns caused by improper heat or radiation treatments.

- **Assault and battery**: Assault is a threat to injure a person, and battery is the unlawful touching of a person without consent. The terms are closely related and often used together. Examples of assault and battery include performing a procedure without the consent of a patient, threatening a patient, and rough treatment of a patient while providing care.

It is important to remember that patients must give consent for any care and have the right to refuse care. Some procedures or practices require written consent from the patient. Examples include surgery, certain diagnostic tests, experimental procedures, treatment of minors without parental consent. Verbal consent is permitted in other cases, this must be "informed consent." **Informed consent** is permission granted voluntarily by a person who is of sound mind and who has been instructed, in terms the person can understand, about all the risks involved. Patients have the right to withdraw consent at any time. Therefore, all procedures must be explained to the patient, and no procedure should be performed if the patient does not give consent.

- **Invasion of privacy**: may be physical or informational. Physical invasion of privacy includes unnecessarily exposing an individual; for example during an examination. Informational invasion of privacy refers to revealing personal information about an individual without that person's consent; for example giving information about a patient to a friend or family member without the patient's permission.
- **False imprisonment**: refers to restraining an individual or restricting an individual's freedom without authorization. Examples include keeping patients hospitalized against their will or applying physical restraints without proper authorization.

Physical restraints, devices used to limit a patient's movements, should be used *only* to protect patients from harming themselves or others and when all other measures to control the situation have failed. A physician's order must be obtained before they are used, and strict guidelines must be observed while they are in use.

- **Abuse**: Abuse includes any care that results in physical harm, pain, or mental anguish. Examples of types of abuse include:
  - **Physical abuse**: hitting, restraining a person by holding them, depriving people of food or water, and not providing physical care.
  - **Verbal abuse**: speaking harshly, swearing or shouting, using inappropriate words to describe a person's race or nationality, and writing threats or abusive statements.
  - **Psychological abuse:** threatening harm; denying rights; belittling, intimidating, or ridiculing the person; and threatening to reveal information about a person.

Patients may experience abuse before entering a health care facility. *Domestic abuse* occurs when an intimate partner uses threats, manipulation, aggression, or violent behavior to maintain power and control over another person. If abuse is directed toward a child, it is *child abuse*. If it is directed toward an older person, it is *elder abuse*. Health care providers must be alert to the signs and symptoms that may indicate patients in their care are victims of abuse. These may include:

- Unexplained bruises, fractures, burns, or injuries.
- Signs of neglect such as poor personal hygiene.
- Irrational fears or a change in personality.
- Aggressive or withdrawn behavior.
- Patient statements that indicate abuse or neglect.

The law requires that any form of abuse be reported to the proper authorities. Even though the signs and symptoms do not always mean a person is being abused, their presence indicates a need for further investigation. Health care providers are required to report any signs or symptoms of abuse to their immediate supervisor or person responsible for reporting suspicions to the proper authorities.

- **Defamation**: Defamation occurs when false statements cause a person to be ridiculed or cause a person's reputation to be damaged. If the information is spoken, it is *slander*; if it is written, it is *libel*. Examples include reporting that a patient has an infectious disease to a government agency when laboratory results are inaccurate, or telling others that a person has a drug problem when actually another medical condition exists.

CONTRACTS OR CONSENTS

A **contract** is an agreement between two or more parties. Contracts usually have three parts:

- **Offer**: a health care facility or provider offers treatment or services to a patient.
- **Acceptance**: a patient makes an appointment with the health care facility or provider and accepts the treatment or services offered.
- **Consideration**: the patient receives the treatment or services; the health care facility or provider receives payment from the patient.

Contracts or consents in health care are implied or expressed. **Implied consents** are understood without using words to give agreement. For example, when a qualified health care provider prepares a medication and a patient takes the medication, it is implied that the patient accepts this treatment. **Expressed consents** are stated in distinct and clear language, either orally or in writing. An example is a surgery consent. Promises of care must be kept. Therefore, all risks



FIGURE 5–2 All risks of treatment must be explained to a patient before asking the patient for permission to administer treatment.

associated with treatment must be explained completely to the patient **(Figure 5–2)**.

All parties entering into a contract must not have *legal disability*. A person who has a legal disability does not have the legal capacity to form a contract. Examples of people who have legal disabilities are minors (individuals under legal age), mentally incompetent persons, individuals under the influence of drugs that alter the mental state, and semiconscious or unconscious people. In such cases, parents, guardians, or others permitted by law must form the contract for the individual.

A contract requires that certain standards of care be provided by competent, qualified individuals. If the contract is not performed according to the agreement, the contract is breached (broken). Failure to provide care and/or giving improper care on the part of the health provider, or failure on the part of the patient to pay according to the consideration, can be considered a breach of contract and cause for legal action.

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A final important consideration in contract law is *vicarious liability*. A person who directs or controls another person, such as an employer, is called the *principal*, and the person working under the employer is called the *agent*. The principal may be held *vicariously liable* or responsible for the actions of the agent and can be required to pay or otherwise compensate people who have been injured by the agent. For example, if a dental assistant tells a patient "your dentures will look better than your real teeth," the dentist, because of vicarious liability, may have to compensate the patient financially should this statement prove false.

PRIVILEGED COMMUNICATIONS

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Privileged communications comprise all information given to health care personnel by a patient. By law, this information must be kept confidential and shared only with other members of the patient's health care team. It cannot be told to anyone else without the written consent of the patient. Certain information is exempt by law and must be reported in accordance with facility policy. Examples of exempt information are births and deaths; injuries caused by violence (such as assault and battery, abuse, or stabbings) that may require police involvement; drug abuse; communicable diseases; and sexually transmitted diseases.

Health care records are also considered privileged communications. Such records contain information about the care provided to the patient. Although the records belong to the health care provider (for example, the physician, dentist, hospital, or long-term care facility), the patient has a right to obtain a copy of any information on the record. Health care records can be used as legal

records in a court of law. Erasures are therefore not allowed on such records. Errors should be crossed out with a single line so the material is still readable. Correct information should then be inserted, initialed, and dated. If necessary, an explanation for the correction should also be provided. Incorrect data on an electronic health record (EHR) should be corrected by following the directions for making corrections in the particular software being used or by following agency policy. All health care records must be properly maintained, kept confidential, and retained for the amount of time required by law. When records are disposed of after the legal time for retention, they should be burned or shredded to maintain confidentiality.



FIGURE 5–3 The growing use of electronic health records (EHRs) has created the need to limit access to computers to maintain confidentiality.

EHR

The growing use of electronic health records (EHRs) has created a dilemma in maintaining confidentiality (**Figure 5–3**). In a large health care facility such as a hospital, many different individuals may have access to a patient's records. For this reason, health care providers are creating safeguards to maintain computer confidentiality. Some examples include limiting the personnel who have access to such records, requiring the use of iris scans or fingerprints to access records, using codes to prevent access to certain information, requiring passwords to access specific information on records, and constantly monitoring and evaluating computer use.

REGULATION OF HEALTH CARE PROVIDERS

Health practice has laws, regulations, and licensing boards that govern health care providers. These regulations usually determine the scope of practice (the procedures, processes, and actions) that health care providers are legally permitted to perform in keeping with the terms of their professional license or registration. Each medical practitioner must understand the scope of practice that his or her license, certification, or registration falls under. Failure to abide by the regulations can result in the suspension or loss of a license, certification, or registration.

The Ministry of Health and Council of Ministers of Saudi Arabia have established national standards that regulate health care. Some of the regulations are mandated by the Royal Decree. A few examples of these laws include:

- Health Law and its implementing Regulations.
- Law of Practicing Health Care Professions.
- Patient-Bill-of-Rights-and-Responsibilities.
- Saudi Guidelines for Informed Consent.
- Law of Private Health Institutions.

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- Pharmaceutical Companies and Products Law.
- Mental Health Care Law.
- Legal Regulations for Telehealth Services.

In addition, most health care agencies have specific rules, regulations, and standards that determine the activities performed by individuals employed in different positions. These standards are usually in the facility's policy or procedure manual. Every health care team member should read and follow the guidelines presented in the manual. Legal standards and regulations can vary; it is important to remember that you are liable, or legally responsible, for your own actions regardless of what anyone tells you or what position you hold. Therefore, when you undertake a particular position of employment in a health care agency, it is your responsibility to learn exactly what you are legally permitted to do and to familiarize yourself with your exact responsibilities.

Modern health care advances have created many medical ethical dilemmas for health care providers. Some of these dilemmas include:

- When should life support be discontinued?
- Can a health care facility refuse to provide expensive treatment, such as a bone marrow transplant, if a patient cannot pay for the treatment?
- Who decides whether a 75-year-old patient or a 56-year-old patient gets a single kidney available for transplant?
- Should animals be used in medical research even if it results in the death of the animal?
- Should aborted embryos be used to obtain stem cells for research, especially as scientists may be able to use the stem cells to cure diseases such as diabetes, osteoporosis, and Parkinson's?

checkpoint

1. List four (4) legal disabilities that would prevent a person from signing a consent form or contract.
2. Define the term *tort*.
3. Define *privileged communications* and explain how they apply to health care.

5:2 ETHICS

Ethics are a set of principles relating to what is morally right or wrong. Ethics provide a standard of conduct or code of behavior. This allows a health care provider to analyze information and make decisions based on what he or she believes is right and good conduct.

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As medical technology advances, the implications on ethical decisions become more complex. For example, digital medicine combines information technology, artificial intelligence, and big data with pharmaceutical, biotechnology, and medical device companies. An example of this is the digital pill. It combines sensor technology with a drug that is used to treat a range of serious mental illnesses. A psychiatrist who prescribes it to a patient with schizophrenia might be better positioned to help that patient by being certain he or she is taking the medicine as prescribed. On the other hand, there is the potential for a negative effect on the doctor–patient relationship with regard to mutual trust. Another consideration is whether patients fully understand how their health information may be collected, used, stored, and shared. Ethics must keep up with the rapid pace of technology and the challenges of managing a large amount of patients' behavioral, medical, and personal information.

Although there are no easy answers to any of these questions, some guidelines are provided by an ethical code. The Saudi Commission for Health Specialties Department of Medical Education and Postgraduate Studies published the *Code of Ethics for Healthcare Practitioners* in 2014. The aim of the *Code* is to enhance medical professional etiquette and to establish ethical guidelines concerning professional and personal attitudes that ought to be followed by any health care practitioner. The *Code* covers:

- Health care practitioner ethics.
- Duties of the health care practitioner toward patients.
- The health care practitioner's duties toward the community.
- The health care practitioner's duties toward professional colleagues.
- The health care practitioner's duties toward him/herself.
- The health care practitioner's duties toward his/her profession.
- Observance of religious rulings.
- Ethics of teaching and learning on patients.
- Ethics of documentation and authentication.
- Ethics of financial affairs in the health care field.
- Ethics of conducting biomedical research.
- Ethics of dealing with communicable diseases.
- Ethics of dealing with emergency situations.
- Ethics of dealing with life-threatening and incurable diseases.

Most of the national organizations affiliated with the different health care professions have established ethical codes for personnel in their respective occupations. Although such codes differ slightly, most contain the same basic principles:

- Put the saving of life and the promotion of health above all else.

- Make every effort to keep the patient as comfortable as possible and to preserve life whenever possible.
- Respect the patient's choice to refuse medical intervention when all options and consequences have been explained and discussed with the patient and family.
- Treat all patients equally, regardless of race, religion, social or economic status, gender, age, or nationality. Bias, prejudice, and discrimination have no place in health care.Provide care for *all* individuals to the best of your ability.
- Maintain a competent level of skill consistent with your particular health care career.
- Stay informed and up to date, and pursue continuing education as necessary.
- 
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Maintain **confidentiality**. Confidentiality means that information about the patient must remain private and can be shared *only* with other members of the patient's health care team. A legal violation can occur if a patient suffers personal or financial damage when confidential information is shared with others, including family members. Information obtained from patients should not be repeated or used for personal gain. Gossiping about patients is ethically wrong.
- Refrain from immoral, unethical, and illegal practices. If you observe others taking part in illegal actions, report such actions to the proper authorities. Failure to report these actions may result in legal actions taken against you.
- Show loyalty to patients, team members, and employers. Avoid negative or derogatory statements, and always express a positive attitude.
- Be sincere, honest, and caring. Treat others as you want to be treated. Show respect and concern for the feelings, dignity, and rights of others.

Always abide by the code of ethics of your health care career to become a competent and ethical health care provider.

checkpoint

What does the term *confidentiality* mean?

5:3 PATIENTS' RIGHTS

Ministry of Health legislation requires health care agencies to have written policies concerning **patients' rights**, for the care that patients can expect to receive. Agencies expect all personnel to respect and honor these rights.



FIGURE 5–4 Patients have the right to fully participate in all decisions related to their health care.

The Saudi Arabia Ministry of Health issued a **Bill of Rights and Responsibilities** that must be recognized and honored by health care providers. This bill of rights states, in part, that patients have the right to:

- Receive accurate, easily understood information and assistance in making informed health care decisions about their health care plans, professionals, and facilities.
- A choice of health care providers that is sufficient to ensure access to appropriate high-quality health care.
- Access emergency health services when and where the need arises.
- Fully participate in all decisions related to their health care (**Figure 5–4**).
- Be represented by parents, guardians, family members, or other conservators if they are unable to fully participate in treatment decisions.
- Considerate and respectful care.
- Not be discriminated against in the delivery of health care services based on race, ethnicity, national origin, religion, gender, age, mental or physical disability, genetic information, or source of payment.

- Communicate with health care providers in confidence and have the confidentiality of their individually identifiable health care information protected.
- Review a copy their own medical records and request amendments to their records.
- A fair and efficient process for resolving differences with their health care plans, health care providers, and the institutions that serve them, including a rigorous system of internal review and an independent system of external review.

checkpoint

What are the patient's rights if he or she is unable to make an informed consent regarding a medical intervention that they need?

5:4 PROFESSIONAL STANDARDS

By following professional standards at all times, you can protect yourself, your employer, and the patient. Some of the basic standards are:

- Perform only those procedures for which you have been trained and you are legally permitted to do.
- Use approved, correct methods while performing any procedure.
- Obtain proper authorization before performing any procedure.
- Identify the patient.
- Obtain the patient's consent before performing any procedure.
- Observe all safety precautions.
- Keep all information confidential.
- Treat all patients equally regardless of race, religion, social or economic status, gender, age, or nationality.
- Accept no tips or bribes for the care you provide.
- If any error occurs or you make a mistake, report it immediately to your supervisor.
- Behave professionally in dress, language, manners, and actions.

Even when standards are followed, errors leading to legal action sometimes still occur.

Legal

It is your responsibility to understand the legal and ethical implications of your particular health care career. Never hesitate to ask specific questions or to request written policies from your employer. By obtaining this information and by following the basic standards listed, you will

protect yourself, your employer, and the patient to whom you provide health care.

checkpoint

Choose three (3) professional standards and explain how they protect yourself, your employer, and the patient.

Case Study Investigation Conclusion

What information can a doctor disclose about a patient? When would a doctor be allowed to break confidentiality according to the Saudi code of ethics for health care practitioners?

Today's Research **Tomorrow's** Health Care

Frozen Stem Cells That Cure Major Diseases?

Stem cells are important because they can become any of the specialized cell types needed in the human body. They can turn into muscle cells in the heart, nerve cells in the brain, or cells that secrete the insulin needed by a patient with diabetes. The major sources of stem cells are a developing embryo (infant); adult tissues such as bone marrow, brain, muscle, skin, and liver; and blood from the umbilical cord of a newborn infant. When a baby is born, blood from the umbilical cord can be collected and stored in liquid nitrogen (**Figure 5–5**). If the child later develops a disease such as cancer and needs stem cells, the cells can be recovered and used for the transplant. The cost of this procedure still limits its widespread use.



FIGURE 5–5 Stem cells are stored in liquid nitrogen.

Scientists the world over are finding ways to grow stem cells and force them to generate special cells that can be used to treat injury or disease. Early research has proved it is easier to work with embryonic cells, but this has created ethical dilemmas because it means embryos are destroyed. However, if adult cells can be harvested and grown, it would be easier to use an adult's own cells because they would not be rejected by the body.

Conditions such as cancer and birth defects are caused by abnormal cell division. If scientists can learn how the abnormal development occurs, they could find ways to treat and even prevent the conditions. Major research is directed toward learning what makes the cells specialize to become a specific type of cell in the body.

Some of the latest research on stem cells involves treatment for heart disease. If the muscle of the heart is deprived of oxygen because of a blocked artery, the muscle cells die. Researchers are using embryonic cells, cardiac stem cells that naturally reside within the heart, myoblasts (muscle stem cells), and umbilical cord blood cells to try to repair damaged heart tissue. Most of their work has been performed on rats or larger animals, but some experiments have been performed on humans undergoing open-heart surgery. Initial studies showed that stem cells injected directly into the injured heart tissue appeared to improve cardiac function.

Another major area of research is directed toward patients with type 1 or insulin-dependent diabetes, a condition in which the cells of the pancreas do not produce sufficient insulin. New studies are showing some success in directing embryonic stem cells in a cell culture to form insulin-producing cells. Intensive research is needed before this is an effective treatment for diabetes, but stem cells do offer exciting promise for future therapies.

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CHAPTER 5 SUMMARY

- Health care professionals have legal and ethical responsibilities that exist to protect the health care team member, employer, and patient.
- Understanding privileged communications is important. Health care records are privileged communications and can be used as legal records in a court of law.
- Health care providers must know and follow all of the regulations that determine which procedures, processes, and actions they can legally perform.
- Ethical responsibilities are based on right or wrong. Most health care careers have established codes of ethics that provide standards of conduct.
- Health care providers must respect patients' rights. Health care facilities have written policies concerning these rights.
- Professional standards of care provide guidelines for meeting legal responsibilities, ethics, and patients' rights. All health care providers should know and follow the laws that regulate their respective careers.

REVIEW QUESTIONS

1. What is the difference between an implied consent and an expressed consent? Write a paragraph explaining the importance of these contracts in health care.

2. Differentiate between medical law and medical ethics.

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3. Obtain the MOH *Code of Ethics for Healthcare Practitioners* from the Internet. How does the Code expect health care professionals to behave when conducting biomedical research?

4. List six (6) different patient rights.

5. Identify six (6) professional standards and explain how they meet legal responsibilities, ethics, or patient's rights. Why are they important?

CRITICAL THINKING

1. Arwa is a finalist in a cross country race but can't quite make it to national competition. She suffered a major car accident in her junior year that left her with a knee injury, a mangled left ankle, and traumatic amputation of the distal end of her foot. After consulting with her physician and surgeon, Arwa has decided to replace her entire left leg with a prosthetic that would allow her to run without fatigue and navigate anything blocking her running path more smoothly and efficiently. In a small group, predict what would happen if she competes with her team after this mechanical enhancement. Come to a consensus and decide if this is fair. What ideas or technology supports your group's decision?

2. In an essay, define privileged communications and explain how electronic health care records can sometimes complicate keeping the medical record confidential.

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ACTIVITIES

1. With a small group, create a terms chart that defines each term listed below and a brief description of how each might be demonstrated in a health care setting.

TERMS: abuse, slander, assault and battery, libel, false imprisonment, malpractice, invasion of privacy, negligence, defamation of character

2. In a small group, using the information in the terms chart, research a legal case for each term. Lead the class in a discussion regarding these cases in which you would include the legal responsibilities and implications of all involved.

3. With a small group, in five (5) minutes, write down as many patient basic rights as you can. Summarize the class findings on the board. With a partner, create a drawing depicting a person that has negative relationships. Label an effect of negativity on each body system.

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CHAPTER

6 MEDICAL TERMINOLOGY

Case Study Investigation

Khalid went to the ER with his father and brother Mohammed when Mohammed fell out of a tree and broke his arm. While waiting for discharge papers, they were given a copy of chart notes to take to their regular doctor. Their father took one look and could not understand the note at all! Luckily, Khalid had taken medical terminology and could interpret the information. Here is what it said: "Mohammed, a 12 yo male presents c/o Rt arm pain and HA. Lateral x-ray show Colles Fx of the Rt distal radius. BP 120/80, P 100, R 22, afebrile. Casted Rt arm, RICE recommended, ASA for HA and Vicodin I tab every 4 hours as required for pain. Pt activity ad lib. See GP in 3 days." At the end of this chapter, you will be asked to transcribe and communicate what is written.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Define prefixes, suffixes, and word roots selected from a list of words.
- Identify basic medical abbreviations selected from a standard list.
- Transcribe and communicate medical terms correctly.

KEY TERMS

abbreviations
eponyms
prefix
suffix
word roots

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6:1 INTERPRETING WORD PARTS

Medical dictionaries include specialized words used in health care. It would be impossible to memorize all such words, but breaking the words into parts can help you guess their meanings.

Medical terminology is made up of and word roots (see **Figure 6–1**).

A **prefix** is a syllable or word placed at the beginning of a word. A **suffix** is a syllable or word placed at the end of the word.

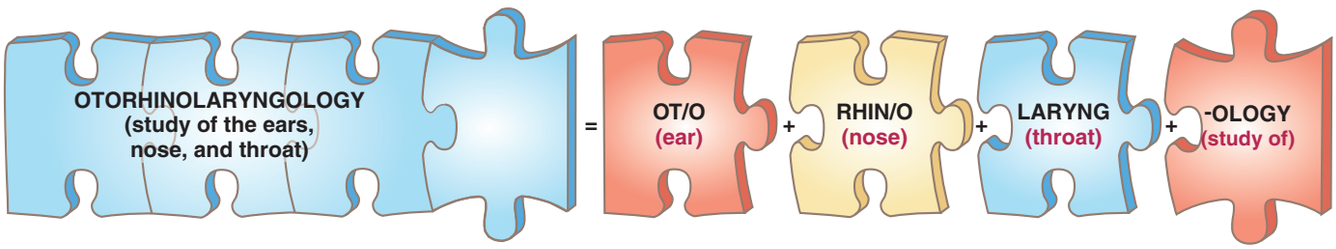


FIGURE 6–1 Prefixes, suffixes, and word roots can be used to interpret the meaning of a word.

The meanings of prefixes and suffixes are set. For example, the suffix *itis* means "inflammation of." *Tonsillitis* means "an inflammation of the tonsils," (**Figure 6–2**) and *appendicitis* means "an inflammation of the appendix." Note that the meaning of the suffix is usually placed first when the word is defined.

Word roots are the main words or parts to which prefixes and suffixes can be added. In the example *appendicitis*, the word root is *appendix*. By adding the prefix *pseudo-*, which means "false," and the suffix *itis*, which means "inflammation of," the word becomes *pseudoappendicitis*. This is interpreted as a "false inflammation of the appendix."

The prefix usually serves to further define the word root. The suffix usually describes what is happening to the word root.

When prefixes, suffixes, and/or word roots are joined together, a *joining vowel* is frequently added, often the letter "o". These are listed in parentheses. Joining vowels are not used if the word root or suffix begins with a vowel. For example, *encephal (o)* means brain. When it is combined with *itis*, meaning "inflammation of," the vowel is not used for *encephalitis*. When it is combined with *gram*, meaning "tracing" or "record," the vowel *o* is added for *encephalogram*. *Hepat (o)* means liver. When it is combined with *itis*, the vowel is not used for *hepatitis*. When it is combined with *megaly*, meaning "enlarged," the vowel *o* is added for *hepatomegaly*.



FIGURE 6–2 Tonsillitis is inflammation of the tonsils in the throat.

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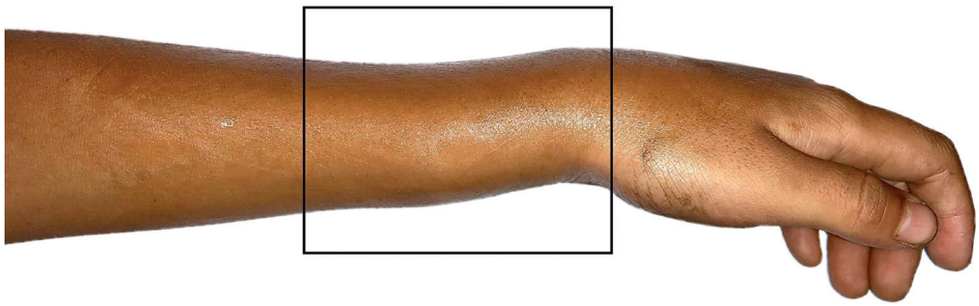


FIGURE 6–3 A Colles fracture of the wrist is named after Abraham Colles, who first described this kind of fracture in 1814.

Eponyms are terms that are named after people, places, or things. They are usually used to identify the individual who identified or discovered a substance, disease, or structure. An eponymous individual is someone who uses his or her name to describe something. Common uses for eponyms in medicine include naming:

- **Anatomical parts**: Achilles tendon, Adam's apple, Eustachian tube
- **Diagnostic tests**: Coombs test, Papanicolaou (Pap) test, Ishihara plates, Wright's stain
- **Diseases**: Alzheimer's disease, Down syndrome, Parkinson's disease
- **Fractures**: Colles' fracture (**Figure 6–3**), Hill-Sachs fracture, hang-man's fracture
- **Instruments or medical devices**: Adson forceps, Auvard speculum, Allis clamp
- **Medical signs**: Babinski sign, Cheyne-Stokes respiration, Korotkoff sounds
- **Medical treatments**: Heimlich maneuver, Kegel exercises, Brandt-Daroff maneuver
- **Microorganisms**: Listeria, *Escherichia coli*, Norwalk virus
- **Surgeries**: Trendelenburg operation, Whipple's procedure, Syme's amputation

By using basic prefixes, suffixes, and word roots and being aware of eponyms, you will frequently be able to interpret the meaning of a word even when you have never before encountered the word. A list of common prefixes, suffixes, and word roots is shown in **Table 6–1**. An example of a medical term using the word part and the meaning of the medical term is also provided. In addition, the prefixes, suffixes, and word roots for parts of the human body are shown in **Figure 6–4**.

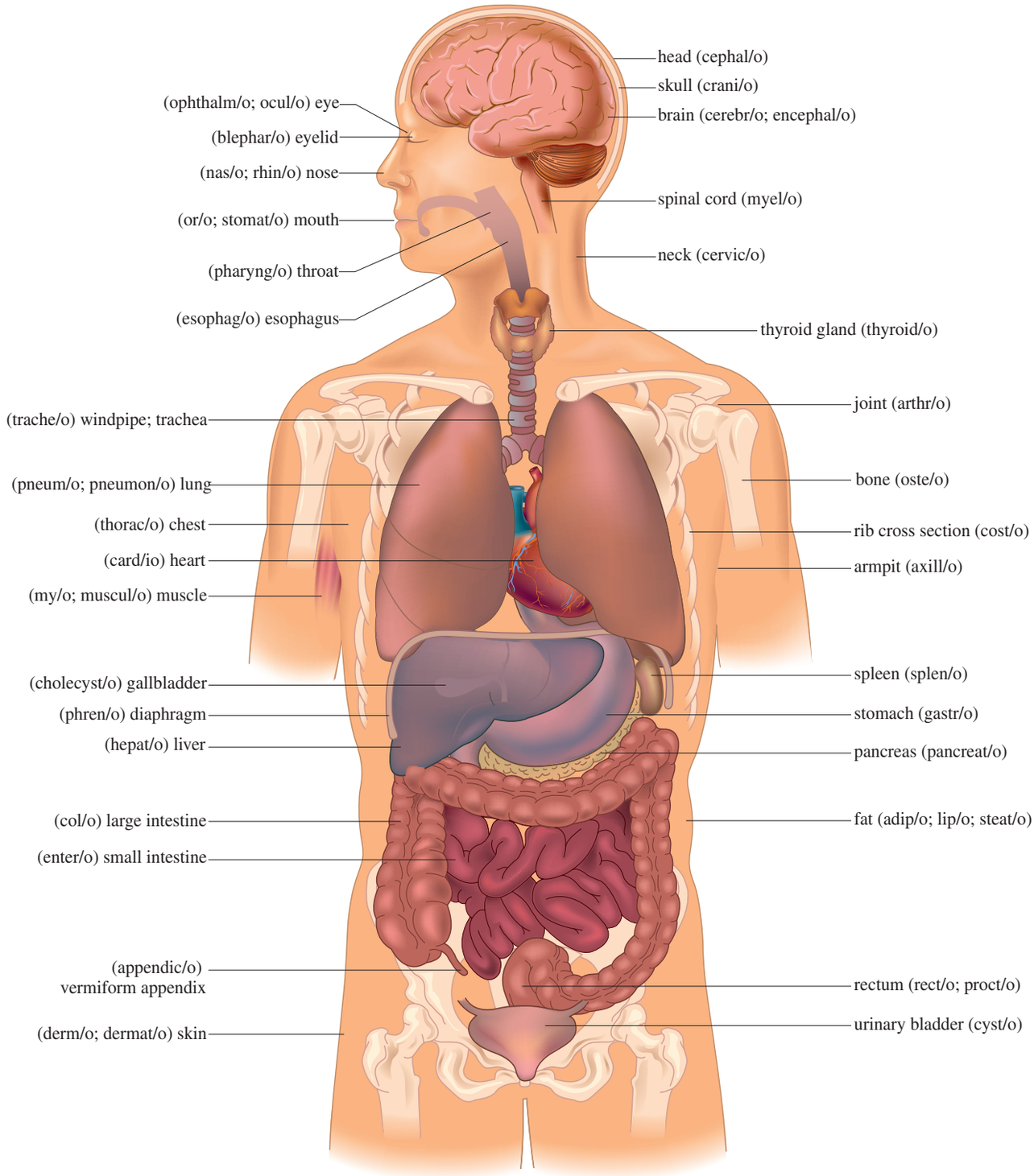


FIGURE 6–4 The prefixes, suffixes, and word roots for parts of the human body.

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TABLE 6–1 Some Common Word Parts

Word Part	Meaning	Medical Term	Meaning
A			
a-, an-	without, lack of	a/pnea	without or lack of breathing
ab-	from, away	ab/duct	to move away from the body
-ac, -ic	pertaining to (about)	cardi/ac	pertaining to the heart
ad-	to, toward, near	ad/duct	to move toward the body
-al	like, similar, pertaining to (about)	neur/al	pertaining to a nerve
alges- (i, ia)	pain	algesi/meter	instrument for measuring pain
-algia	pain	my/algia	muscle pain
ante- (ro)	before, in front of, ahead of	ante/partum	before labor or childbirth
anti-	against	anti/bacterial	against bacteria
-asis	condition of	chole/lithi/asis	condition of stones in the gallbladder
B			
bi- (s)	twice, double, both	bi/lateral	two sides
bio-	life	bio/logy	study of science of life
brachy-	short	brachy/dactyl/ic	condition of having short fingers
brady-	slow	brady/cardia	slow heart rate
C			
cardi- (a, o)	pertaining to (about) heart	cardi/ologist	physician who studies and treats heart disease
-cele, -coele	swelling, tumor, cavity, hernia	meningo/cele	swelling or tumor of the membranes of the brain and spinal cord
chem- (o)	drug, chemical	chemo/therapy	treatment with drugs or chemicals
-cide	causing death	germi/cide	causing death to germs
circum-	around, about	circum/duction	movement in a circular motion
-cise	cut	ex/cise	cut out
co- (n)	with, together	co/chromato/ graphy	identifying a substance by comparing color hues with a known substance
contra-	against, counter	contra/stimulant	against a stimulant
cryo-	cold	cryo/therapy	treatment with cold
crypt- (o)	hidden, obscure	crypto/genic	obscure or unknown origin
D			
dextr- (i, o)	to the right	dextro/ocular	right eye
di- (plo)	double, twice	diplo/blast/ic	pertaining to two germ/embryonic cells
dia-	through, between, part	dia/dermal	cutting through the skin
dis- (ti, to)	separation, away from	dis/infect	to separate or free from infection
dors- (i, o)	to the back, back	dors/al	pertaining to the back
dys-	difficult, painful, bad	dys/uria	difficult or painful urination
E			
e-(c)	without	e/dentu/lous	condition of being without teeth
ec- (ti, to)	outside, external	ecto/genous	capable of developing away from the host
-ectasis	expansion, dilation, stretching	bronchi/ectasis	dilation or expansion of air tubes in lungs
-ectomy	surgical removal of	hyster/ectomy	surgical removal of the uterus
endo-	within, innermost	endo/crine	secrete within
epi-	upon, over, upper	epi/gastric	above the stomach
erythro-	red	erythro/cyte	red (blood) cell
-esis	condition of	par/esis	condition of paralysis
eu-	well, easy, normal	eu/pnea	normal respiration or breathing
ex- (o)	outside of, beyond	exo/path/ic	disease that originates outside the body

(continues)

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TABLE 6–1 Word Parts *(continued)*

Word Part	Meaning	Medical Term	Meaning
F			
fore-	in front of	fore/arm	the front part of the arm
-form	having the form of, shape	uni/form	one shape or form
-fuge	driving away, expelling	centri/fuge	driving away from the center
G			
-genesis	development, production, creation	fibro/genesis	the development of fibrous tissue
-genous	kind, type	exo/genous	outside kind or type
-graph	diagram, instrument for recording	electro/cardio/graph	instrument for recording electrical activity in the heart
H			
hem- (a, ato, o)	blood	hemat/ology	study of the blood
hemi-	half	hemi/plegia	paralysis on half of the body
herni-	rupture	hernio/plasty	surgical repair of a rupture
hetero-	other, unlike, different	hetero/genous	different kind or type
hom- (eo, o)	same, like	homeo/stasis	maintaining a constant level
hydro-	water	hydro/therapy	water treatment
hyper-	excessive, high, over, increased, more than normal	hyper/tension	high blood pressure
hypo-	decreased, deficient, low, under, less than normal	hypo/tension	low blood pressure
I			
-ic, -ac	pertaining to	thorac/ic	pertaining to the chest
idio-	peculiar to an individual, self-originating	idio/pathic	disease arising by itself or from an unknown cause
infra-	beneath, below	infra/sonic	sound waves below the frequency of the human ear
inter-	between, among	inter/costal	between the ribs
intra-	within, into, inside	intra/ven/ous	into a vein
iso-	equal, alike, same	iso/chromatic	constant or same color
-itis	inflammation, inflammation of	pharyng/itis	inflammation of the throat
K			
-kinesis, -kinetic	motion	dys/kinetic	difficult movement
L			
latero- (al)	side	ambi/lateral	both sides
-logy	study of, science of	bio/logy	study or science of life
-lys (is, o)	destruction, dissolving of	thrombo/lysis	destruction or dissolving of clots
M			
macro-	large	macro/cyte	large cell
mal-	bad, abnormal, disordered, poor	mal/nutrition	poor nutrition
med- (i, io)	middle, midline	medio/carpal	in the middle of or between the two rows of carpals (wrist bones)
-megaly, mega-	large, enlarged	cardio/megaly	enlarged heart
mes- (o)	middle, midline	meso/cephal/ic	condition of having a head of medium proportions
-metry	measurement	audio/metry	measurement of hearing acuity
micro-	small	micro/scope	instrument to examine small things
mono-	one, single	mono/cyte	single cell
N			
neo-	new	neo/natal	newborn (infant)
O			
olig- (o)	few, less than normal, small	olig/uria	less than normal (amounts of) urine

(continues)

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TABLE 6–1 Word Parts *(continued)*

Word Part	Meaning	Medical Term	Meaning
-ology	study of, science of	hemat/ology	study of blood
-oma	tumor, a swelling	carcin/oma	cancerous tumor
-otomy	cutting into	crani/otomy	cutting into the skull
P			
pan-	all, complete, entire	pan/arter/itis	inflammation of all layers of an artery
para-	near, beside, beyond, abnormal, lower half of the body	para/plegia	paralysis of the lower half of the body
path- (ia, o, y)	disease, abnormal condition	path/ology	study of disease
per-	through, by, excessive	per/axillary	through the axilla or armpit
peri-	around	peri/cardi/al	pertaining to area around the heart
-plasty	surgical correction or repair	chondro/plasty	surgical repair of cartilage
poly-	many, much	poly/uria	much urine (more than normal amounts)
post-	after, behind	post/operative	after an operation
pre-	before, in front of	pre/operative	before an operation
pro-	in front of, forward	pro/cephalic	in front of the head
Q			
quad- (ra, ri)	four	quadra/plegia	paralysis of four extremities (arms and legs)
R			
retro-	backward, in back, behind	retro/lingual	occurring behind or near the base of the tongue
S			
-scopy	observation	procto/scopy	examination of the rectum
-sect	cut	bi/sect	to cut into two parts
steno-	contracted, narrow	steno/sis	condition of narrowing
sub-	less, under, below	sub/lingual	under the tongue
sup- (er, ra)	above, upon, over, higher in position	supra/thorac/ic	pertaining to the area in the upper part of the chest
sym-, syn-	joined, fused, together	syn/dactyl	two or more digits (fingers or toes) joined together
T			
tach- (o, y)	rapid, fast	tachy/cardia	fast or rapid heart rate
tetra-	four	tetra/paresis	weakness or paralysis of all four limbs
therm- (o, y)	heat	therm/algesia	sensitive to heat
-tox (ic)	poison	cyto/toxic	cell poison
trans-	across, over, beyond	trans/neural	across a nerve
tri-	three	tri/angle	three angles
-trophy	nutrition, growth, development	a/trophy	without nutrition (wasting away)
U			
ultra-	beyond, excess	ultra/sonic	beyond sound waves
uni-	one	uni/ocular	one eye
V			
vas- (o)	vessel, duct	vaso/neur/otic	pertaining to blood vessels and nerves
vascul- (o)	blood vessel	vascul-itis	inflammation of a blood vessel
ven- (a)	vein	ven/ous	pertaining to vein
ventro-	to the front, abdomen	ventr/al	pertaining to the front
X			
xeno-	strange, abnormal, foreign	xeno/genetic	derived or originating from a foreign species
xer- (o)	dry	xero/derma	dry skin
Z			
zoo-	animal	zo/ology	study of animals

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checkpoint

Replace the words in italics with the correct medical term.

Sara has a *fast heart rate* and *fast respiration rate,* and her skin is blue. Her lungs are clear, but she is complaining of cranial pain. She feels like she is going to vomit from the pain. Sara is 1 day *after* a *surgical fixation of her nose*. Her doctor recommends slow breathing.

6:2 USING MEDICAL ABBREVIATIONS

Abbreviations are shortened forms of words, usually just letters. Common examples are AM, which means morning, and PM, which means afternoon or evening.

Abbreviations are used in all health care careers. Sometimes they are used by themselves. At other times, several abbreviations are combined to give orders or directions. Consider the following statement:

NPO 8 pm, To Lab for CBC, BUN, and FBS

This example shows short forms for giving directions. The statement is interpreted as follows: nothing by mouth after eight o'clock in the evening, to the laboratory for a complete blood count, blood urea nitrogen, and fasting blood sugar. As you can see, it is much quicker to write using abbreviations than it is to write the corresponding detailed messages, although clarity of meaning is still very important.

Table 6-2 contains some of the most commonly used abbreviations. Different abbreviations may be used in different facilities and in different parts of the country. It is the responsibility of health care providers to learn the meanings of the abbreviations used in the agencies where they are employed.

It is important to note that some abbreviations and symbols are no longer used because they are prone to causing errors.

Health care team members must use only the abbreviations or symbols approved by the facility in which they are employed. In addition, extreme care must be used while writing abbreviations and symbols so they are legible and readily understood. It is also important to note that texting abbreviations are not allowed on legal documents in a health care facility. For example, b4 is not acceptable for "before" and UR is not acceptable for "you are."

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TABLE 6–2 Abbreviations

ADHD	attention deficit hyperactivity disorder
ad lib	as desired
ASA	aspirin (acetylsalicylic acid)
BP	blood pressure
BMI	body mass index
°C	degrees Celsius (Centigrade)
cal	calorie
CBC	complete blood count
CBR	complete bed rest
CHF	congestive heart failure
c/o	complains of
CPR	cardiopulmonary resuscitation
CXR	chest x-ray or radiograph
D/C, dc, disc	discontinue, discharge
DM	diabetes mellitus
DOB	date of birth
Dr	doctor
ECG, EKG	electrocardiogram
ED	emergency department
EHR	electronic health record
EMR	electronic medical record
ENT	ear, nose, throat
ER	emergency room
ESR	erythrocyte sedimentation rate
et, etiol	etiology (cause of disease)
ETT	endotracheal tube
Ex, exam	examination
Exc	excision
Exp	exploratory, expiration
ext	extract, extraction, external
°F	degrees Fahrenheit
FBS	fasting blood sugar
Fx, Fr	fracture
GP	general practitioner
HA	Headache
MRI	magnetic resonance image
Na	sodium
NPO	nothing by mouth
NSAIDs	nonsteroidal anti-inflammatory drugs
NVD	nausea, vomiting, and diarrhea
O2	oxygen
Ob, Obs	obstetrics
OP	outpatient
PET	positron emission tomography
P	pulse
pt	patient
q	every
qh	every hour
q4h	every 4 hours
R	respiration
RICE	rest, ice, compression, and elevation
Rt	right
TSH	thyroid-stimulating hormone
UTI	urinary tract infection
UV	ultraviolet
VS	vital signs
WBC	white blood cell
WHO	World Health Organization
XR	x-ray
y/o, yo	years old

NOTE: *There is a growing trend toward eliminating periods from most abbreviations. Although the table does not show periods, you may work in an agency that chooses to use them. When in doubt, follow the policy of your agency.*

checkpoint

Read the paragraph below.

pt is admitted to a hospital with a diagnosis of pancreatitis, dysphagia, and gastralgia. Symptoms include NVD and a severe HA. The Dr orders an abdominal MRI, CBC, NPO except for clear liquids, and CBR.

Interpret all these medical abbreviations and terms to determine the patient's condition and plan of treatment.

Case Study Investigation Conclusion

How did taking medical terminology allow Khalid to help his family? What information from the chart could Khalid explain to his father? Can you decipher the "medical code?" After you studied this chapter, were you able to translate Khalid's brother's chart notes?

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CHAPTER 6 SUMMARY

- Medical terminology and abbreviations are used in all health care occupations and facilities.
- Medical terminology consists of the use of prefixes, suffixes, and word roots to create words.
- Eponyms—terms named after people, places, or things—are also used in medical terminology.
- Medical abbreviations are shortened forms of words, usually just letters, that are used to give orders or directions. Abbreviations should be clear and easy to understand to avoid errors.

REVIEW QUESTIONS

1. True or False? Circle the correct answer.

a. A suffix is added to the beginning of a word root. **T / F**
b. "Hyper-" is an example of a prefix. **T / F**
c. You need to add the combining vowel when adding a prefix. **T / F**
d. You always use a combining vowel when combining two word roots. **T / F**
e. A combining form is used when the suffix begins with a consonant. **T / F**

2. Add different suffixes to the word root "cardio" to create at least three (3) different terms; for example: cardio/graph (an instrument for recording the heart or heartbeat). What do your terms mean?

_____

_____

3. Identify the individuals or places after whom the following medical terms were named:

a. Parkinson's disease **b.** Norwalk virus **c.** Achilles tendon

_____

_____

4. List three (3) abbreviations for directions, such as up, down, behind, in front of.

_____

_____

5. Match each definition with the correct word part.

1. backward, behind	**a.** -itis
2. cutting into, surgical incision	**b.** -otomy
3. pain	**c.** -algia
4. inflammation	**d.** -retro-

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CRITICAL THINKING

1. Create a story integrating 20 of the medical terms from the week.

2. Construct a game that will help you and your classmates recall the week's medical terms and abbreviations.

3. Research the position of medical scribe. Compose a paper; the first paragraph should be a brief job description. Then write an essay answering the question, "Why is knowledge of medical terminology and abbreviations essential information for a successful medical scribe to possess?" Conclude by naming five (5) different medical fields in which medical terminology skills would also be invaluable.

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4. With a partner, interpret and transcribe the meaning for the medical words and conditions in the following case study. Use online resources to supplement terms from this book. Create an explanation that would communicate this medical information to the patient and caregivers who may not have an understanding of medical terms; use online video and image sources to help illustrate these medical conditions and treatments.

Ayisha is a 66-year-old obese female with five children. Her history is CHF, cardiomyopathy with cardialgia, hypertension, type 1 diabetes. She presented to the ER c/o chest pain, dyspnea, bilateral lower extremity edema, BP of 160/98 and was admitted to the hospital. The hospital orders for Ayisha are 1200cal low Na diet, accu checks ac and hs, activity BRP, AP q4h, monitor VS q2h for 8 h and then q4h, weigh now and in 12 hours.

ACTIVITIES

1. Write the week's medical terms on the board. Divide the class into two teams. The first person on each team gets a ruler and stands on a mark on the floor. The scorekeeper reads out a definition, and the two team members hit the corresponding medical term with the ruler. The team that gets there first gets a point, and the ruler is handed to the next team member.

2. Put medical terms on an inflatable beachball. Have the class form a circle. Toss the ball to each other. The "catcher" must define the term that is closest to their right thumb.

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CHAPTER

7

HUMAN GROWTH AND DEVELOPMENT

Case Study Investigation

You are the nurse practitioner at the pediatric office where Noura and Abdullah take their baby boy, Ali, 18 months old, and his sister Sara, 4 yrs old, for routine health check-ups. The mother is concerned about Ali's inability to stand up on his feet, and he still prefers crawling. She also asks if it is OK for his age that he is not saying any words rather than only making tuneful babbles because his sister was able to say 'mama' at 8 months. At the end of the chapter you will be asked to compare Ali's case with the normal milestones for his age group. Why should Abdullah and Noura know about normal developmental milestones and how it would affect them taking care of their child?

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Identify at least two physical, mental, emotional, and social developments that occur during each of the seven main life stages.
- Recognize ways that life stages affect an individual's needs.
- Create examples for each of Maslow's Hierarchy of Needs.
- Name the two main methods people use to meet or satisfy needs.
- Create a situation that shows the use of each of the following defense mechanisms: rationalization, projection, displacement, compensation, daydreaming, repression, suppression, denial, and withdrawal.

KEY TERMS

affection
defense mechanisms
esteem
growth
life stages
needs
physiological needs
puberty
safety
self-actualization

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INTRODUCTION

Human **growth** and development begins at birth and continues throughout an individual's lifetime. Growth refers to measurable physical changes that occur throughout a person's life, e.g. height, weight and body shape. Development refers to the changes in intellectual, mental, emotional, social, and functional skills that occur over time. Health care providers must be aware of these **life stages** and individual needs to provide quality health care (**Figure 7–1**).

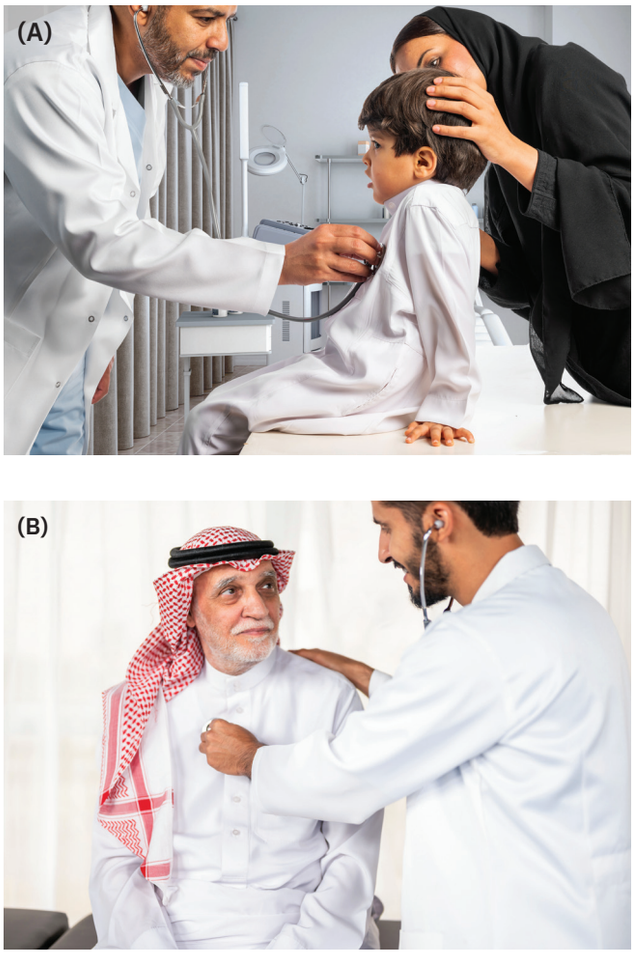


FIGURE 7–1 An understanding of life stages is important for the health care provider, who may provide care to individuals of all ages, from the very young (A) to the elderly (B).

7:1 LIFE STAGES

Although individuals differ greatly, each person passes through life stages of growth and development:

- **Infancy**: birth to 1 year.
- **Early childhood**: 1–6 years.
- **Late childhood**: 6–12 years.
- **Adolescence**: 12–18 years.
- **Early adulthood**: 19–40 years.
- **Middle adulthood**: 40–65 years.
- **Late adulthood**: 65 years and older.

As individuals pass through these life stages, four main types of growth and development occur: physical, mental or cognitive, emotional, and social. *Physical* refers to body growth and includes height and weight changes, muscle and nerve development, and changes in body organs. *Mental* or *cognitive* refers to intellectual development and includes learning how to solve problems, make judgments, and deal with situations. *Emotional* refers to feelings and includes dealing with love, hate, joy, fear, excitement, and other similar feelings. *Social* refers to interactions and relationships with other people. Relationships with family, friends, and peers affect our emotional and physical health.

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INFANCY

Physical Development

The most dramatic and rapid changes in growth and development occur during the first year of life. A newborn baby weighs approximately 2.7–3.6 kg (6–8 lbs) and measures 46–55 cm (18–22 inches) in length (**Figure 7–2**). By the end of the first year of life, weight has usually tripled to 9.5–11 kg (21–24 lb), and height has increased to approximately 74–76 cm (29–30 inches).

At birth, the muscular and nervous systems are very immature and include reflex actions which allow the infant to respond to the environment, like the Moro reflex (startle), the rooting reflex (turning the mouth to the cheek), the sucking reflex (response to a slight touch on the lips) and the grasp reflex (holding an object in the hand) (**Figure 7–3**). Muscle coordination develops in stages from lifting of the head slightly at birth to walking without assistance, grasping objects with the thumb and fingers, and throwing small objects at the age of 12 months.

Most infants have four to eight teeth by the end of the first year of life and have developed good vision with the ability to focus on small objects. Sensory abilities such as smell, taste, and hearing are also more refined.

Mental Development

Mental development is also rapid during the first year. Newborns respond to discomforts such as pain, cold, or hunger by crying. As their needs are met, they gradually become more aware of their surroundings and begin to recognize individuals associated with their care. As infants respond to stimuli in the environment, learning activities grow. At birth, they are unable to speak. By 2–4 months, they coo or babble when spoken to, laugh out loud, and



FIGURE 7–2 A newborn baby usually weighs approximately 2.7–3.6 kg and measures 46–55 cm in length.

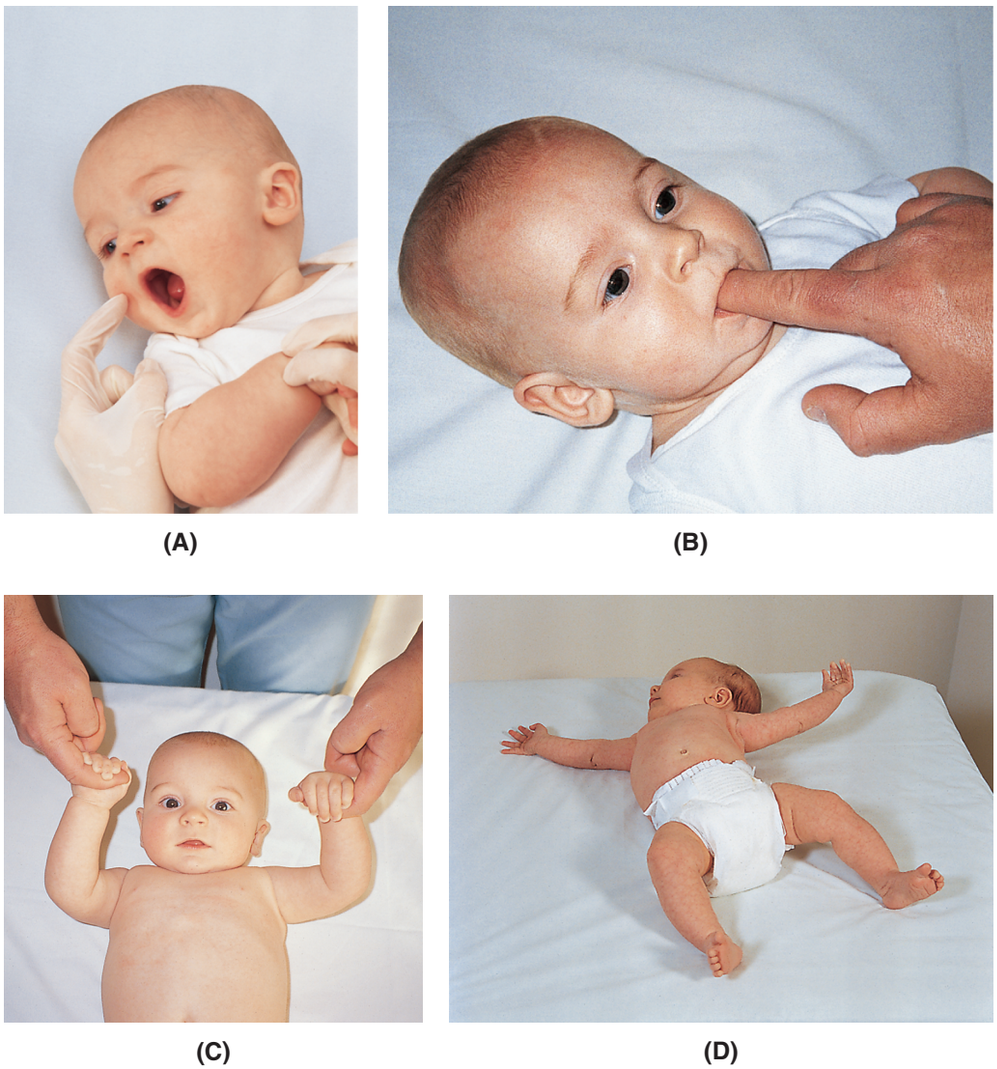


FIGURE 7–3 Some reflex actions an infant has at birth include (A) rooting, (B) sucking, (C) grasp, and (D) Moro.

squeal with pleasure. By 6 months of age, infants understand some words and can make basic sounds, such as "mama" and "baba." By 12 months, infants understand many words and use single words in their vocabularies.

Emotional Development

Emotional development is observed early in life. Newborns show excitement. By 4–6 months of age, distress, delight, anger, disgust, and fear can often be seen. By 12 months of age, elation and affection for family and caregivers is evident. Events and relationships that occur in the first year of life when these emotions are first exhibited can have a strong influence on an individual's emotional behavior during adulthood.

Social Development

Social development progresses gradually from the self-centeredness concept of the newborn to the recognition of others in the environment. By 4 months

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FIGURE 7–4 By 4 months of age, infants recognize their caregivers and stare intently at others.

of age, infants recognize their caregivers, smile readily, and stare intently at others (**Figure 7–4**). By 6 months of age, infants watch the activities of others, show signs of possessiveness, and may become shy or withdraw when in the presence of strangers. By 12 months of age, infants may still be shy with strangers, but they socialize freely with familiar people, and mimic and imitate gestures, facial expressions, and vocal sounds.

Needs and Care

Infants are dependent on others for all needs. Food, cleanliness, and rest are essential for physical growth. Love and security are essential for emotional and social growth. Stimulation is essential for mental growth.

While caring for infants, a health care provider should give the parents or guardians support and reassurance and involve them in the infant's care. Promoting these positive relationships will ensure the appropriate amount of stimulation for infant development in physical and emotional ways. Providing information on nutrition, growth, development, sleep patterns, meeting needs, and creating a healthy environment will promote wellness in the infant. Care must be taken at all times to ensure the infant's safety. Preventing the transmission of infection by washing hands thoroughly and observing standard precautions is also essential during care.

EARLY CHILDHOOD

Physical Development

During early childhood, from 1–6 years of age, physical growth is slower than during infancy. By age 6, the average weight is 20.4 kg (45 lb), and the average height is 116 cm (46 inches). Skeletal and muscle development helps the child

assume a more adult appearance. The legs and lower body tend to grow more rapidly than do the head, arms, and chest. Muscle coordination allows the child to run, climb, and move freely. As muscles of the fingers develop, the child learns to write, draw, and use a fork and knife. By age 2 or 3, most primary teeth have erupted, and the digestive system is mature enough to handle most adult foods. Between 2 and 4 years of age, most children learn bladder and bowel control.

Mental Development

Mental development advances rapidly during early childhood. Verbal growth progresses from the use of several words at age 1 to a vocabulary of 1,500–2,500 words at age 6. Two-year-olds have short attention spans but are interested in many different activities (**Figure 7–5**). They can remember details and begin to understand concepts. Four-year-olds ask frequent questions and usually recognize letters and some words. They begin to make decisions based on logic rather than on trial and error. By age 6, children are very verbal and want to learn how to read and write. Memory has developed to the point where the child can make decisions based on both past and present experiences.



FIGURE 7–5 1 to 2-year-olds are interested in many different activities, but they have short attention spans.

Emotional Development

Emotional development also advances rapidly. At ages 1–2, children begin to develop self-awareness and to recognize the effect they have on other people and things. Limits are usually established for safety, leading the 1- or 2-year-old to either accept or defy such limits. By age 2, most children begin to gain self-confidence and are enthusiastic about learning new things (**Figure 7–6**). However, children can feel impatient and frustrated as they try to do things beyond their abilities. Anger, often in the form of "temper tantrums," occurs when they cannot perform as desired. Children at this age also like routine and become stubborn, angry, or frustrated when changes occur. From ages 4–6, children begin to gain more control over their emotions. They understand the concept of right and wrong, and because they have achieved more independence, they are not frustrated as much by their lack of ability. By age 6, most children also show less anxiety when faced with new experiences because they have learned they can deal with new situations.



FIGURE 7–6 By age 2, most children begin to gain some self-confidence and are enthusiastic about learning new things.

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FIGURE 7–7 Playing alongside and with other children allows preschoolers to learn how to interact with others.

Social Development

Social development expands from a self-centered (egocentric) 1-year-old to a sociable 6-year-old. In the early years, children are usually strongly attached to their parents (or to the individuals who provide their care), and they fear any separation. They begin to enjoy the company of others, but are still very possessive. Playing alongside other children is more common than playing with other children (**Figure 7–7**). Gradually, children learn to put "self" aside and begin to take more of an interest in others. They learn to trust other people and make more of an effort to please others by becoming more agreeable and social. Friends of their own age are usually important to 6-year-olds.

Needs and Care

The needs of early childhood still include food, rest, shelter, protection, love, and security. In addition, children need routine, order, and consistency in their daily lives. They must be taught to be responsible and must learn how to conform to rules. This can be accomplished by making reasonable demands based on the child's ability to comply.

While caring for toddlers, a health care provider must be sensitive to the child's fears and anxiety when dealing with strangers. Enlisting the help of parents or guardians, using a calm but firm approach, establishing rapport with the child, using play to alleviate fear, providing simple explanations to gain cooperation, allowing the child to participate in care by providing one or two choices, and reassuring the child are all ways to make care easier. Building these positive family relationships allows the child to develop self-control and participate fully in the larger community. After a painful procedure, it is essential to comfort the child. At all times, it is important to maintain a safe environment and prevent the transmission of infection.

LATE CHILDHOOD

Physical Development

The late childhood life stage, which covers the ages of 6–12, is also called *preadolescence*. Physical development is slow but steady. Weight gain averages 2.3–3.2 kg (4–7 pounds) per year, and height usually increases approximately 5–7.5 cm (2–3 inches) per year. Muscle coordination is well developed, and children can engage in physical activities that require complex motor-sensory coordination. During this age, most of the primary teeth are lost, and permanent teeth erupt. The eyes are well developed, and visual acuity is at its best. During ages 10–12, secondary sexual characteristics begin to develop in some children.

Mental Development

Mental development increases rapidly because much of the child's life centers around school. Speech skills develop more completely, and reading and writing skills are learned. Children learn to use information to solve problems, and the memory becomes more complex. They begin to understand more abstract concepts such as loyalty, honesty, values, and morals. Children use more active thinking and become more adept at making judgments.



FIGURE 7–8 Role-playing allows a child to control fears and gain self-confidence.

Emotional Development

Emotional development continues to help the child achieve a greater independence and a more distinct personality. At age 6, children are often frightened and uncertain as they begin school. Reassuring parents and success in school help children gain self-confidence. Role-playing also allows a child to control fears and gain self-confidence (**Figure 7–8**). Gradually, fears are replaced by the ability to cope. Emotions are slowly brought under control and dealt with in a more effective manner. By ages 10–12, sexual maturation and changes in body functions can lead to periods of depression followed by periods of joy. These emotional changes can cause children to be restless, anxious, and difficult to understand.

Social Development

Social changes are evident during these years. Seven-year-olds tend to like activities they can do by themselves and do not usually like group activities. However, they want the approval of others, especially their parents and friends. Toward the end of this period, children tend to make friends more easily, and they begin to develop relationships with others. As these relationships develop, a sense of being part of a wider community develops.

Needs and Care

Needs of children in this age group include the same basic needs of infancy and early childhood, together with the need for reassurance, parental approval, and peer acceptance. Hopefully, family relationships have been built to support the child.

Because this age group is prone to accidents and minor infections, health care providers must stress safety and healthy living principles. Information should be provided about nutrition, personal hygiene, sleep patterns, exercise, dental hygiene, preventing infection, and puberty.

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ADOLESCENCE

Physical Development

Adolescence, ages 12 to 18, is often a traumatic life stage. Physical changes occur most dramatically in the early period. A sudden "growth spurt" can cause rapid increases in weight and height. A weight gain of up to 11 kg (25 pounds) and a height increase of several centimeters can occur in a period of months. Muscle coordination does not advance as quickly. This can lead to awkwardness or clumsiness in motor coordination. This growth spurt usually occurs anywhere from ages 11 to 13 in girls and ages 13 to 15 in boys.

The most obvious physical changes in adolescents relate to the development of the sexual organs and secondary sexual characteristics, frequently called **puberty**. Secretion of sex hormones leads to the onset of menstruation in girls and the production of seminal fluid in boys. Secondary sexual characteristics in females include growth of pubic hair, development of breasts and wider hips, and distribution of body fat leading to the female shape. The male develops a deeper voice; attains more muscle mass and broader shoulders; and grows pubic, facial, and body hair.

Mental Development

Since most of the foundations have already been established, mental development primarily involves an increase in knowledge and a sharpening of skills. Adolescents learn to make decisions and to accept responsibility for their actions. At times, this causes conflict because they are treated as both children and adults, or are told to "grow up" while being reminded that they are "still children."



FIGURE 7–9 Adolescents use the peer group as a safety net as they try to establish their identities and independence.

Emotional Development

Emotional development is often stormy and conflicted. As adolescents try to establish their identities and independence, they are often uncertain and feel inadequate and insecure. They worry about their appearance, their abilities, and their relationships with others. They frequently respond more and more to peer group influences. At times, this leads to changes in attitude and behavior and conflict with values previously established via family relationships. Toward the end of adolescence, self-identity has been established. At this point, teenagers feel more comfortable with who they are and turn attention toward what they may become. They gain more control of their feelings and become more mature emotionally.

Social Development

Social development usually involves spending less time with family and more time with peer groups. As adolescents attempt to develop self-identity and independence, they seek security in groups of people their own age who have similar problems and conflicts (**Figure 7–9**). If these peer relationships help develop self-confidence through the approval of others, adolescents become more secure and satisfied. Peer relationships that are considerate and supportive allow the adolescent to have more confidence in their choices. Toward the end of this life stage, adolescents develop a more mature attitude and begin to develop patterns of behavior that they associate with adult behavior or status.

Needs and Care

In addition to basic needs, adolescents need reassurance, support, and understanding. Many problems that develop during this life stage can be traced to the conflict and feelings of inadequacy and insecurity that adolescents experience. Examples include eating disorders and smoking. Even though these types of problems also occur in earlier and later life stages, they are frequently associated with adolescence.

Eating disorders often develop from an excessive concern with appearance. Three common eating disorders are *anorexia nervosa*, *bulimia*, and *bulimarexia*. All three conditions are more common in female than male individuals. Psychological or psychiatric help is usually needed to treat these conditions.

Because of the many conflicts adolescents experience, health care providers must be nonjudgmental to establish rapport while providing care. It is essential to listen to the adolescent's concerns, be sensitive to their nonverbal behavior, involve them in decision making, and answer questions as honestly and completely as possible. It is also important to provide education about hygiene, nutrition, developmental changes, and substance abuse. Encouraging and upbeat relationships between peers, family, and friends not only impacts the individuals' physical and emotional health but promotes healthy relationships with the entire community as the adolescent moves into adulthood.

EARLY ADULTHOOD

Physical Development

Early adulthood, ages 19–40, is frequently the most productive life stage. Physical development is basically complete, muscles are developed and strong, and motor coordination is at its peak. This is also the prime child-bearing time and usually produces the healthiest babies (**Figure 7–10**). Both male and female sexual development is at its peak.



FIGURE 7–10 Early adulthood is the prime childbearing time and usually produces the healthiest babies.

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Mental Development

Mental development usually continues throughout this stage. Many young adults pursue additional education to establish and progress in their chosen careers. Frequently, formal education continues for many years.

Emotional Development

Emotional development usually involves preserving the stability established during previous stages. Young adults are subjected to many emotional stresses related to career, marriage, family, and other similar situations. If emotional structure is strong, most young adults can cope with these worries. They find satisfaction in their achievements, take responsibility for their actions, and learn to accept criticism and to profit from mistakes.

Social Development

Social development frequently involves moving away from the peer group. Instead, young adults tend to associate with others who have similar ambitions and interests, regardless of age.

Needs and Care

Needs of early adulthood include the same basic needs as other age groups. In addition, young adults need independence, social acceptance, self-confidence, and reassurance.

MIDDLE ADULTHOOD

Physical Development

Middle adulthood, ages 40–65, is frequently called *middle age*. Physical changes begin to occur during these years. The hair tends to gray and thin, the skin begins to wrinkle, muscle tone tends to decrease, hearing loss starts, visual acuity declines, and weight gain occurs. Women experience *menopause*, or the end of menstruation, along with decreased hormone production that causes physical and emotional changes. Men also experience a slowing of hormone production. This can lead to physical and psychological changes, a period frequently referred to as the *male climacteric*.

Mental Development

Mental ability can continue to increase during middle age, a fact that has been proved by the many individuals in this life stage who seek formal education. Middle adulthood is a period when individuals have acquired an understanding of life and have learned to cope with many different stresses. This allows them to be more confident in making decisions and to excel at analyzing situations.

Emotional Development



FIGURE 7–11 Job stability and enjoyment during middle adulthood contribute to emotional satisfaction.

Emotionally, middle age can be a period of contentment and satisfaction, or it can be a time of crisis. The emotional foundation of previous life stages and the situations that occur during middle age determine emotional status during this period. Job stability, financial success, the end of child rearing, and good health can all contribute to emotional satisfaction (**Figure 7–11**). Stress—created by loss of job, fear of aging, loss of youth and vitality, illness, marital problems, problems with children, or aging parents—can contribute to emotional feelings of depression, insecurity, anxiety, and even anger. Therefore, emotional status varies in this age group and is largely determined by events that occur during this period.

Social Development

Social relationships also depend on many factors. Relationships between husband and wife can become stronger as they have more time together and opportunities to enjoy success.

Needs and Care

Needs of middle adulthood include the same basic needs as other age groups. In addition, these individuals need self-satisfaction, a sense of accomplishment, autonomy, and supportive social relationships. Peer and friend relationships continue to be important as these adults establish a healthy role in their community.

Health care providers must encourage middle-aged adults to identify risk factors to their health status and to make changes to promote wellness. Increasing exercise, improving nutrition, avoiding obesity, quitting smoking, and other similar actions can improve health status and increase longevity.

LATE ADULTHOOD

Physical Development

Late adulthood, age 65 and older, has many different terms associated with it. These include “elderly,” “senior citizen,” “golden ager,” and “retired citizen.”

Physical development is on the decline. All body systems are usually affected. The skin becomes dry, wrinkled, and thinner. Brown or yellow spots (frequently called “age spots”) appear. The hair becomes thin and frequently loses its luster or shine. Bones become brittle and porous and are more likely to fracture or break. Cartilage between the vertebrae thins and can lead to a stooping posture. Muscles lose tone and strength, which can lead to fatigue

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FIGURE 7–12 Elderly individuals who remain mentally active show fewer signs of decreased mental ability.

and poor coordination. A decline in the function of the nervous system leads to hearing loss, decreased visual acuity, and decreased tolerance for temperatures that are too hot or too cold. Memory loss can occur, and reasoning ability can diminish. The heart is less efficient, and circulation decreases. The kidney and bladder are less efficient. Breathing capacity decreases and causes shortness of breath. However, it is important to note that these changes usually occur slowly over a long period. Many individuals, because of better health and living conditions, do not show physical changes of aging until their 70s and even 80s.

Mental Development

Mental abilities vary among individuals. Elderly people who remain mentally active and are willing to learn new things tend to show fewer signs of decreased mental ability (**Figure 7–12**). Although some 90-year-olds remain alert and well oriented, other elderly individuals show decreased mental capacities at much earlier ages. Short-term memory is usually first to decline. Many elderly individuals can clearly remember events that occurred 20 years ago but do not remember yesterday's events. Diseases such as *Alzheimer's disease* can lead to irreversible loss of memory, deterioration of intellectual functions, speech and gait disturbances, and disorientation. *Arteriosclerosis*, a thickening and hardening of the walls of the arteries, can also decrease the blood supply to the brain and cause a decrease in mental abilities.

Emotional Development

Emotional stability also varies among individuals in this age group. Some elderly people cope well with the stresses presented by aging and remain happy and able to enjoy life. Others become lonely, frustrated, withdrawn, and depressed. Emotional adjustment is necessary throughout this cycle. Retirement, death of a spouse and friends, physical disabilities, financial problems, loss of independence, and knowledge that life must end can all cause emotional distress. The adjustments that the individual makes during this life stage are similar to those made throughout life.

Social Development

Social adjustment also occurs during late adulthood. Retirement can lead to a loss of self-esteem, especially if work is strongly associated with self worth. Less contact with team members and a more limited circle of friends usually occur. Many elderly adults engage in other activities and continue to make new social contacts. Others limit their social relationships. Death of a spouse and friends and moving to a new environment can also cause changes in social relationships. Development of new social contacts is important at this time.

Needs and Care

Needs of this life stage are the same as those of all other life stages. In addition to basic needs, the elderly need a sense of belonging, self-esteem, financial security, social acceptance, and love.

While caring for older adults, health care providers must use a nonjudgmental, supportive approach. Encourage them to talk; allow them as much independence as possible; recognize achievements they have accomplished; provide required health care information as illnesses occur; help them adjust and adapt to physical and mental changes; allow them to express fears and regrets, but remind them of positive accomplishments; and help them find support systems and social networks.

checkpoint

1. What are the seven (7) main life stages?
2. Identify two (2) physical, mental, emotional, and social developments that occur during each of the life stages.

7:2 HUMAN NEEDS

Needs are frequently defined as "a lack of something that is required or desired." From the moment of birth, every human being has needs. Needs motivate the individual to behave or act so that these needs will be met, if at all possible.

Certain needs have priority over other needs. For example, at times a need for food may take priority over a need for social approval, or the approval of others. If individuals have been without food for a period of time, they will direct most of their actions toward obtaining food. Even though they want social approval and the respect of others, they may steal for food, knowing that stealing may cause a loss of social approval or respect.

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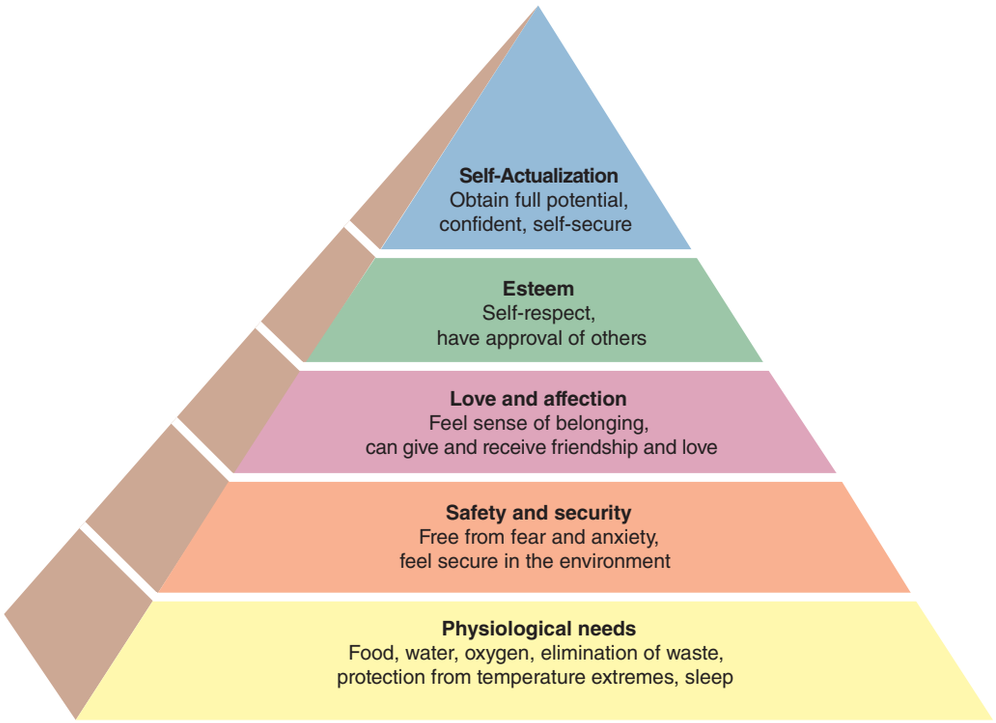


FIGURE 7–13 Maslow's Hierarchy of Needs: The lower needs should be met before the individual can try to meet higher needs.

MASLOW'S HIERARCHY OF NEEDS

Abraham Maslow, a noted psychologist, developed a hierarchy of needs (**Figure 7–13**). According to Maslow, the lower needs should be met before an individual can strive to meet higher needs. Only when satisfaction has been obtained at one level is an individual motivated toward meeting needs at a higher level. The levels of needs include physiological needs, safety, affection, esteem, and self-actualization.

Physiological Needs

Physiological needs are often called "physical," "biological," or "basic" needs. These needs are required by every human being to sustain life. They include food, water, oxygen, elimination of waste materials, sleep, and protection from extreme temperatures. These needs must be met for life to continue. If any of these needs goes unmet, death will occur. Even among these needs, a priority exists. For example, because lack of oxygen will cause death in a matter of minutes, the need for oxygen has priority over the need for food. A patient with severe lung disease who is gasping for every breath will not be concerned with food intake. This individual's main concern will be to obtain enough oxygen to live through the next minute.

Safety

Safety becomes important when physiological needs have been met. **Safety** needs include the need to be free from anxiety and fear, and the need to feel secure in the environment. The need for order and routine is another example of an individual's effort to remain safe and secure. Individuals often prefer the familiar over the unknown. New environments, a change in routine, marital problems, job loss, injury, disease, and other similar events can threaten an individual's safety.



FIGURE 7–14 Individuals of all ages need love and affection.

Love and Affection

The need for love and **affection**, a warm and tender feeling for another person, occupies the third level of Maslow's Hierarchy of Needs. When an individual feels safe and secure, and after all physiological needs have been met, the individual next strives for social acceptance, friendship, and to be loved. The need to belong, to relate to others, and to win approval of others motivates an individual's actions at this point. The individual may now attend a social function that was avoided when safety was more of a priority. Individuals who feel safe and secure are more willing to accept and adapt to change and are more willing to face unknown situations. The need for love and affection is satisfied when friends are made, social contacts are established, acceptance by others is received, and the individual is able to both give and receive affection and love (**Figure 7–14**).

Esteem

Maslow's fourth level includes the need for esteem. **Esteem** includes feeling important and worthwhile. When others show respect, approval, and appreciation, an individual begins to feel esteem and gains self-respect. The self-concept—or beliefs, values, and feelings people have about themselves—becomes positive. Individuals will engage in activities that bring achievement, success, and recognition in an effort to maintain their need for esteem. Failure in an activity can cause a loss of confidence and lack of esteem. When esteem needs are met, individuals gain confidence in themselves and begin to direct their actions toward becoming what they want to be.

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Self-Actualization

Self-actualization, frequently called *self-realization*, is the final need in Maslow's hierarchy. All other needs must be met, at least in part, before self-actualization can occur. **Self-actualization** means that people have obtained their full potentials, or that they are what they want to be. People at this level are autonomous, confident, and willing to express their beliefs and stick to them. They feel so strongly about themselves that they are willing to reach out to others to provide assistance and support.

MEETING NEEDS

When needs are felt, individuals are *motivated* (stimulated) to act. If the action is successful and the need is met, *satisfaction*, or a feeling of pleasure or fulfillment, occurs. If the need is not met, *tension*, or frustration, an uncomfortable inner sensation or feeling, occurs. Several needs can be felt at the same time, so individuals must decide which needs are stronger. For example, if individuals need both food and sleep, they must decide which need is most important, because an individual cannot eat and sleep at the same time.

METHODS OF SATISFYING HUMAN NEEDS

Needs can be satisfied by direct or indirect methods. Direct methods work at meeting the need and obtaining satisfaction. Indirect methods work at reducing the need or relieving the tension and frustration created by the unmet need.

Direct Methods

Direct methods include:

- Hard work.
- Realistic goals.
- Situation evaluation.
- Cooperation with others.

All these methods are directed toward meeting the need. Students who constantly fail tests but who want to pass a course have a need for success. They can work harder by listening more in class, asking questions on points they do not understand. They can set realistic goals that will allow them to find success. By working on one aspect of the course at a time, by planning to study a little each night rather than studying only the night before a test, they can establish goals they can achieve. They can evaluate the situation to determine why they are failing and to try to find other ways to pass the course. They can cooperate with others. By asking the teacher to provide extra assistance, or by having a tutor provide extra help, they may learn the material, pass the tests, and achieve satisfaction by meeting their need.

Indirect Methods

Indirect methods of dealing with needs usually reduce the need and help relieve the tension created by the unmet need. The need is still present, but its intensity decreases. **Defense mechanisms**, unconscious acts that help a person deal with an unpleasant situation or socially unacceptable behavior, are the main indirect methods used. Some use of defense mechanisms is helpful because it allows individuals to cope with certain situations. However, defense mechanisms can be unhealthy if they are used all the time and individuals substitute them for more effective ways of dealing with situations.

Examples of defense mechanisms include:

- **Rationalization**: This involves using a reasonable excuse or acceptable explanation for behavior to avoid the real reason or true motivation.
- **Projection**: This involves placing the blame for one's own actions or inadequacies on someone else or on circumstances rather than accepting responsibility for the actions.
- **Displacement**: This involves transferring feelings about one person to someone else. Displacement usually occurs because individuals cannot direct the feelings toward the person who is responsible.
- **Compensation**: This involves the substitution of one goal for another goal to achieve success. If a substitute goal meets needs, this can be a healthy defense mechanism.
- **Daydreaming**: This is a dreamlike thought process that occurs when a person is awake. Daydreaming provides a means of escape when a person is not satisfied with reality.
- **Repression**: This involves the transfer of unacceptable or painful ideas, feelings, and thoughts into the unconscious mind. An individual is not aware that this is occurring. When feelings or emotions become too painful or frightening for the mind to deal with, repression allows the individual to continue functioning and to "forget" the fear or feeling. Repressed feelings do not vanish, however. They can resurface in dreams or affect behavior.



FIGURE 7–15 At times interpersonal conflict cannot be avoided

- **Suppression**: This is similar to repression, but the individual is aware of the unacceptable feelings or thoughts and refuses to deal with them. The individual may substitute work, a hobby, or a project to avoid the situation.
- **Regression**: This involves retreating to a previous developmental level that provided more safety and security than the current level an individual is experiencing.

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- **Denial**: This involves disbelief of an event or idea that is too frightening or shocking for a person to cope with. Often, an individual is not aware that denial is occurring.
- **Withdrawal**: There are two main ways withdrawal can occur: individuals can either cease to communicate or remove themselves physically from a situation. Withdrawal is sometimes a satisfactory means of avoiding conflict or an unhappy situation. At times, however, interpersonal conflict cannot be avoided (**Figure 7–15**). In these cases, an open and honest communication with the individual may lead to improved understanding in the relationship.

checkpoint

What are the two (2) main methods people use to meet or satisfy needs?

Case Study Investigation Conclusion

What are the normal milestones that should be achieved by Ali's age group? What is the importance of early detection of growth and developmental delay?

Today's Research **Tomorrow's** Health Care

A Microchip to Cure Diabetic Retinopathy?

Diabetes mellitus is a chronic disease caused by a decreased secretion of or abnormal response to insulin, a hormone that is needed by body cells to absorb glucose (sugar) from the blood. According to the General Authority for Statistics in Saudi Arabia, approximately 3.3 million or 10.1 percent of the people in the Kingdom have diabetes. A common complication of diabetes is diabetic retinopathy, a disorder of the retina, or nerve-sensitive layer of the eye that provides vision. Diabetic retinopathy affects approximately 36 percent of people with diabetes and is the leading cause of blindness among working-age people.

Treatment for diabetic retinopathy has its limitations. Laser therapy is used, but it can cause diminished peripheral (side) and night vision and cause laser burns that damage the eyes. A cancer drug, docetaxel, is effective, but the high dosages required to produce the desired effect cause toxic damage to other tissues in the body. Now a team of researchers in Canada has created a microelectromechanical system, commonly called a "MEMS," that can be implanted behind the eyes to release docetaxel on command using an external magnet. The team made the device from a reservoir loaded with docetaxel, sealed in place with an elastic magnetic membrane. By applying a magnetic field, the team was able to trigger the release of a specific amount of docetaxel into the back of the eye, similar to a squirt bottle.

Many other researchers are trying to develop MEMS to treat specific diseases. Some researchers are evaluating MEMS that secrete blood-clotting factors for individuals with hemophilia. Others are trying to develop MEMS that will carry dopamine to treat Parkinson's disease. Think of a future in which tiny capsules floating or implanted in the body will cure chronic diseases and allow individuals to live long and healthy lives.

CHAPTER 7 SUMMARY

- Human growth and development is a process that begins at birth and continues throughout life.
- Each life stage has its own characteristics and specific developmental tasks that an individual must master. Each stage establishes the foundation for the next stage.
- Abraham Maslow, a noted psychologist, developed a hierarchy of needs used to classify and define the needs experienced by human beings, classified into five levels: physiological, safety and security, love and affection, esteem, and self-actualization.
- Needs are met or satisfied by direct and indirect methods. Direct methods meet and eliminate a need. Indirect methods, usually the use of defense mechanisms, reduce the need and help relieve the tension created by the unmet need.

REVIEW QUESTIONS

1. Differentiate between growth and development.

2. Classify life stages and how they can affect an individual's needs.

3. Using Maslow's Hierarchy, create formulated and prioritized examples for an individual's needs.

4. As a health care provider, why is it important to understand human needs?

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CRITICAL THINKING

1. You are a cognitive behavioral therapist working with Hamad, who is a 19-year-old student struggling to formulate his future career plan. He finds himself stressed out and unable to focus in his classes. Discuss with Hamad the methods of satisfying human needs and how learning them would help in coping to achieve satisfaction by meeting his need.

2. Reflect on how you obtain the things you need. What are two (2) methods you use to meet or satisfy your needs?

3. Using an unlined sheet of paper, create a symbolic representation for Maslow's Hierarchy, such as a building, pile of books, or anything else to make the analogy. Based upon your idea, label each level, and list a health care-based example of each level of needs.

ACTIVITIES

1. The teacher will form seven groups. With your group, create a brochure for patient education for families in your clinic where you are a physician's assistant. Include your evaluation of the factors that impact growth and development in the physical, mental, emotional, and social areas for the stage of life your teacher assigns to your group. Add an illustration or summary paragraph analyzing how each factor contributes to the health and wellness of individuals in this stage of life.

2. Noor is a 16-year-old junior in high school that has severe asthma. She has been hospitalized an average of six times a year, for a week at a time, throughout her life. She is an average student, has low physical endurance, and is not part of any groups or organizations at school or in the community. She has three friends, who live on her street. Noor is meeting her counselor, complaining that she does not feel a part of her school or community and needs help to understand her options.

In a small group, create a dialogue between Noor and the counselor that would illustrate her use of each defense mechanism: rationalization, projection, displacement, compensation, daydreaming, repression, suppression, regression, denial, and withdrawal as Noor reacts to the counselor's suggestions.

3. With a partner, create a flow chart explaining the causes and treatment for smoking. Include healthy choices instead of turning to harmful habits such as smoking.

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Link to digital lesson

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CHAPTER

8 NUTRITION AND DIETS

Case Study Investigation

Noura loves her new job as a residential assisted living dietician. She enjoys getting to know the residents and learning about their dietary requirements in order to design a meal plan for them. She must keep in mind disease process, cognition, and physical limitations as well. Haya has been living at the residential home for three years. She has a BMI of 34, a history of stroke, hypertension, diabetes mellitus, and has recently broken her lower denture. At the end of this chapter you will be asked what considerations Noura needs to keep in mind as she creates a meal plan for Haya.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Define the term *nutrition* and list the effects of good and bad nutrition.
- Name the six groups of essential nutrients and their functions and sources.
- Differentiate between the processes of digestion, absorption, and metabolism.
- Create a sample daily menu using the five major food groups.
- Use the body mass index (BMI) graph to determine an individual's BMI.
- Calculate an individual's daily required caloric intake to maintain current weight.
- Name, describe, and explain the purposes of at least eight therapeutic diets.

KEY TERMS

absorption
antioxidants
balanced diet
body mass index (BMI)
calorie
carbohydrates
cellulose
cholesterol
digestion
essential nutrients
fats
lipids
metabolism
minerals
nutrition
obesity
proteins
vitamins

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8:1 FUNDAMENTALS OF NUTRITION

Nutrition includes all body processes relating to food. These include digestion, absorption, metabolism, circulation, and elimination. These processes allow the body to use food for energy, maintenance of health, and growth. *Nutritional status* refers to the state or condition of a person's nutrition. The goal is to be in a state of good nutrition and to maintain *wellness*, with optimal body function.

Nutrition plays a large role in determining height, weight, strength, skeletal and muscular development, physical agility, and resistance to disease. The immediate effects of good nutrition include a healthy appearance, a well-developed body, proper sleep and bowel habits, and a high energy level. In addition, the effects of good nutrition accumulate throughout life and may prevent or delay diseases or conditions such as:

- **Hypertension**: high blood pressure; may be caused by an excess amount of fat (increased body weight) or salt in the diet; can lead to diseases of the heart, blood vessels, and kidneys.
- **Atherosclerosis**: narrowing of the arteries by the accumulation of fatty substances on their inner surfaces; thought to be caused by a diet high in saturated fats and cholesterol; can lead to heart attack or stroke.
- **Osteoporosis**: condition in which bones become porous (full of tiny openings) and break easily; one cause is long-term deficiencies of calcium, magnesium, and vitamin D.
- **Diabetes mellitus**: metabolic disease caused by an insufficient secretion or use of insulin leading to increased blood glucose (sugar) levels, lack of exercise, and diets high in carbohydrates and sugars contribute to individuals developing this disease.
- **Malnutrition**: the state of poor nutrition; may be caused by poor diet or illness. Symptoms include fatigue, being overweight or under-weight, having a poor complexion, and lifeless hair, and irritability (**Figure 8–1**). Malnutrition can cause deficiency diseases, poor muscular and skeletal development, reduced mental abilities, and even death. Malnutrition is most likely to affect individuals living in extreme poverty, and patients undergoing drug therapy, such as treatments for cancer.



FIGURE 8–1 This child shows many of the signs of severe malnutrition. Courtesy of the Centers for Disease Control Public Health Image Library

checkpoint

1. Define *nutrition*.
2. List four (4) diseases that may be avoided by good nutrition.

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FIGURE 8–2 Essential nutrients include protein sources.

8:2 ESSENTIAL NUTRIENTS

Essential nutrients (**Figure 8–2**) are composed of chemical elements found in food. They are used by the body to perform many different body functions. As the body uses these elements, they are replaced by elements in the food one eats. The essential nutrients are divided into six groups. The six groups and the specific functions of each group are shown in **Table 8–1**.

CARBOHYDRATES

Carbohydrates are the major source of readily usable human energy. They are commonly called *starches* or *sugars*. Carbohydrates are a cheaper source of energy than proteins and fats because they are mainly produced by plants. They are easily digested, grow well in most climates, and keep well without refrigeration. They are made of carbon, hydrogen, and oxygen.

The main sources of carbohydrates are breads, cereals, noodles or pastas, crackers, potatoes, corn, peas, beans, grains, fruits, sugar, and syrups.

Cellulose is the fibrous, indigestible form of plant carbohydrate. It is important because it provides bulk in the digestive tract and causes regular bowel movements. The best sources of cellulose are bran, whole-grain cereals, and fibrous fruits and vegetables.

LIPIDS (FATS)

Lipids, commonly called **fats** and oils, are organic compounds found in foodstuffs and in the human body. Lipids also are made of carbon, hydrogen, and oxygen, but they contain more oxygen than carbohydrates do. Fats provide the most concentrated form of energy but are a higher calorie option than carbohydrates. They provide insulation, cushion organs and bones, aid in the absorption of fat-soluble vitamins, and provide flavor to meals. The main sources of fats include butter, margarine, oils, cream, fatty meats, cheeses, and egg yolks.

Fats are also classified as saturated or polyunsaturated. *Saturated fats* are usually solid at room temperature and are found in animal-based foods. Examples include the fats in meats, eggs, whole milk, cream, butter, and cheeses. *Polyunsaturated fats* are usually soft or oily at room

temperature and are found in plant-based foods. Examples include vegetable oils, margarines and other products made from vegetable oils, fish, and peanuts. One type of polyunsaturated fat that seems to decrease the risk of coronary artery disease is *omega-3 fatty acid*. It is found in fatty fish such as salmon, tuna, trout, mackerel, sardines, and herring.

Cholesterol is a sterol lipid found in body cells and animal products. It is used in the production of steroid hormones, vitamin D, and bile acids. Cholesterol is also a component of cell membranes. Common sources are egg yolks, fatty meats, shellfish, butter, cream, cheeses, whole milk, and organ meats (liver, kidney, and brains). In addition, cholesterol is synthesized (manufactured) by the liver.

PROTEINS

Proteins are made of carbon, hydrogen, oxygen, and nitrogen, and some also contain sulfur, phosphorus, iron, and iodine.

Proteins are made up of 22 "building blocks" called *amino acids*. Nine of these amino acids are essential to life. The proteins that contain all nine essential amino acids are called *complete proteins*. The best sources of complete proteins are animal foods such as meats, fish, poultry, milk, cheeses, and eggs (**Figure 8–2**). Proteins that contain any of the remaining 13 amino acids and some of the nine essential amino acids are called *incomplete proteins*. Sources of incomplete proteins are usually plant foods such as cereals, soybeans, dry beans, peas, corn, and nuts. Choosing plant foods carefully can provide a mixture of amino acids from incomplete proteins that contain all the essential amino acids. It is important for a vegetarian to select foods that meet these dietary needs.

VITAMINS

Vitamins are organic compounds that are essential to life. They are important for metabolism, tissue building, and other body processes. They allow the body to use the energy provided by carbohydrates, fats, and proteins. Only small amounts of vitamins are required, and a well-balanced diet usually provides the required vitamins. An excess amount of vitamins or a deficiency of vitamins can cause poor health.

TABLE 8–1 The Six Essential Nutrient Groups

Nutrient Group	Functions
Carbohydrates	Provide heat and energy Supply fiber for good digestion and elimination
Lipids (Fats)	Provide fatty acids needed for growth and development Provide heat and energy Carry fat-soluble vitamins (A, D, E, and K) to body cells
Proteins	Build and repair body tissue Provide heat and energy Help produce antibodies
Vitamins	Regulate body functions Build and repair body tissue
Minerals	Regulate body functions Build and repair body tissue
Water	Carries nutrients and wastes to and from body cells Regulates body functions



FIGURE 8–3 Antioxidants found in these foods help to protect the body.

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Some vitamins are **antioxidants**, organic molecules that help protect the body from harmful chemicals called *free radicals*. In the body, oxygen used during metabolism causes free radicals to form. Free radicals can damage tissues, cells, and even genes in the same way that oxygen causes metals to rust or apples to become brown. Research indicates that free radicals can lead to the development of chronic diseases such as cancer, heart disease, and arthritis. Antioxidants, found mainly in fruits and vegetables, deactivate the free radicals and prevent them from damaging body cells (**Figure 8–3**). The main antioxidant vitamins are vitamins A, C, and E.

Vitamins are usually classified as water soluble or fat soluble. *Water-soluble* vitamins dissolve in water; are not normally stored in the body; and are easily destroyed by cooking, air, and light. *Fat-soluble* vitamins dissolve in fat; can be stored in the body; and are not easily destroyed by cooking, air, and light. Some of the vitamins along with their sources and functions are listed in **Table 8–2**.

MINERALS

Minerals are inorganic (nonliving) elements found in all body tissues. They regulate body fluids, assist in various body functions, contribute to growth, and aid in building tissues. Some minerals—such as selenium, zinc, copper, and manganese—are antioxidants. **Table 8–2** lists some of the minerals essential to life, their sources, and their main functions.

WATER

Water is found in all body tissues. It is essential for the digestion (breakdown) of food, makes up most of the blood plasma and cytoplasm of cells, helps body tissues absorb nutrients, and helps move waste material through the body. Total daily intake of water includes water that is found in all foods and beverages. Dietary guidelines state that thirst should be the main indicator of how much water an individual drinks. High external temperatures and a great amount of exercise or physical activity also increase the need for water. A general guideline is that the average person should drink six to eight glasses of water each day to provide the body with the water it needs.

checkpoint

1. List the six (6) groups of essential nutrients.
2. According to general guidelines, how much water should the average person drink a day?

TABLE 8–2 Some of the vitamins and minerals our bodies need.

Vitamins	Best Sources	Functions
Vitamin A (Retinol)	Liver, fatty fish Butter, margarine Whole milk, cream, cheese Egg yolks Leafy green and yellow vegetables	Growth and development Health of eyes, skin, and mucous membranes Antioxidant to protect cells from free radicals
Vitamin D (Calciferol)	Sunshine (stimulates production in skin) Fatty fish, liver Egg yolks Butter, cream, fortified milk	Growth Regulates calcium and phosphorous absorption and metabolism Builds and maintains bones and teeth
Vitamin E (Tocopherol)	Vegetable oils, butter, margarine Peanuts, egg yolks Dark green leafy vegetables Soybeans and wheat germ	Necessary for protection of cell structure, especially red blood cells and epithelial cells Antioxidant to inhibit breakdown of vitamin A and some unsaturated fatty acids
Vitamin K	Spinach, kale, cabbage, broccoli Liver, soybean oil, cereals	Normal clotting of blood Formation of prothrombin
Vitamin B_{12} (Cobalamin)	Liver, kidney, muscle meats, seafood Milk, cheese Eggs	Metabolism of proteins Production of healthy red blood cells Maintains nerve tissue
Vitamin C (Ascorbic Acid)	Citrus fruits, pineapple Melons, berries, tomatoes Cabbage, broccoli, green peppers	Healthy gums Aids in wound healing Aids in absorption of iron Formation of collagen
Folic Acid (Folacin, Folate, B_9)	Green leafy vegetables Citrus fruits Organ meats, liver Whole-grain cereals, yeast	Protein metabolism Maturation of red blood cells Formation of hemoglobin Synthesis of DNA
Calcium (Ca)	Milk and milk products Cheese Salmon and sardines Some dark green leafy vegetables	Develops/maintains bones and teeth Clotting of the blood Normal heart and muscle action Nerve function
Magnesium (Mg)	Meat, seafood Nuts and legumes Milk and milk products Cereal grains Fresh green vegetables	Constituent of bones, muscles, and red blood cells Healthy muscles and nerves Metabolism of carbohydrates and fats
Sodium (Na)	Salt Meat, poultry and fish Eggs, milk and cheese	Fluid balance, acid–base balance Regulates muscles and nerves Glucose (sugar) absorption
Potassium (K)	Meat Milk and milk products Vegetables Oranges, bananas, prunes, raisins Cereals	Fluid balance Regular heart rhythm Cell metabolism Proper nerve function Regulates contraction of muscles
Iron (Fe)	Liver, muscle meats Dried fruits Egg yolks Enriched breads and cereals Dark green leafy vegetables	Formation of hemoglobin in red blood cells Part of cell enzymes Aids in production of energy
Fluorine (Fl) (Fluoride)	Fluoridated water Fish, meat, seafood	Healthy teeth and bones
Zinc (Zn)	Seafood, especially oysters Eggs Milk and milk products	Component of enzymes and insulin Essential for growth and wound healing

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8:3 USE OF NUTRIENTS

Before the body is able to use nutrients, it must break down the foods that are eaten to obtain the nutrients and then absorb them into the circulatory system. These processes are called *digestion* and *absorption* (**Figure 8–4**). The actual use of the nutrients by the body is called *metabolism*.

DIGESTION

Digestion is the process by which the body breaks down food into smaller parts, changes the food chemically, and moves the food through the digestive system.

There are two types of digestive action: mechanical and chemical. During *mechanical digestion*, food is broken down by the teeth and moved through the digestive tract by a process called *peristalsis*, a rhythmic, wavelike motion of the muscles. During *chemical digestion*, food is mixed with digestive juices secreted by the mouth, stomach, small intestine, and pancreas. The digestive juices contain enzymes, which break down the food chemically so the nutrients can be absorbed into the blood.

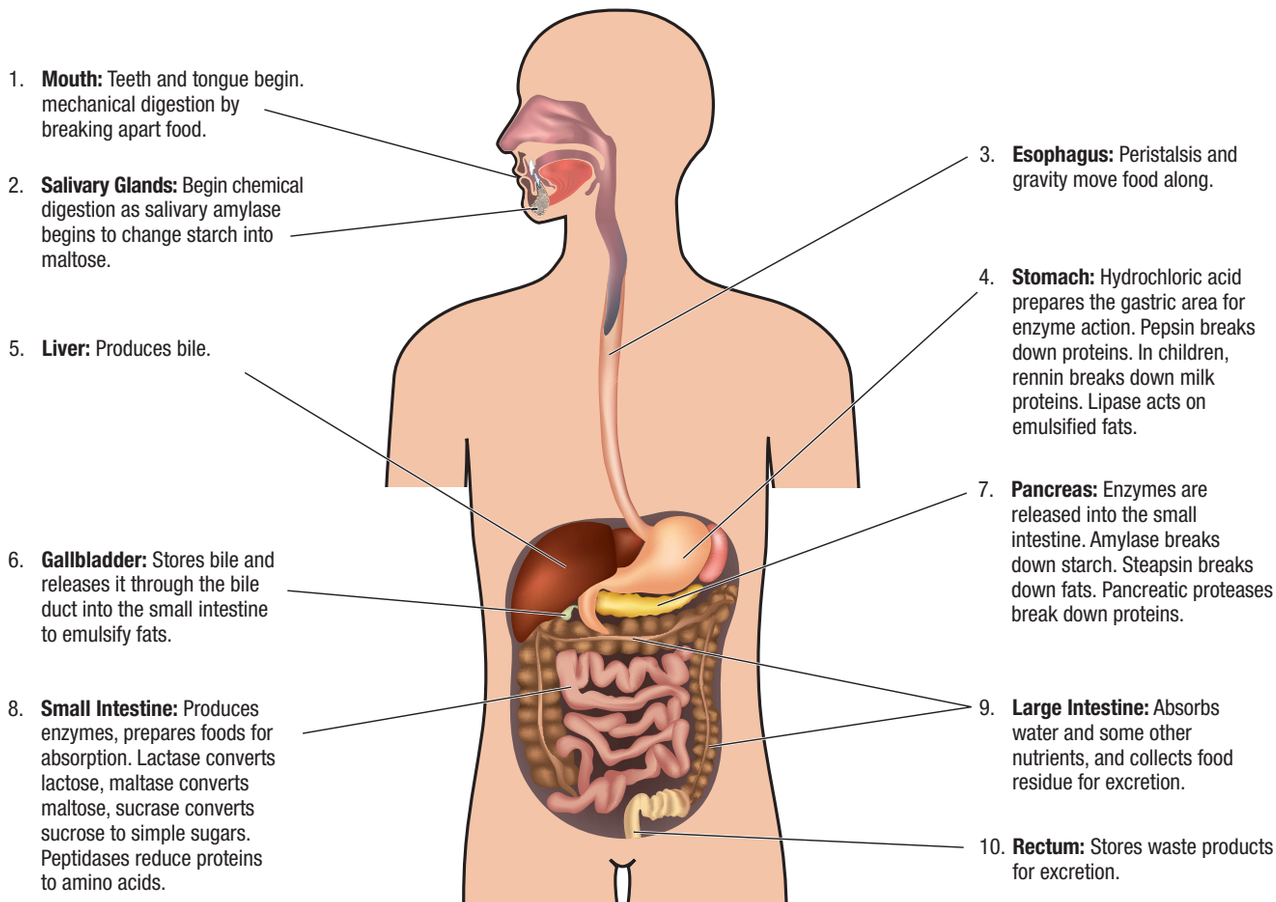


FIGURE 8–4 The processes of digestion and absorption.

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ABSORPTION

After the food is digested, absorption occurs. **Absorption** is the process in which blood or lymph capillaries pick up the digested nutrients. The nutrients are then carried by the circulatory system to every cell in the body. Most absorption occurs in the small intestine, but water, salts, and some vitamins are absorbed in the large intestine.

METABOLISM

After nutrients have been absorbed and carried to the body cells, **metabolism** occurs. This is the process in which nutrients are used by the cells for building tissue, providing energy, and regulating various body functions. During this process, nutrients are combined with oxygen, and energy and heat are released. Energy is required for voluntary work, such as physical activity, and for involuntary work, such as breathing and digestion. The rate at which the body uses energy just for maintaining its own tissue, without doing any other work, is called the *basal metabolic rate*, or *BMR*. The body needs energy continuously, so it stores some nutrients for future use. These stored nutrients are used to provide energy when food intake is not adequate for energy needs.

checkpoint

1. Define *peristalsis*.
2. Where in the body does most of the absorption of nutrients occur?

8:4 MAINTENANCE OF GOOD NUTRITION

Good health is everyone's goal, and a balanced nutritional diet is the best way to achieve it as our prophet, peace be upon him, urges us to be moderate in terms of the food we eat; he says "No man fills a container worse than his stomach. A few morsels that keep his back upright are sufficient for him. If he has to, then he should keep one-third for food, one-third for drink and one-third for his breathing." Accomplishing a **balanced diet** requires the inclusion of all the essential nutrients in correct amounts.

The simplest guide for planning healthy meals is the *Healthy Food Palm* guide from the Saudi Ministry of Health, which classifies foods into seven

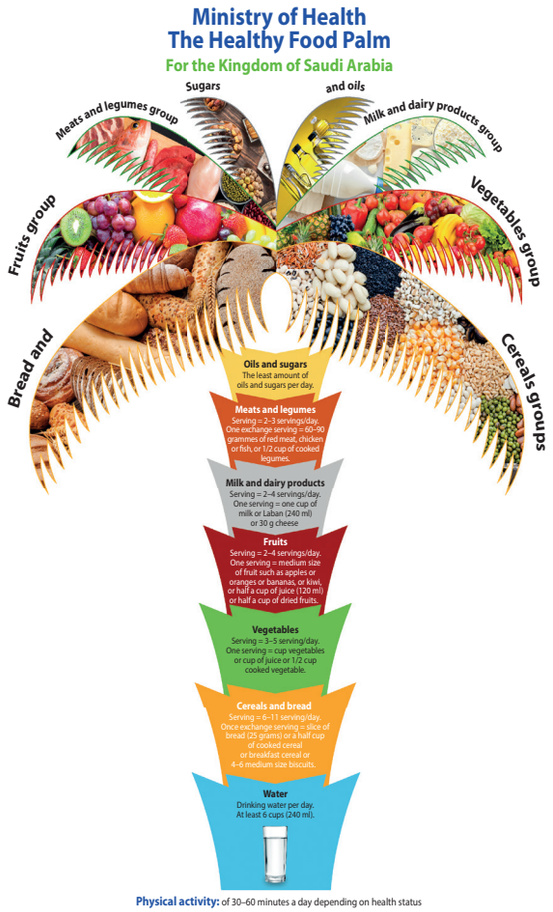


FIGURE 8–5 The Healthy Food Palm.

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major food groups (**Figure 8–5**). Foods are arranged in groups containing similar nutrients.

Sound and sensible nutritional principles can be found on the Internet at *www.moh.gov.sa*.

checkpoint

How many food groups are there? Name them.

8:5 WEIGHT MANAGEMENT

Math

Good nutrition and adequate exercise allow an individual to maintain a body weight that is in proportion to body height. One indication of an individual's health status is body mass index. **Body mass index (BMI)** is a calculation that measures weight in relation to height. It is determined by dividing a person's weight in kilograms by height in meters squared. A graphic chart showing BMI ranges is the easiest way to determine BMI (**Figure 8–6**). A calculator to determine BMI is also available at the Ministry of Health website, *www.moh.gov.sa*. The ideal range is 18.5 to 24.9. A BMI less than 18.5 indicates the individual is underweight. A BMI from 25 to 29.9 indicates the individual is overweight and has increased health risks. A BMI of 30 and above indicates **obesity** and much higher health risks.

UNDERWEIGHT AND OVERWEIGHT

Weight management is used to achieve and maintain the desired body weight. The major conditions that occur due to poor nutrition and improper exercise are underweight, overweight, and obesity.

Underweight is a body weight when the BMI is less than 18.6, and is considered too low to be healthy. Underweight individuals are much more likely to have nutritional deficiencies. Causes can include an inadequate supply of or intake of food, excessive exercise, severe infections, and diseases and/or treatments that cause anorexia (lack of appetite) such as chemotherapy for cancer. However, the most common cause is eating disorders, which can lead to severe malnutrition and even death. Individuals who develop eating disorders may start by dieting to lose weight but then become obsessed with controlling the amount of food they consume. A poor self-image, emotional stress, unsatisfactory social relationships, peer pressure, the desire to resemble slim fashion models, obsessive-compulsive personality traits, an extreme drive for perfectionism, and even genetic influences may cause an individual to develop eating disorders. Eating disorders are more common in females and often develop during adolescence or early adulthood. Some of the most common eating disorders include:

Body Mass Index Table																											
	Normal						Overweight					Obese										Exteme Obesity					
BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Height (cm)	Body Weight (kg)																										
147	41	44	45	48	50	52	54	56	59	61	63	65	67	69	72	73	76	78	80	82	84	87	89	91	93	95	98
150	43	45	47	49	52	54	56	58	60	63	65	67	69	72	74	76	78	81	83	85	88	90	92	94	96	98	101
152	44	46	49	51	54	56	58	60	63	65	67	69	72	74	76	79	81	83	86	88	90	93	95	98	100	102	104
155	45	48	50	53	55	58	60	62	65	67	69	72	74	77	79	82	84	86	88	91	93	96	98	101	103	105	108
157	47	49	52	54	57	59	62	64	67	69	72	74	77	79	82	84	87	89	92	94	97	99	102	104	107	109	112
160	49	51	54	56	59	61	64	66	69	72	74	77	79	82	84	87	89	92	94	97	100	102	105	108	110	112	115
163	50	53	55	58	61	64	66	68	71	74	77	79	82	84	87	89	93	95	98	100	103	105	108	111	113	116	119
165	52	54	57	60	63	65	68	71	73	76	79	82	84	87	90	93	95	98	101	103	106	109	112	114	117	120	122
168	54	56	59	62	64	67	70	73	76	78	81	84	87	90	93	95	98	101	104	107	109	112	115	118	121	123	126
170	55	58	61	64	66	69	72	75	78	81	84	87	90	93	96	98	101	104	107	110	113	116	118	122	124	127	130
173	57	59	63	65	68	72	74	78	80	83	86	89	92	95	98	101	104	107	110	113	116	119	122	125	128	131	134
175	58	61	64	68	70	73	77	80	83	86	89	92	95	98	101	104	107	110	113	117	119	122	126	129	132	135	138
178	60	63	66	69	73	76	79	82	85	88	92	95	98	101	104	107	110	113	117	120	123	126	129	132	136	139	142
180	62	65	68	71	75	78	81	84	88	91	94	98	101	104	107	110	113	117	120	123	127	130	133	137	140	143	146
183	64	67	70	73	77	80	83	87	90	93	97	100	103	107	110	113	117	120	123	127	130	133	137	140	143	147	150
185	65	68	72	75	79	83	86	89	93	96	99	103	107	110	113	117	120	123	127	131	134	137	141	144	147	151	154
188	67	70	74	78	81	84	88	92	95	99	102	106	109	113	116	120	123	127	130	134	137	141	145	148	152	155	159
191	69	73	76	80	83	87	91	94	98	102	105	109	112	116	120	123	127	130	134	137	141	145	148	152	156	159	163
193	71	74	78	82	86	89	93	97	100	104	108	112	115	119	123	127	130	134	138	142	145	148	152	156	160	164	167

FIGURE 8–6 Body mass index (BMI) helps individuals determine healthy weight ranges.

- **Anorexia nervosa**: commonly called *anorexia*; a psychological disorder in which a person drastically reduces food intake or refuses to eat at all.
- **Bulimia**: a psychological disorder in which a person alternately binges (eats excessively) and then fasts, or refuses to eat at all; in some cases, a person will exercise excessively after binging.
- **Bulimarexia**: a psychological disorder in which a person alternately binges and then induces vomiting or uses laxatives to get rid of food that has been eaten.

Physical symptoms of eating disorders include excessive weight loss, extreme weakness and fatigue, irregular heart rhythms, low blood pressure, amenorrhea (absence of menstruation), thin or brittle hair that falls out, an intolerance to cold, dehydration, constipation, dry skin, metabolic disturbances, and osteoporosis. Individuals with a disorder may refuse to eat or lie about eating habits, monitor weight constantly, exercise excessively, withdraw from social situations, use laxatives or diet aids frequently, and have a distorted body image. Death can occur if the condition is not treated. Treatments for eating

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disorders include medical intervention for severe physical symptoms such as irregular heart rhythms and metabolic disturbances, and psychotherapy or counseling to allow the individual to develop behavioral patterns that maintain a healthy weight.

Overweight is a body weight that is 10 to 20 percent greater than the average recommended weight for a person's height, or a BMI from 25 to 29.9. *Obesity* is excessive body weight 20 percent or more above the average recommended weight, or a BMI equal to or greater than 30. Obesity has become a major health concern in the Kingdom of Saudi Arabia. According to the World Health Organization,:

- Around 36 percent of the population are overweight and 25 percent are classed as obese.
- More than 23 percent of Saudi children 5–18 years are overweight and over 11 percent are obese.
- Health problems associated with overweight and obesity have a significant economic impact on the Saudi health care system.

The main causes of obesity are excessive calorie consumption and inadequate physical activity. Genetic, psychological, and biochemical (metabolic) factors can also contribute to this condition. Treatment involves modifying eating habits and increasing physical activity. In more severe cases, medical intervention with medications, counseling, and even surgery may be necessary. If obesity is not controlled, an individual is at high risk for development of hypertension, diabetes mellitus, coronary heart disease, high cholesterol, cerebrovascular accident (stroke), osteoarthritis, gallbladder disease, breathing problems such as sleep apnea, and certain types of cancer such as breast and colon cancer. Research has also shown that obesity decreases life span and causes many early deaths.

MEASURING FOOD ENERGY

Foods vary in the amount of energy they contain. For example, a candy bar provides more energy than an apple does. When the body metabolizes nutrients to produce energy, heat is also released. The amount of heat produced during metabolism is the way the energy content of food is measured. This heat is measured by a unit called a **calorie**. The number of calories in a certain food is known as that food's *caloric value*. Carbohydrates and proteins provide four calories per gram. Fat provides nine calories per gram. Vitamins, minerals, and water do not provide any calories.

An individual's caloric requirement is the number of calories needed by the body during a 24-hour period. Caloric requirements vary from person to person, depending on activity, age, size, sex, physical condition, and climate. The amount of physical activity or exercise is usually the main factor determining caloric requirement because energy used must be replaced. An individual who wants to gain weight can decrease activity and increase caloric intake. An individual who wants to lose weight can increase activity and decrease caloric intake.

MANAGING WEIGHT

Most people know that maintaining desired body weight can lead to a longer and healthier life. Research has shown that even though diets might be beneficial or lead to weight loss, they usually do not allow an individual to maintain their weight when the diet is no longer used. Most fad diets require eating specific foods, limiting certain food groups, eating large amounts of one type of food, or using liquid supplements in place of food. When individuals resume their normal eating habits, the weight that was lost is quickly regained.

The best method for weight control is to make desired changes slowly. Research has shown that gradual weight loss with a change in habits is much healthier and more likely to be sustained. For example, a person who never exercises may start by walking at a slow pace for 15 minutes every day. Gradually, the time and rate can be increased until the person is walking at a brisk pace for 30 minutes 5 days a week. At the same time that the amount of exercise increases, the number of calories consumed must change.

Before starting any diet or weight management plan, a physician should be consulted. The physician may perform a physical examination, order blood or other laboratory tests to check for diseases that could affect weight, run an electrocardiogram, or order a stress test to determine cardiovascular fitness. The physician can then recommend a nutrition plan and exercise program that is customized to the individual's needs. A general guideline for weight loss or gain is that 1 kilogram of body fat equals approximately 7,700 calories. To lose 1 kilogram, a decrease of 7,700 calories is required, either by consuming 7,700 fewer calories or by using 7,700 calories through increased exercise. To gain 1 kilogram, an increase of 7,700 calories is required. It is important to note that increasing or decreasing exercise along with controlling calorie intake is essential. Also, a slow, steady gain or loss of 0.5 kg per week is an efficient and safe form of weight control.

Some recommendations for managing weight include:

- Balance calories from foods and beverages with calories expended.
- Make small decreases in daily calories and small increases in physical activity.
- Engage in at least 30 minutes or more of moderate-intensity physical activity most days of the week with a weekly goal of at least 150 minutes.
- Consume less than 10 percent of calories from saturated fatty acids.
- Keep daily total fat intake to between 20 and 35 percent of calories consumed.
- Select lean, low-fat, or fat-free foods whenever possible.
- Eat more fiber-rich fruits, vegetables, and whole grains.
- Limit foods high in sugar and salt.

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Following these recommendations can help an individual reduce the risk for heart disease, hypertension, diabetes mellitus, high cholesterol, and certain cancers, and also allow the individual to enjoy a longer and healthier life span.

checkpoint

What is the best method for weight control?

8:6 THERAPEUTIC DIETS

Therapeutic diets are modifications of the normal diet to improve specific health conditions. They are normally prescribed by a doctor for specific health conditions, and for short periods of time, and are planned by a dietitian. These diets may change the nutrients, caloric content, or texture of the normal diet. They may seem strange and even unpleasant to patients, so it is essential that the health care provider use patience and tact to convince the patient to eat the foods on the diet. An understanding of the purposes of the various diets will also help the health care provider give simple explanations to patients.

REGULAR DIET

A *regular diet* is a balanced diet usually used for the patient with no dietary restrictions. At times, it has a slightly reduced calorie content. Foods such as rich desserts, cream sauces, salad dressings, and fried foods may be decreased or omitted.

LIQUID DIETS

Liquid diets include both clear liquids and full liquids. Both are nutritionally inadequate and should be used only for short periods of time. All liquids must be served at body temperature. These diets may be used after surgery, for patients with acute infections or digestive problems, to replace fluids lost by vomiting or diarrhea, and before some x-rays of the digestive tract.

SOFT DIET

A *soft diet* is similar to the regular diet, but foods must require little chewing and be easy to digest. Foods to avoid include meat and shellfish with tough connective tissues (most meat is ground), coarse cereals, spicy foods, rich desserts, fried foods, raw fruits and vegetables, nuts, and coconut. This diet may be used following surgery or for patients who have infections, digestive disorders, dysphagia (difficulty in swallowing), or chewing problems.

DIABETIC DIET

A *diabetic diet* is used for patients with diabetes mellitus. In this condition, the body does not produce enough of the hormone insulin to metabolize carbohydrates. Patients frequently take insulin by injection. The diet is called a *carbohydrate-controlled diet* because patients must calculate the amount of carbohydrates in each meal. Usually approximately 40–60 percent of calories are from carbohydrates. In some cases, calorie levels are controlled in addition to the amount of carbohydrates.

CALORIE-CONTROLLED DIETS

Calorie-controlled diets include both low-calorie and high-calorie diets. Low-calorie diets are frequently used for patients who are overweight. High-calorie foods are either prohibited or very limited. High-calorie diets are used for patients who are underweight. Extra proteins and carbohydrates are included.

LOW-CHOLESTEROL DIET

A *low-cholesterol diet* restricts foods that contain cholesterol and usually limits fats to less than 50 grams (g) daily. It is used for patients who have atherosclerosis and heart disease.

FAT-RESTRICTED DIETS

Fat-restricted diets, also called *low-fat diets*, usually limit fats to less than 50 grams (g) daily. Fat-restricted diets may be used for obese patients or patients who have gallbladder and liver disease or atherosclerosis.

SODIUM-RESTRICTED DIETS

Sodium-restricted diets are also called *low-sodium* or *low-salt diets*. Low-sodium-diet lists provide the amount of sodium present in a specific food. Patients should avoid or limit adding salt to food and avoid smoked meats or fish, processed foods, pickles, olives, sauerkraut, and some processed cheeses. This diet reduces salt intake for patients who have cardiovascular diseases (such as hypertension or congestive heart failure), kidney disease, and edema (retention of fluids).

PROTEIN DIETS

Protein diets include both low-protein and high-protein diets. Protein-rich foods include meats, fish, milk, cheeses, and eggs. These foods are limited or decreased in low-protein diets and increased in high-protein diets. Low-protein diets are ordered for patients who have certain kidney or renal diseases and certain allergic conditions. High-protein diets may be ordered for children and adolescents with growth delay; for pregnant or lactating (milk-producing) women and for patients suffering from burns, fevers, or infections.

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BLAND DIET

A *bland diet* consists of easily digested foods that do not irritate the digestive tract. This diet is used for patients who have gastric (stomach) disorders, colitis, and other diseases of the digestive system.

FIBER DIETS

Fiber diets are usually classified as high fiber or low fiber. A high-fiber diet usually provides at least 30 grams (g) of fiber without seeds or nuts. It is used to stimulate activity in the digestive tract, such as for constipation. A *low-fiber or low-residue* diet containing less than 10–15 grams of fiber per day eliminates or limits foods that are high in bulk and fiber. It is used for patients who have digestive and rectal diseases, such as colitis or diarrhea.

checkpoint

What is the difference between a regular diet and a therapeutic diet?

Case Study Investigation Conclusion

Haya has several medical conditions that Noura will have to address when she makes her dietary recommendations. What other physical restrictions should she consider? Should Noura give Haya's food preferences any consideration? What other things do you think will impact Noura's menu plan?

Today's Research — Tomorrow's Health Care

A Daily Pill That Prevents Cardiovascular Disease and Alzheimer's Disease?

Cardiovascular (heart and blood vessels) disease is the main cause of death worldwide. Scientists at the University of Chester in the United Kingdom and at Kent State University in Ohio have developed two new vitamin compounds that could reduce the risk of these diseases. Working as an international team, they are evaluating the effectiveness of the vitamins in reducing elevated blood levels of an amino acid, homocysteine. Homocysteine is acquired mainly by eating meat. It increases the risk of cardiovascular disease and Alzheimer's disease because it produces large amounts of free radicals that interfere with the way body cells use oxygen. Even though vitamin B_{12} and folic acid are somewhat effective in breaking down the homocysteine in the body, researchers have found that the new compounds are four times more effective. Tests were carried out using human vascular cells in a model cell system. Results indicated that the compounds reduced the inflammation caused by the homocysteine in vascular cells. Clinical trials will have to be conducted to determine if there are any adverse effects from the compounds. If the trials are successful, the researchers estimate that in 5–6 years a new vitamin medication could be available.

In addition to cardiovascular disease and Alzheimer's disease, elevated blood levels of homocysteine may be associated with osteoporosis (bones become porous), pregnancy complications, and other inflammatory disorders. If a vitamin compound could reduce the risk of these conditions, thousands of lives could be saved each year.

CHAPTER 8 SUMMARY

- An understanding of basic nutrition is essential for health care providers.
- Good nutrition helps maintain wellness, a state of good health with optimal body function.
- There are six groups of essential nutrients: carbohydrates, fats, proteins, vitamins, minerals, and water.
- The simplest guide for planning healthy meals that provide the required essential nutrients is to eat a variety of foods from each of the major food groups.
- Weight management is used to achieve and maintain the desired body weight. Good weight management reduces the risks for many diseases and allows an individual to enjoy a longer and healthier life span.
- Therapeutic diets are modifications of the normal diet. They are used to improve specific health conditions.

REVIEW QUESTIONS

1. List the six (6) essential nutrients and the main function of each nutrient.

2. Differentiate between the processes of digestion, absorption, and metabolism.

3. Differentiate between overweight and obesity. List six (6) conditions that can develop as a result of obesity.

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4. Calculate the number of calories you require per day to maintain your present weight. How many calories should you ingest per day to **gain** 1 kilogram per week? How many calories should you ingest per day to **lose** 1 kilogram per week?

5. Identify the type of therapeutic diet that may be ordered for patients with the following conditions:

a. Gallbladder or liver disease
b. Diabetes mellitus
c. Hypertension or heart disease
d. Gastric disorders, colitis, or diseases of the digestive tract
e. Pregnant or lactating women
f. Severe nausea, vomiting, or diarrhea
g. Kidney disease
h. Poor dentation

CRITICAL THINKING

1. You are planning your family's meals. It is important that everyone eat a balanced diet and about 1,800 calories a day to maintain a healthy weight. Based on those criteria, create a sample menu for three (3) meals and two (2) snacks. Don't forget to include beverages.

2. You have an 88-year-old male patient who is from Abha in the hospital recovering from a left hip fracture. It is day 4; he has lost 3.6 kg and doesn't like the hospital food. As the hospital's dietician, what are three (3) questions you might ask this patient to provide balanced nutrition and the food he will eat?

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3. Using the data from **Table 8–1**, list what kind of nutrient group each patient needs to increase based on their medical condition:
   - **a.** A 16-year-old with anorexia
   - **b.** An 8-month-old with dysentery
   - **c.** An underweight 78-year-old with cancer
   - **d.** A 19-year-old burn victim
   - **e.** A 26-year-old with the flu that has been vomiting for 2 days who can't start an IV
   - **f.** A 6-year-old undergoing a fourth major surgery to correct congenital problems

ACTIVITIES

1. **a.** Define *BMI*. Using the BMI graph or calculator, determine your BMI. What does your number indicate?
   - **b.** List everything you ate yesterday. Determine how many servings of each nutrient you consumed. Calculate your calories.
   - **c.** Based upon your BMI, calorie intake, and the *Healthy Food Palm* food distribution, answer these questions:
     1. Do I need to change my total calorie intake? Raise, lower, or remain the same. If you need to adjust, by how much?
     2. Do I need to change the types of foods I eat? Do I eat fruit? Do I eat enough vegetables for a balance diet?

2. In a small group, create a patient education oral presentation that will include:
   - **a.** A poster, trifold, or commercial promoting healthy eating and nutrition
   - **b.** A brochure on a disease impacting poor eating habits. This brochure must include signs and symptoms of the disease, major associated physical concerns, preventive measures, treatment, and support systems. Include at least three (3) resources. Be ready to present your brochure to the class.

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CHAPTER

9

COMPUTERS AND TECHNOLOGY IN HEALTH CARE

Case Study Investigation

Mohammed is a team member of technology support at the University Hospital System. Nuha is a nurse in an intensive care unit (ICU). Nuha has a new patient that has come up from the emergency room (ER). She is having trouble pulling up the patient's ER intake report, radiology and lab results, and the medication and dietary orders. Nuha calls the help desk and Mohammed answers. After giving Nuha some instructions and running a preliminary diagnostic check, Mohammed determines that he will need to come to the ICU to teach Nuha how to access the patient information and to make sure there are no other problems. While he is there, Mohammed will also update the computer and install a shielding security screen. At the end of this chapter, you will be asked about troubleshooting and patient confidentiality as it relates to computer technology.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Describe the areas in health care where computer and technology applications are currently being used.
- Describe a situation showing how at least six different health care personnel in a health care facility use computers and technology as information systems.
- Identify at least four diagnostic tools that use computers and technology.
- Describe at least six treatments using computers and technology.
- Discuss how computers and technology are used for health science education and research.
- Illustrate how computers and technology have improved health care communication.

KEY TERMS

computer-assisted instruction
computed tomography (CT)
diagnosis
echocardiogram
electrocardiogram (ECG)
electronic health record (EHR)
exercise stress test
hearing assistive technology
image-guided surgery
lasers
magnetic resonance imaging (MRI)
radiation therapy
robotic surgery
ultrasound

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9:1 INTRODUCTION

Computers and technology are used in many different areas:

- **Information systems**: equipment inventories, electronic health records (EHRs), laboratory reports, operating room and personnel scheduling, and general records; two common systems in use are hospital information systems (HIS) and medical information systems (MIS).
- **Diagnostic testing**: performing medical laboratory analyses, scanning or viewing body parts by computed tomography (CT scan), magnetic resonance imaging (MRI), and ultrasound.
- **Treatment**: lasers, robotic surgery, image-guided surgery, cancer treatment, dispensing medications, and rehabilitation.
- **Patient monitoring**: monitors are used for cardiac, critical care, neurological, neonatal, and surgical patients.
- **Educational tools**: computer-assisted instruction (CAI) for health personnel, virtual learning, patient simulator manikins, and web conferences.
- **Research**: statistical analysis of data.
- **Communication**: use of intranet to communicate with other health care personnel in the same agency or other agencies, insurance companies, financial institutions, research networks, and patients using electronic mail, telemedicine, and telepharmacies.

A working knowledge of computers and an understanding of technology is sometimes called *computer literacy*. Computer literacy also means feeling comfortable using a computer for your job needs.

Different types of computers are used in health care, from a microcomputer, such as a handheld tablet, or smartphone, to a laptop in a compact case (**Figure 9–1**) to a personal computer, which can sit on a desktop, to a very large mainframe computer.

checkpoint

1. Name four (4) areas in health care where computers and technology applications are used.
2. Define *computer literacy*.



FIGURE 9–1 Microcomputers include handheld tablets.

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9:2 INFORMATION SYSTEMS

Today's health care providers use computers and technology to manage information in every health care facility. Computers are used for:

- **Word processing**: This includes writing letters, memos, reports, policies, and procedures, creating patient care plans, and documenting care on a patient's record.
- **Compiling databases**: This includes creating information records for patients and employees. The database may contain contact information such as name, address, telephone, e-mail address, and medical history. A database allows a user to locate records quickly, compile statistics and reports, enter additional information and changes readily, and store information more efficiently than paper files. Most databases that contain patient records are access limited or password protected to maintain patient confidentiality.
- **Creating and transferring electronic health records**: An **electronic health record (EHR)** is a computerized version of a patient's medical information that may include statistical data, diagnoses, medical history, treatments, medications taken, tests performed, and any other information that could be included in a patient's paper record.



FIGURE 9–2 A pharmacist can scan a bar code on a medication to maintain an inventory, place an order, or bill a patient account.

- **Scheduling**: Recording appointments for patients and creating work schedules for employees.
- **Maintaining financial records**: This includes processing charges, billing patients, recording payments, completing insurance forms, maintaining accounts, and calculating payrolls for employees.
- **Maintaining inventories and ordering supplies**: Inventory maintenance includes ordering and tracking supplies and equipment, as well as coding supplies with bar codes for billing purposes (**Figure 9–2**).
- **Developing spreadsheets**: A spreadsheet allows the user to create budgets, develop statistical reports, analyze finances, and project future needs.

Some of the different health care providers who use computers and technology to record the patient's information include:

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- **Health information technician (admitting officer or clerk)**: obtains the patient's name, age, and all other vital information to enter, process, and store in the computer's memory; establishes an electronic database so that the information about the patient can be retrieved whenever it is needed; creates an electronic health record (EHR) for the patient or retrieves the patient's EHR from a health information exchange.
- **Physician**: enters the findings of the initial admitting physical examination; orders the patient's medications from the pharmacy; orders laboratory tests, orders an electrocardiogram or radiographs; and specifies dietary restrictions.
- **Pharmacist**: checks the database regularly for new orders, supplies the nursing departments with ordered medications, warns about drug interactions, and monitors pharmacy inventory.
- **Dietitian**: checks dietary restrictions and creates a spreadsheet to show a nutritional analysis of prescribed diets.
- **Laboratory technician**: checks the database for new or revised orders; records the results of tests and procedures in the patient's EHR.
- **Environmental service worker (central/sterile supply/service technician)**: maintains an inventory of all supplies in the facility, orders supplies, and provides information for billing supplies.

After each health care provider inputs information into the patient's record, the information is then immediately accessible to medical, nursing, and allied health teams. Because patient care plans are electronic records, they can be easily updated. This decreases the time health care providers spend on paperwork and away from patient care. Eventually, this will lead to a "paperless" patient record, and only an electronic health record (EHR) will be used. All information will be stored in a computer database and sent electronically to insurance companies, pharmacies, and other health care facilities that require the information. Massive filing systems with tons of paper charts will no longer be necessary. Safeguards have to be installed in the computers and networks, and to protect the privacy of patient information.

Legal

Confidentiality of patient information must be strictly enforced by means of access codes, special passwords, or fingerprints (**Figure 9–3**). Computer users use the required access code to enter or retrieve information. Only authorized users are given access to the system. Health care providers must keep their required access code confidential to protect themselves and the patient.

A contingency backup plan is always essential when computers are used. At times, a computer must be shut down for reprogramming or adding



FIGURE 9–3 Fingerprints are often used as an identifying factor for computer access. ©iStock.com/Mike Liu

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additional or new software. At other times, power or computer failure will shut down the computer system. When the computer is not functioning, manual recording of all information is required and an alternative plan must be used to avoid losing essential information. Most facilities make frequent or continuous backups of the data onto external hard drives, disks, flash drives, secure clouds, or off-site servers to prevent a loss of information when computer failure occurs.

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What is an EHR?

9:3 DIAGNOSTICS

A major goal of health care and medicine is determining exactly what is wrong with the patient, or making a **diagnosis**. The first step in the process is taking a medical history and doing a physical examination. Based on these findings, several tests may be ordered to diagnose or rule out disease.

Several computer-related technological diagnostic tests have had a real impact on patient care. These diagnostic aids or specialized technological tools are quite varied. They may be *invasive*, such as a blood test where a syringe is inserted into a vein and blood is removed, or *noninvasive*, such as an imaging procedure where no opening into the body is required.

MEDICAL LABORATORY TESTS

Most laboratories rely heavily on computerized analyzers for both blood and urine analysis. These instruments can analyze a drop of serum, blood, urine, or body fluid placed on a slide or in special tubes at rates of 50 to more than 2,000 specimens per hour. Such systems are also reliable for clinical chemistry evaluations, and many analyzers can perform hundreds of different tests.

CARDIAC TESTS

Computers and technology have also revolutionized cardiac care. Examples include:

- **Electrocardiogram (ECG)**: a computerized interpretation system of the electrical activity of a patient's heart; assists in diagnosing heart disease.
- **Exercise stress test**: an ECG runs while the patient is exercising (**Figure 9–4**); usually involves walking a treadmill or riding an exercise bike until a target heart rate is reached; the function of the patient's heart during activity.
- **Echocardiogram**: uses technology to direct ultrahigh-frequency sound waves through the chest wall and into the heart; a computer then converts the reflection of the waves into an image of the heart.

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IMAGING TECHNOLOGY

Medical imaging using technology and computers has allowed for better diagnosis and treatment. Examples of imaging devices include:

- **Computed tomography (CT)**: Introduced in 1972, this noninvasive, computer-assisted x-ray **(Figure 9–5A)** permits physicians to see clear, cross-sectional views of both bone and body tissues and to find abnormalities such as tumors or bleeding (**Figure 9–5B**). These days, newer, low-dose CT scans are in use.
- **Magnetic resonance imaging (MRI)**: This computerized, body-scanning method uses nuclear magnetic resonance instead of x-ray radiation. The patient is placed in a large circular magnet, which measures the activity of hydrogen atoms within the body (**Figure 9–6A**). A computer translates that activity into cross-sectional images of the body (**Figure 9–6B**). For example, MRI allows physicians to see blood moving through veins and arteries, and to see an inflamed joint shrink in response to medication. Because of the strong magnetic field in the MRI scanner, patients with pacemakers or metal implants usually cannot have an MRI scan.
- **Ultrasound**: This is a noninvasive scanning method that uses high-frequency sound waves that bounce back as an echo when they hit different tissues and organs inside the body. A computer then uses the sound wave signals to create a picture of the body part. Ultrasound can be used to detect tumors, locate aneurysms and blood vessel abnormalities, and examine the shape and size of internal organs.

During pregnancy, when radiation can harm the fetus, ultrasound is used to detect multiple pregnancies and to determine the size, position, sex, and even abnormalities of the fetus (**Figure 9–7A**). A more recent development is three-dimensional (3-D) ultrasound



FIGURE 9–4 Computers are used to perform stress tests to evaluate the function of a patient's heart during exercise.



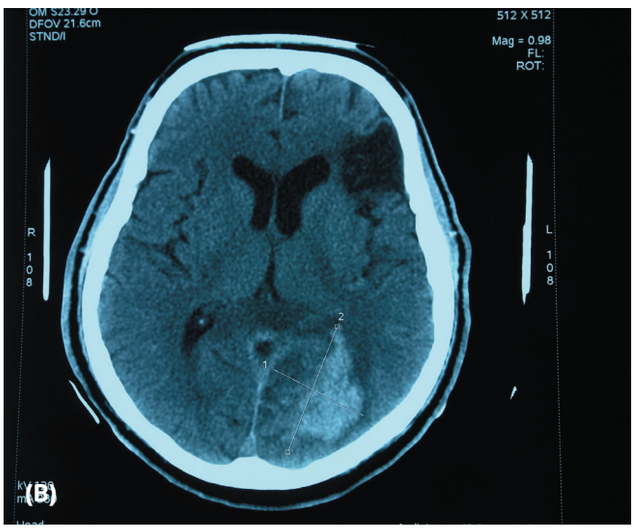


FIGURE 9–5 (A) A computed tomography (CT) scanner uses a pencil-thin beam of radiation to create clear, cross-sectional views of both bone and body tissues. (B) This CT scan shows bleeding in the right hemisphere of the brain.

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FIGURE 9–6 (A) For magnetic resonance imaging (MRI), the patient is placed in the center of a large magnet that measures the activity of hydrogen ions inside the body and creates an image of the body. (B) This MRI scan shows a herniated (slipped) disc between the fifth lumbar and first sacral (L5/S1) vertebrae in the spine.

(**Figure 9–7B**) which creates a 3-D colored picture of the infant in the uterus. Physicians use the 3-D ultrasound to detect birth defects that are not always visible on a standard sonogram and to determine the severity of a birth defect. The newest ultrasound is a 4-D ultrasound that actually creates a live video similar to a movie. It allows physicians to study the motion of various moving organs in the body.

- **Dental digital radiography**: A small electronic sensor is placed in the patient's mouth. The sensor uses imaging techniques to transfer the image to a computer monitor where it can be seen immediately. Because the patient is exposed to less radiation than a conventional radiograph, it is safer for the patient.

SUMMARY

Computers and technology have made diagnosing diseases easier and more precise. Manual laboratory tests and simple radiographs have been replaced by more exacting tests or imaging techniques. As technology improves, new techniques and diagnostic tests will be developed.

checkpoint

List five (5) diagnostic tools that use computers and technology.

9:4 TREATMENT

Advances in technology and computers have enhanced the treatment for many diseases and conditions.

Lasers are light beams that can be focused precisely. Laser scalpels used in surgery focus light beam and make an incision at a constant depth because the light beam gives off the same amount of energy every second. The laser light beam heats the targeted cells until they burst open. At the same time, the heat in the beam cauterizes, or seals off, smaller blood vessels such as those in the skin. This results in less bleeding at the surgical site. One of the most

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common uses for lasers is reshaping the cornea of the eye to correct vision defects (**Figure 9–8**). Lasers are also used to remove warts, moles, birthmarks, scars, and even tattoos. They can be used by cosmetic surgeons to remove skin wrinkles, hair, dilated blood vessels, and other blemishes.

Robotic surgery uses a computer-controlled device with mechanical arms that attach to surgical instruments. The surgeon operates a telemanipulator, a device similar to a joystick, to perform the movements that the robot carries out. Robotic surgery is more precise, tissues and organs experience less trauma, and recovery is faster.

In **image-guided surgery** the surgeon uses images to guide or direct the surgery (**Figure 9–9**). Before the surgery, CT or MRI images are taken of the surgical area. and converted into three-dimensional (3-D) images that show precise details of the organs and tissues. The images allow the surgeon to create a precise plan for the surgery: where to make the incision, how deep the incision should be, critical areas to be avoided, instruments needed, and, in some cases, determine whether or not the surgery will be beneficial. During the surgery, the 3-D images are projected on the screen so that the surgeon can see the path of the instruments, identify the surgical area, avoid critical areas, make minute adjustments to achieve the best results, and prevent damage to healthy tissues and organs.

Radiation therapy uses high-energy particles to decrease the size of tumors and treat cancer by destroying most of the cancer cells to improve the quality of a person's life.

Ultrasound is used by physical therapists and chiropractors as a form of deep heat therapy. When applied to soft tissues and joints, the sound waves use heat and gentle massage to reduce swelling, increase blood flow, and decrease pain, stiffness, and muscle spasms. Ultrasound is also used to enhance the absorption of drugs through the skin, promote gene therapy to tissues, and direct chemotherapy to tumors.

Hearing assistive technology has provided many enhancements for people with hearing impairments. For example, cochlear implants and hearing aids that are more effective have been developed using computers and technology.

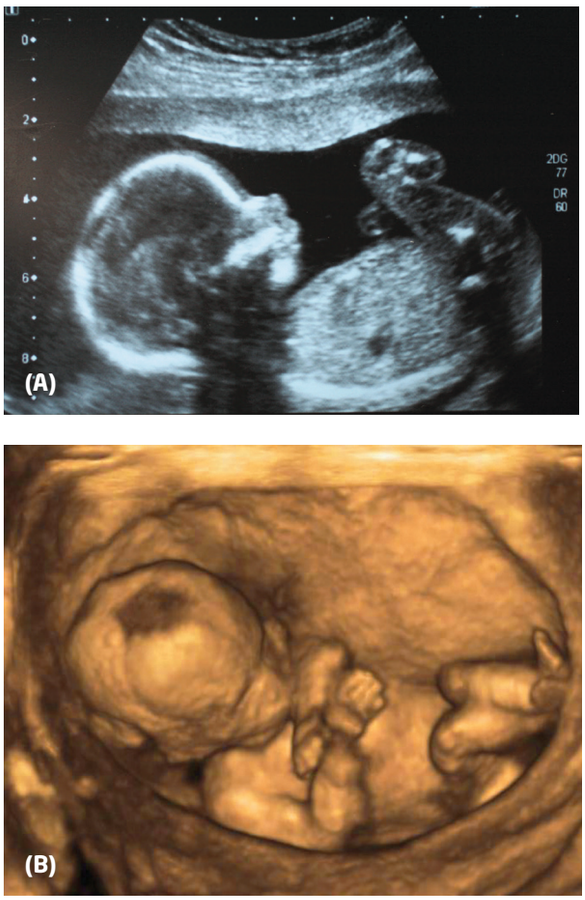


FIGURE 9–7 (A) Ultrasound is used during pregnancy to determine the size, position, sex, and even abnormalities of the fetus. (B) This ultrasound scan shows a fetus at 22 weeks.



FIGURE 9–8 Lasers are used to reshape the cornea of the eye to correct vision defects.

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FIGURE 9–9 Image-guided surgery allows the surgeon to see a three-dimensional image of the operative site during the procedure.

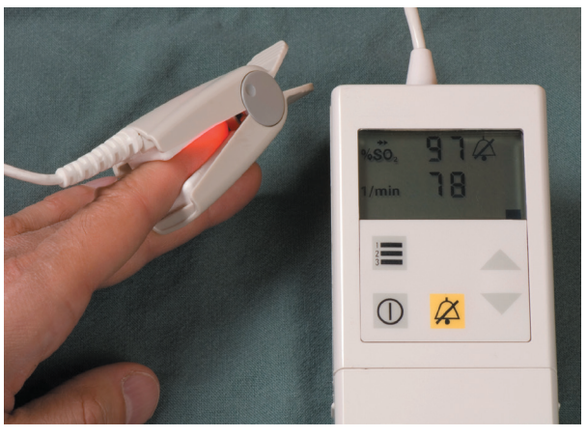


FIGURE 9–10 Pulse oximeters measure the oxygen level in the blood. ©iStock.com/Photomick

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1. List two (2) ways lasers are used in the medical field.
2. How are robots used in treatment?

9:5 PATIENT MONITORING

Patient monitors measure and display vital signs such as pulse (**Figure 9–10**), blood pressure, respiratory rate, and heart rhythms. They are used in critical care units, cardiac care, emergency care, surgery, and many other areas (**Figure 9–11**). The monitors record information from sensors placed on or in the patient's body. Specific information, such as an abnormal heart rhythm, can also be printed for a hard-copy record or transferred to a patient's electronic record. Some monitors also measure pulmonary blood pressure or intracranial pressure (pressure inside the skull against the brain).

Obstetrical departments use fetal heart monitors to check the heart rate of the infant any time during the pregnancy. Infants born prematurely are placed in incubators that constantly monitor temperature, humidity, oxygen levels, and many other factors to provide the infant with optimal conditions for survival. Some incubators even have computer-controlled photo (light) therapy for infants with jaundice, a yellow discoloration of the skin and eyes (**Figure 9–12**).

Wearable monitors or sensors consist of a device that can be worn on the body, such as a wrist band or strip that adheres to a body part. These sensors can be used to monitor fitness, blood pressure, heart rhythms, body temperature, blood oxygen saturation, gait and posture, chemical balance, and stress. Some monitors alert the wearer to the body's response to exercise, the amount of exercise obtained, or even an abnormal reading such as a high blood pressure or blood sugar level. Others are used to transmit information obtained to health care providers for interpretation.

GPS (global positioning satellites) technology is being used to monitor patients who have dementia and Alzheimer's disease. A wrist or ankle bracelet is used to track and find these individuals if they wander away.

checkpoint

List three (3) ways technology assists medical providers in monitoring patients.

9:6 EDUCATION

Research has shown that computer-based learning decreases time on the task and increases achievement and retention of knowledge.

Computer-assisted instruction is educational computer programming designed for individualized use. It is user paced, user friendly, and proceeds in an orderly, organized fashion from topic to topic. It may use video, animated graphics, color, and sound. It may be a drill-and-practice program for learning to calculate medication doses, or it may take the form of a tutorial for learning concepts about the heart. In addition, it can be a simulation that allows the learner to do a clinical procedure, such as taking a patient's blood pressure or drawing blood from a vein (venipuncture), while sitting in front of the computer. Computer programs have even been developed to allow a user to perform a simulated physical examination or operation on a patient.

New technology has produced patient simulator manikins that provide lifelike learning experiences for health care providers. Actual emergency situations are created to allow health care providers to learn how to "treat" the patient. Depending on the treatment provided, the manikin is programmed to react in a positive or negative manner **(Figure 9–13)**. The simulation programs and manikins have become more specific as technology has improved. We now have infant simulators, pregnant manikins that deliver a baby, surgical manikins that can have surgery and even "die" if the anesthesia is incorrect, and manikins that can be monitored, intubated, and receive CPR. Instructors can change the manikin response based on the actions of the student to provide an even more individualized experience. This provides instant feedback to the learner and prepares the learner to treat patients more effectively. Research has shown that this technology greatly enhances learning and retention.

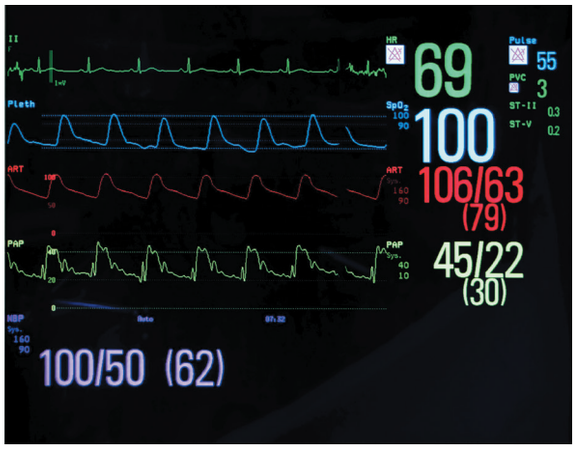


FIGURE 9–11 Monitors are used to measure and display vital signs such as pulse, blood pressure, and heart rhythms. ©iStock.com/aaM Photography, Ltd



FIGURE 9–12 Some infant incubators use computer technology to provide photo (light) therapy for infants with jaundice.



FIGURE 9–13 A simulator manikin can be monitored and programmed to react in a positive or negative manner when treated.

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Patient-education software is available for the patient who has osteoarthritis (inflammation of the joints), obesity (overweight), and many other diseases. Software is even available to teach people how to manage stress.

Technology has even improved the availability and storage of knowledge. Books and entire reference libraries can be downloaded onto wireless devices, decreasing the need for massive libraries holding volumes of books. Internet search engines can identify vast amounts of information about any given topic.

Many health care providers use the Internet to obtain continuing education units (CEUs) or to complete college courses to advance in their professions. Refresher courses to prepare for licensure are also available for many health care careers. In addition, many tests for licensure are now taken on computers. This allows for immediate grading of the licensure examination. Examples include the licensure tests for registered nurses and physicians.

checkpoint

List two (2) ways education can be improved because of better technology.

9:7 RESEARCH

Today, health care research without the use of computers is almost nonexistent. The Internet is used by almost every health care team member. It is important to ensure that any information obtained is from reliable sources. A major source used to help health care providers analyze statistics and obtain information is the National Library of Medicine (NLM) database, MEDLINE.

The main topics covered by MEDLINE are bio-medicine and health, including all areas of life sciences, behavioral sciences, chemical sciences, biophysics, and bioengineering. Free access to the MEDLINE database is available at PubMed (*www.pubmed.gov*). At this site, there are over 30 million citations for biomedical literature with more added on a daily basis. PubMed has easy-to-follow directions to search for topics by subject, author names, title words or phrases, or journal names.

MedlinePlus (*www.medlineplus.gov.*) is another service offered by the NLM. It provides consumer-oriented health information. It combines information from the NLM, the National Institutes of Health (NIH), other government agencies, and health-related organizations. MedlinePlus contains health topics, a medical encyclopedia containing information about diseases and wellness issues, a medical dictionary, drug information, herbal and dietary supplement information, health news and press releases, directories of health care providers, videos of surgeries and medical procedures, tutorials that use animation and sound to explain medical conditions and procedures, a service that links patients or providers in electronic health record (EHR) systems to related information in MedlinePlus, and even a mobile site to provide information



FIGURE 9–14 Robots can be used in research to fill pipettes with the correct amount of solution. ©iStock.com/David Gray

to mobile Internet users. It is an excellent source of information for research. Another useful resource is the Saudi Digital Library (SDL) (*https://sdl.edu.sa*). The aims of the library are to make available local and international digital information sources, including books, journals, theses and other publications, to serve the scientific and academic communities.

Research using computer technology is being conducted for almost every disease, infection, or abnormal health condition that exists. Examples include genetic diseases, heart conditions, diabetes, arthritis, patient management systems, and speech recognition patterns. Information acquired during research is frequently organized into large databases and shared with other researchers throughout the world. This process, known as *bioinformatics*, allows for rapid scientific progress through the sharing of information. In addition, the high speeds and increased capabilities of computers allow scientific researchers to analyze huge amounts of data and run statistical analyses quickly and accurately. They are also able to run simulations and build electronic models to facilitate research.

Technologies such as imaging devices, lasers, and robotics have also enhanced research, especially in bio-technology. For example, robots can be used in laboratory experiments to decrease the need for manual labor (**Figure 9–14**).

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List two (2) ways research is facilitated because of advances in technology and computer use.

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9:8 COMMUNICATION

Computers have enhanced communication for health care providers in multiple ways. Examples include electronic mail, telemedicine, telepharmacies, and virtual communities.

Electronic mail, or e-mail, allows health care providers to quickly send messages, memos, announcements, reports, and other data to one or more persons.

Telemedicine involves the use of video, audio, and computer systems to provide medical or health care services. For example, radiographs or electrocardiograms can be transmitted electronically from one physician to another for consultation. Telemedicine also allows patients to communicate with physicians or health care specialists at a distance, transmit medical information to a physician, or be monitored by health care professionals.


EHR

Electronic health records (EHRs) have also simplified communication between different health care providers. Previously if medical records had to be transferred between physicians or health care agencies, they were faxed, mailed, or manually carried by the patient. Now EHRs containing all of a patient's medical information can be electronically transferred to any other health care facility or provider.

Even though technology and computers have enhanced the communication options for health care personnel and facilities, it is essential to remember that professional standards must be observed at all times while using these technologies. Safeguards must be used to ensure the privacy of patient information.

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What is telemedicine?

Case Study Investigation Conclusion

What might Mohammed advise Nuha to do before he sends a staff member to her floor? What confidentiality concerns must they be aware of before they access this patient files?

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Issues in Health Care

Telemedicine

The World Health Organization (WHO) defines telemedicine as "healing from a distance." Tele-medicine gives people the opportunity to get expert medical treatment without going to a clinic (**Figure 9–15**). Using telemedicine, people can receive a diagnosis, learn their treatment options, and get a prescription. Health care providers can even monitor readings from medical devices remotely to monitor patients' conditions. There are three common types of telemedicine:

- Interactive medicine: physicians and patients communicate in real-time
- Remote patient monitoring: allows caregivers to monitor patients who use mobile medical equipment to collect data on things like blood pressure, blood sugar levels, and so on
- Store and forward: providers can share a patient's health information with other health care professionals or specialists

Telemedicine isn't appropriate for emergency situations like a heart attack or broken bones that require x-rays and casts. Anything that requires immediate, hands-on care should be handled in person. However, telemedicine is very useful for simple issues. For instance, if a patient suspects that a cut may be infected, they can schedule a virtual consultation with a health care provider to discuss their symptoms. If a patient is on vacation and thinks that they are coming down with strep throat, they can communicate with a physician. It is helpful for a variety of other health issues including psychotherapy and dermatology, which offers consultations of moles, rashes, and so on.

In 2020, as the COVID-19 virus started wreaking havoc with the health care system, telemedicine was used to help caregivers respond to the needs of people who had contracted the virus as well as people who needed to touch base with their providers for other health issues. Telemedicine made a very positive contribution to health care during the pandemic and was used in a variety of ways.



FIGURE 9–15 Doctors can now use smartphones, laptops and tablets to communicate with patients.

There were three main roles for telehealth technologies during the COVID-19 crisis:

- To screen patients remotely rather than having them visit the practice or hospital. Keeping infected individuals out of hospitals and doctors' offices, the health care system could lower the risk of transmission to other patients and health care staff.
- To help provide routine care for patients with chronic diseases who are at high risk if exposed to the virus.
- Providers and their staff were at increased risk for contracting COVID-19 due to their continuous exposure to infected patients. Once tested and confirmed, these providers were quarantined and technologies in place, quarantined providers had the option to continue to see patients.

Telemedicine also can reduce health care costs. It can increase efficiency of care delivery, cut the cost of transporting patients, and can keep patients out of the hospital. In fact, one study showed that telemedicine care had 19 percent savings over inpatient care. It seems that telemedicine is here to stay and grow as a useful health care tool.

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CHAPTER 9 SUMMARY

- The use of computers and technology in health care has become a necessity. All health care providers should have basic computer literacy.
- Computers are used to provide patient information, schedule personnel, manage financial records, and maintain records and inventory.
- Computers are used as diagnostic tools to perform blood tests or view body parts. Technology, such as lasers, robotics, image-guided surgery, radiation therapy, ultrasound, hearing-assistive devices, and medication-dispensing systems, have provided efficient methods of treatment.
- Patients can be monitored using computerized technology to check heart rate, pulse and many other body systems.
- Computers and technology can be used as major educational tools.
- Computers are critical components in health care research.

REVIEW QUESTIONS

1. List six (6) different health care personnel that use computer technology as information systems.

2. Briefly describe the main uses of the following imaging techniques:

a. computed tomography (CT)

b. magnetic resonance imaging (MRI)

c. ultrasound

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3. As part of a research project, you are conducting an Internet search for information about the following research question: "Does hypertension affect some cultures or age groups more readily than others?"

a. Identify the key words in the question.

b. List at least two (2) possible search phrases.

c. Which search engine will you use? Why?

d. Using correct formatting, create a paragraph based on the results of your research.

4. How can a health care provider maintain the confidentiality of patient information while using computer technology?

5. Why is a contingency backup plan essential when computers are used to record information?

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CRITICAL THINKING

1. Why are lasers, robotic surgery, and image-guided surgery more efficient than standard types of surgery?

2. How do health standards impact computer use?

ACTIVITIES

Using the following scenarios, create a flow chart illustrating how computer technologies have improved communication and therefore improved patient care.

a. Mona is expecting her first child and has developed high blood pressure. Her doctor has ordered complete bedrest and blood pressure medication, but Mona needs to be monitored for spikes in blood pressure, premature contractions, and personal stress levels.

b. Younis is a 58-year-old man suffering from kidney failure. He is currently on dialysis while awaiting a kidney transplant. He has developed type 2 diabetes mellitus and is having difficulty stabilizing his condition.

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Part 2

Chapter 10 PROMOTION OF SAFETY

Chapter 11 INFECTION CONTROL

Chapter 12 VITAL SIGNS

Chapter 13 FIRST AID

Chapter 14 PREPARING FOR THE WORLD OF WORK

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CHAPTER

10 PROMOTION OF SAFETY

Case Study Investigation

Noura is a nurse at her local hospital. She is giving an insulin injection to her patient, Maryam, who has diabetes mellitus. She carefully draws up the correct dose and has it cross-checked by another nurse. When she walks into the room, Maryam asks Noura to help her to the bathroom before she gives her the insulin because she cannot maneuver around the power cord for the bed. After Noura assists Maryam to the bathroom, she removes her gloves and washes her hands before administering Maryam's medication. She makes sure that she disposes of the needle in the sharps container, the power cord is tucked safely under the bed, and the call light is clipped to the bed's siderail before she leaves the room. What does Noura do that addresses patient safety? How does she make sure that Maryam's environment is safe, and equipment is correctly maintained? At the end of this chapter, you will be asked about the basic safety techniques Noura needs to be aware of to keep both herself and her patient safe.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Define body mechanics.
- Use correct body mechanics while carrying objects.
- Identify the general principles for preventing accidents and injuries.
- Follow safety regulations around hazardous chemicals, pathogens, equipment, and solutions.
- Identify the causes of fires, and follow safety regulations around fires, including a fire emergency plan, and the use of fire extinguishers.
- Simulate the operation of a fire extinguisher by following the directions on the extinguisher and specific measures for observing fire safety.

KEY TERMS

base of support
body mechanics
ergonomics
fire extinguishers
good posture
radiation exposure

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10:1 USING BODY MECHANICS

To prevent injury to yourself and others, it is important that you observe good **body mechanics** and maintain correct posture. Body mechanics refers to the way in which the body moves and maintains balance while preventing strain and helping to maintain muscle strength.

There are four main reasons for using good body mechanics:

- Muscles work best when used correctly.
- The correct use of muscles makes lifting, pulling, and pushing easier.
- Correct body mechanics prevent unnecessary fatigue and strain, and save energy.
- Correct body mechanics prevent injury to self and others.

Eight basic rules of good body mechanics include:

- Maintain a broad **base of support** by keeping the feet 20–25 cm apart, placing one foot slightly forward, balancing weight on both feet, and pointing the toes in the direction of movement.
- Bend from the hips and knees to get close to an object, and keep your back straight (**Figure 10–1A**). Do not bend at the waist.
- Use the strongest muscles to do the job. The larger and stronger muscles are located in the shoulders, upper arms, hips, and thighs. Back muscles are weak.
- Use the weight of your body to help push, pull, or slide an object rather than lifting it.
- Carry heavy objects close to the body (**Figure 10–1B**). Stand close to any object or person being moved.
- Avoid twisting your body as you work. Turn with your feet and entire body when you change the direction of movement.
- Avoid bending for long periods.
- If something is too heavy for you to lift alone, always get help.

Good posture is also an essential part of correct body mechanics. Aligning the body correctly puts less stress on muscles and prevents fatigue (**Figure 10–2**):

- Stand straight with your feet aligned with your shoulders, and your weight supported equally on each foot.
- Pull in your stomach muscles.
- Relax your shoulders, and pull them back.
- Hold your chin and chest up.

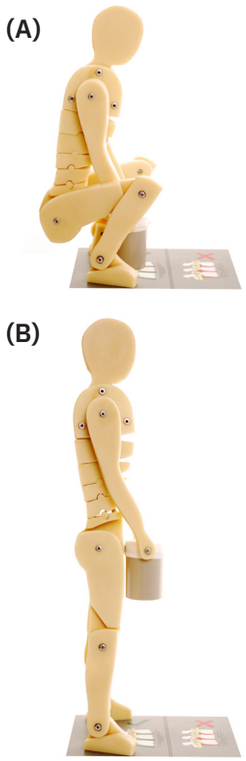


FIGURE 10–1 (**A**) Bend from the hips and knees to get close to an object. (**B**) Carry heavy objects close to the body.



FIGURE 10–2 Good posture puts less stress on muscles and prevents fatigue.

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checkpoint

1. Define body mechanics.
2. Why is good posture important?

10:2 PREVENTING ACCIDENTS AND INJURIES

Safety is the responsibility of every health care provider. It is essential that established safety standards be observed by everyone. This protects the provider, the employer, and the patient.

The Ministry of Human Resources and Social Development is responsible for occupational safety and health matters in the Kingdom of Saudi Arabia. The Saudi Standards, Metrology, and Quality Organization is responsible for setting standards in the Kingdom. SASO provides environmental and health protection, and general safety by ensuring that products comply with the standards approved by SASO. The Saudi Food and Drug Authority (SFDA) ensures the safety of food, drugs, biological, and chemical substances as well as medical devices that are related to human health. The Saudi Arabia Public Health Authority aims to protect and promote public health, prevent disease, and raise awareness of public health emergencies. It works to monitor, measure, evaluate, control, and prevent any risk factors related to public health in the Kingdom of Saudi Arabia, including communicable and noncommunicable diseases, injuries, and other health challenges.

The following sections show how to prevent accidents and injuries with regard to chemical hazards, environmental safety, patient/resident safety, and personal safety.

CHEMICAL HAZARDS

All employers should inform employees of all chemicals and hazards in the workplace. They should also train their employees to follow the proper procedures or policies for:

- Identifying the types and locations of all chemicals or hazards.
- Locating and using safety manuals.
- Reading and interpreting chemical labels and hazard signs.
- Using personal protective equipment such as masks, gowns, goggles, and gloves.
- Locating cleaning equipment and following the correct methods for managing spills and disposal of chemicals.
- Reporting accidents or exposures and documenting any incidents.

OCCUPATIONAL EXPOSURE TO BLOOD AND BODY FLUIDS

Health care providers should follow standard precautions to protect themselves and their patients from diseases caused by exposure to body fluids. Examples of body fluids include blood and blood components, urine, feces, cerebrospinal fluid, saliva, mucus, and other similar fluids. Three diseases that can be contracted by exposure to body fluids include hepatitis B, caused by the hepatitis B virus; hepatitis C, caused by the hepatitis C virus; and acquired immune deficiency syndrome (AIDS), caused by the human immunodeficiency virus (HIV). Further discussion of standard precautions is presented in detail in Chapter 11, Section 11:3.

ENVIRONMENTAL SAFETY

Ergonomics is an applied science used to promote the safety and well-being of a person by adapting to the environment and using techniques to prevent injuries. The health care provider must be conscious of personal and patient/resident safety at all times. In addition, every health care provider must be alert to unsafe situations and report them immediately. Examples include burned-out lightbulbs, frayed electrical cords, scalding water in a sink or bath area, missing floor tiles or torn carpet, and other similar hazards.

Environmental hazards in health care facilities can also endanger patients, health care personnel, other individuals, and the environment.

Radiation exposure is a major concern in radiology departments and dental offices.

- In dental offices, the person taking x-rays usually stands outside the room to avoid exposure to the rays.
- In radiology departments, machines that emit radiation waves must be checked frequently to make sure they are operating correctly and not leaking radiation. Radiographers should stand behind a protective shield when activating the machines and wear dosimeter badges that measure exposure to radiation.
- Radioactive iodine is used to treat thyroid diseases. After it has been given to a patient, small amounts of radiation are present in the neck area for several days. This is a beneficial treatment for the patient, but precautions must be taken to protect the patient's family and friends.
- Drugs used to treat different cancers can be hazardous to health care personnel and pregnant individuals, and must be handled with care.
- Contaminated waste containing body fluids such as blood or tissues can spread disease if it is not destroyed properly.

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- Mercury is used in dental offices, older sphygmomanometers (an instrument for measuring blood pressure), and glass thermometers, and can present a danger to people and the environment if it is not disposed of correctly.

All health care providers are responsible for identifying hazards and for following the approved method of disposal. Health care providers must always follow approved policies and procedures to create a safe environment.

EQUIPMENT AND SOLUTIONS SAFETY

Basic rules when working with equipment and solutions include:

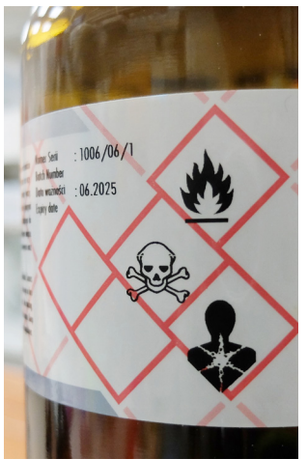


FIGURE 10–3 Read the relevant standards before using hazardous chemical solutions.

- Do not operate or use any equipment until you have been instructed on how to use it.
- Read and follow equipment operating instructions. If you do not understand the instructions, ask for assistance.
- Report damaged or malfunctioning equipment immediately, and do not use it.
- Do not use frayed or damaged electrical cords.
- Never handle electrical equipment with wet hands or around water.
- Store all equipment in its proper place.
- Observe all safety precautions when handling equipment.
- Read the relevant standards before using hazardous chemical solutions.
- Never use solutions from bottles that are not labeled.
- Read the labels of solution bottles at least three times during use to be sure you have the correct solution (**Figure 10–3**): before taking the bottle off the shelf, before pouring from the bottle, and after you have poured from the bottle.
- Do not mix any solutions together unless instructed to do so, or you can verify that they are compatible.
- Some solutions can be harmful or poisonous. Avoid contact with your eyes and skin. Avoid inhaling any fumes emitted by a solution.
- Store chemical solutions in a locked cabinet or closet following the manufacturer's recommendations. For example, some solutions must be kept at room temperature, while others must be stored in a cool area.
- Dispose of chemical solutions according to the instructions provided for the solution.

- If any equipment is broken or any solutions spilled, immediately report the incident to an instructor/immediate supervisor. They will advise on how to dispose of the equipment or how to remove the spilled solution (**Figure 10–4**).

PATIENT/RESIDENT SAFETY

Basic rules that must be followed to protect a patient or resident include:

- Do not perform any procedure on patients unless you have the proper authorization, and follow instructions carefully. Ask questions if you do not understand.
- Use correct and approved methods while performing any procedure.
- Provide privacy for all patients. Knock on the door before entering a room. Speak to the patient and identify yourself (**Figure 10–5A**). Ask for permission to enter before going behind closed privacy curtains. Close the door or draw the curtains for privacy before beginning a procedure on a patient (**Figure 10–5B**).
- Always identify patients correctly by checking the identification wristband and asking the patient to state their name. Check the name on the patient's bed and record.
- Always explain the procedure so the patient knows what you are going to do. Make sure you have the patient's consent before performing any procedure (**Figure 10–5C**). Never perform a procedure if a patient refuses to allow you to do so.
- Observe the patient closely during any procedure and report any changes in the patient's condition immediately.
- Frequently check the patient area and waiting room for safety hazards. Report all unsafe situations immediately.

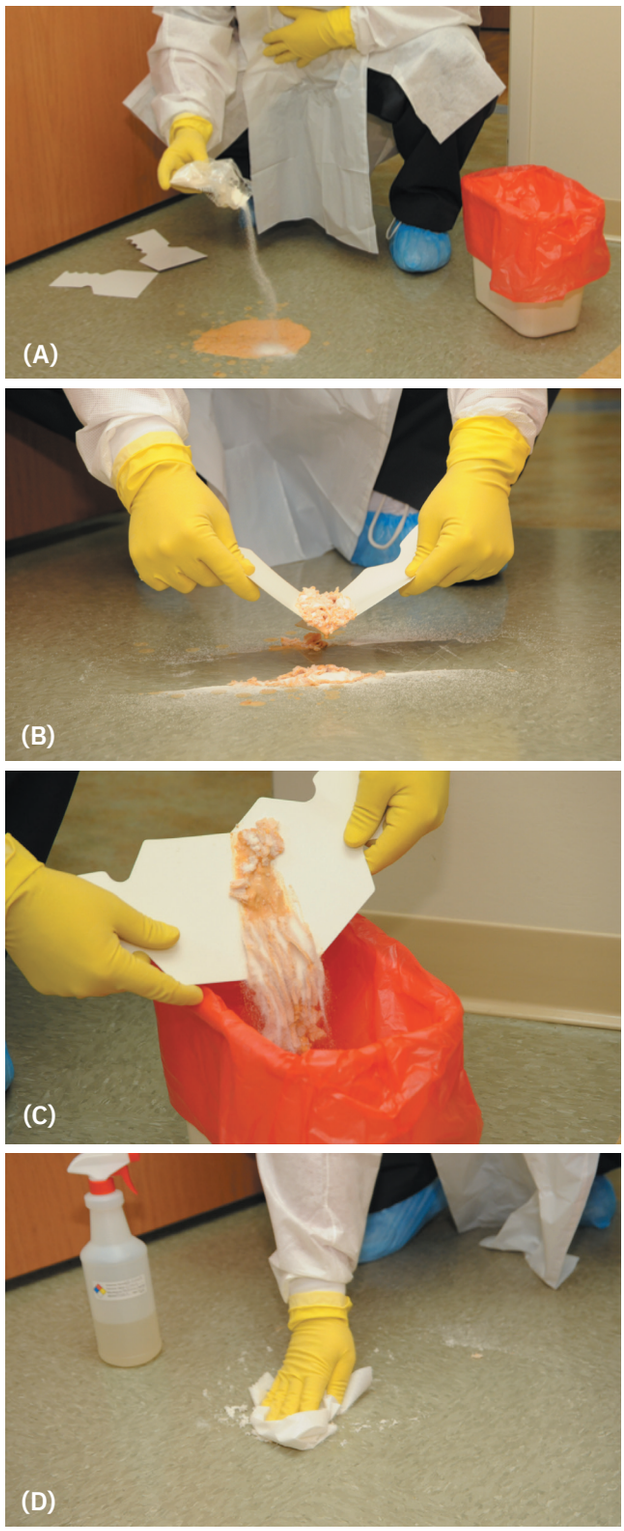


FIGURE 10–4 To clean a spill: (**A**) Pour coagulating powder on the spill. (**B**) When the material has been absorbed, pick up the residue and (**C**) place it in a biohazard container. (**D**) Clean the area thoroughly with a disinfecting solution.

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FIGURE 10–5 (**A**) Always knock on the door or speak before entering a patient's room. (**B**) Close the door or draw the curtains for privacy before beginning a procedure. (**C**) Explain the procedure and make sure you have the patient's consent.

- Before leaving a patient in a bed, observe all safety checkpoints and make sure the patient is comfortable (**Figure 10–6A**).
- Wash your hands thoroughly with soap and water (**Figure 10–6B**). If your hands are not visibly dirty or contaminated with blood or body fluids, they can be cleaned with a hand gel (**Figure 10–6C**).

PERSONAL SAFETY

Basic rules that must be followed to protect yourself and others include the following:

- It is your responsibility to protect yourself and others from injury.
- Use correct body mechanics while performing any procedure.
- Wear appropriate personal protective equipment.
- Walk—do not run—in the laboratory area or clinical area, in hallways, and especially on stairs.
- Promptly report any personal injury or accident.
- If you see an unsafe situation, report it to your instructor/immediate supervisor promptly.



FIGURE 10–6 (**A**) Lower the bed and place the call signal and other supplies within easy reach of the patient before leaving a patient. (**B**) Wash your hands before and after any procedure, and any time they become contaminated during a procedure. (**C**) If your hands are not visibly dirty or contaminated with blood or body fluids, they can be cleaned with a hand gel.

- Keep all areas clean and neat, with all equipment and supplies in their proper locations at all times.
- Wash your hands before and after any procedure, and any time they become contaminated during a procedure.
- Keep your hands away from your face, eyes, mouth, and hair.
- Dry your hands thoroughly before handling any electrical equipment.
- Wear safety glasses when instructed to do so and in any situations that might result in possible eye injury.
- If any solutions come into contact with your skin or eyes, immediately flush the area with cool water. Inform your instructor/supervisor.
- If a particle gets in your eye, do not try to remove the particle or rub your eye.

checkpoint

1. What is radioactive iodine used for?
2. How many times should you read the label of a solution bottle to be sure that you have the correct solution?

10:3 OBSERVING FIRE SAFETY

Health care providers must know three basic facts about fires: how they start, how to prevent them, and how to respond when they occur.

Fires need three things to start (**Figure 10–7**):

1. Oxygen—present in the air.
2. Fuel—any material that will burn.
3. Heat—sparks, matches, or flames.

The major cause of fires is unattended cooking fires. Other causes include misuse of electricity (overloaded circuits, frayed electrical wires, improperly grounded plugs), defects in heating systems and portable heaters, use of inhalers and matches, candles, spontaneous ignition, improper waste disposal, children playing with matches and lighters, and arson.

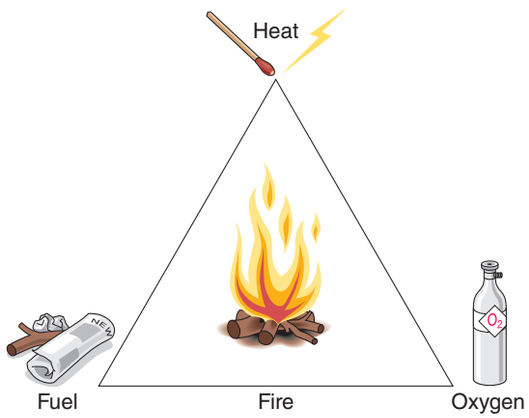


FIGURE 10–7 The fire triangle shows the three things needed to start a fire.

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FIRE EXTINGUISHERS

Fire extinguishers are metal cylinders filled with water or chemicals used to put out fires. They are portable and easy to operate, and are mainly used to put out small fires before flames spread. Fire extinguishers are classified and labeled according to the kind of fire they extinguish. The main classes are:

- **Class A**: used on fires involving combustibles such as paper, cloth, plastic, and wood.
- **Class B**: used on fires involving flammable liquids such as gasoline, oil, paint, grease, and cooking fat.
- **Class C**: used on electrical fires such as fuse boxes, appliances, wiring, and electrical outlets that are nonconductive. Water is a good conductor of electricity, so the electricity should be turned off before using an extinguisher on an electrical fire, if possible.
- **Class D**: used on burning metals; often specific for the type of metal being used, and not used on any other types of fires.
- **Class K**: used on burning cooking materials (fats, grease, and oils) and appliances in commercial cooking sites such as restaurants.

Many different types of fire extinguishers are available. The main types are:

- **Water**: contain pressurized water—only for use on class A fires.
- **Carbon dioxide**: contain carbon dioxide gas that smothers the fire by forming a cloud of cool ice that displaces the air and oxygen. They leave a powdery residue that irritates the skin and eyes, and can be dangerous if inhaled—most effective on class B or C fires.



FIGURE 10–8 Fire extinguishers contain diagrams and/or letters to show the type of fire on which they should be used.

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- **Dry chemical**: contain a chemical that acts to smother a fire:
  - Type BC extinguishers leave a mildly corrosive residue that must be cleaned up as soon as possible.
  - Type ABC extinguishers leave a sticky residue that can damage electrical appliances such as computers.
  - Type K extinguishers leave a soapy foam that can damage appliances.
- All the residues from extinguishers used on class A, B, C, or K fires can irritate the skin and eyes.
- **Halon**: contain a gas that interferes with the chemical reaction that occurs when fuels burn—used on electrical equipment because they do not leave a residue and will not damage appliances such as computers; most effective on class C fires.

Most fire extinguishers are labeled with a diagram and/or a letter showing the type of fire for which they are effective (**Figure 10–8**). The main rules to be followed in case of fire are:

- Keep calm.
- If your personal safety is endangered, evacuate the area according to the stated method and sound the alarm.
- If the fire is small, confined to one area, and your safety is not endangered, determine what type of fire it is and use the proper extinguisher.

FIRE EMERGENCY PLAN

Most institutions have a fire emergency plan, which should be followed in all cases of fire outbreak.

- The fire alarm should be activated as quickly as possible (**Figure 10–9**).
- All doors and windows should be closed, if possible, to prevent drafts, which cause fire to spread more rapidly.



FIGURE 10–9 When a fire occurs, the fire alarm should be activated as quickly as possible.

- Electrical equipment and oxygen should be shut off.
- Rescue anyone in immediate danger. In a health care facility, move patients to a safe area. If a patient can walk, escort them to a safe area. It may be necessary to move a patient in a bed or carry the patient to a safe area.
- Elevators should never be used during a fire.
- Activate the fire alarm. Sound the alarm and give the location and type of fire.

By following the fire emergency plan, knowing the location of fire extinguishers and exit doors, and remaining calm, you can help to prevent loss of life or serious injury during a fire.


Safety

Preventing fires is everyone's job. Constantly be alert to potential causes of fires, and correct all situations that can lead to fires.

Some rules for preventing fires are:

- Obey all "No Smoking" signs.
- Extinguish matches, inhalers, and any other flammable items completely.
- Dispose of all waste materials into proper containers.
- Before using electrical equipment, check for damaged cords or improper grounding. Avoid overloading electrical outlets.
- Store flammable materials in proper containers and in a safe area. If you spill a flammable liquid, wipe it up immediately.
- Do not allow clutter to accumulate in rooms, closets, doorways, or traffic areas. Make sure no equipment or supplies block any fire exits.
- When oxygen is in use, observe special precautions. Post a "No Smoking—Oxygen in Use" sign. Avoid the use of electrically operated equipment whenever possible. Do not use flammable liquids such as alcohol, nail polish, and oils. Avoid static electricity by using cotton blankets, sheets, and gowns.

HOW TO USE A FIRE EXTINGUISHER

1. Check the extinguisher type to be sure it is the proper one to use on the fire (**Figure 10–10A**).
2. Locate the lock or pin at the top handle. Release the lock following the manufacturer's instructions (**Figure 10–10B**).

3. Grasp the handle to hold the extinguisher firmly in an upright position.
4. Stand approximately 2–3 meters from the near edge of the fire.
5. Aim the nozzle at the fire (**Figure 10–10C**).
6. Discharge the extinguisher. Use a side-to-side motion. Spray toward the near edge of the fire at the bottom of the fire.
7. Take care: do not spray into the center or top of the fire because this will cause the fire to spread in an outward direction.
8. Continue with the same side-to-side motion until the fire is extinguished.
9. Take care: avoid contact with residues from chemical extinguishers as they can irritate the skin and eyes.

DISASTER PLANS

In addition to fires, other types of disasters may occur, such as earthquakes and floods. In any type of disaster, stay calm, follow the most current policy of the health care facility, and provide for the safety of yourself and the patient. Health care providers have a duty to familiarize themselves with disaster policies so that appropriate action can be taken when a disaster strikes.

checkpoint

1. What three things do fires need to start?
2. Where should you store flammable materials?



(A)


(B)


(C)

FIGURE 10–10 (**A**) Check the extinguisher type to make sure it is the correct one to use. (**B**) Release the pin on the fire extinguisher. (**C**) Aim the nozzle at the near edge of the fire, and push the handle to discharge the extinguisher.

Case Study Investigation Conclusion

Noura needs to think of patient safety, equipment safety, environmental safety, and her own personal safety. What two techniques did Noura use to keep Maryam safe? What personal protective equipment did she use to keep herself safe? Did you list moving the bed's power cord as one way she addressed environmental safety? The way Noura disposed of the used insulin needle showed her concern for equipment safety. Did your answer include all of these areas?

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CHAPTER 10 SUMMARY

- Safety is the responsibility of every health care provider. It is essential that established safety standards be observed by everyone. This protects the provider, the employer, and the patient.
- Body mechanics refers to the way the body moves and maintains balance while making the most efficient use of all its parts. Practicing basic principles of good body mechanics prevents strain and maintains muscle strength. In addition, using correct body mechanics makes lifting, pulling, and pushing easier.
- Knowing and following basic safety standards about hazardous chemicals and pathogens, hazards in the environment, and with equipment and solutions is also important.
- An awareness of the causes and prevention of fires is essential. Following the fire emergency plan or other disaster plan, knowing the location of fire extinguishers and exit doors, and remaining calm allow the health care provider to help to prevent loss of life or serious injury during a disaster.

REVIEW QUESTIONS

1. List the four main reasons why it is important to use good body mechanics.

2. Describe how to align your body to achieve good posture.

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3. You are using an electrical centrifuge to spin blood. You see smoke coming from the back of the machine. What should you do?

4. List four ways that radiation might be a concern in hospitals.

5. List four safety precautions that must be followed while using equipment and solutions.

6. Identify four basic rules that must be followed to protect a patient or resident.

7. Identify five possible causes of fires.

8. What are the four types of fire extinguisher?

9. State four elements found in a fire emergency plan.

10. Describe five rules for preventing fires.

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CRITICAL THINKING

1. Create a chart showing the five main types of fire extinguishers and the type of fire for which each is effective. Include examples of each in a health care setting.

2. Think about the tasks that a lab team member does each day. List the safety regulations that the lab team member must be aware of as they accomplish their assignments for the day.

ACTIVITIES

1. In a group of four, create a skill checklist to demonstrate safely using a fire extinguisher and putting out a fire. To practice: two people are partners that go in to put out the fire, one person is a "scribe" observing and completing the checklist, and one is assisting the scribe in spotting procedure specifics.

2. In a small group, develop a scenario that demonstrates observation of good practice in the event of a chemical spill such as mercury.

3. With a partner, research and create a training video covering good posture and how to use effective body mechanics.

4. Write a safety guide for nurses working with patients in hospital.

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CHAPTER

11 INFECTION CONTROL

Case Study Investigation

Fahad and Ayisha worked as nurses at University Hospital during the coronavirus disease 2019 (COVID-19) pandemic. They worked in the emergency room (ER) and needed to be aware of how this virus was transmitted so they could use the proper personal protective equipment (PPE). After they went through training, they understood that this disease was highly contagious and potentially deadly. Fahad and Ayisha knew that patients would sometimes have to remain in the ER for extended periods of time waiting on test results, and they would have to use correct precautions when interacting with those patients. At the end of this chapter, you will be asked what PPE they needed to use and why.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Identify the basic principles of infection and infection control.
- Wash hands following aseptic technique.
- Observe standard precautions needed while working in the laboratory or clinical area.
- Follow basic principles of sterilization, disinfection, ultrasonic cleaning, and sterile techniques.
- Explain how to care for patients in a transmission-based isolation unit.

KEY TERMS

bacteria
chain of infection
chemical disinfection
contamination
microorganism
parasite
pathogens
sterilization
ultrasonic cleaning
viruses

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11:1 UNDERSTANDING THE PRINCIPLES OF INFECTION CONTROL

A **microorganism**, or microbe, is a small living organism that is not visible to the naked eye. It must be viewed under a microscope. Microorganisms are found everywhere in the environment, including on and in the human body (our microbiome). Microorganisms which are beneficial in maintaining certain body processes are called nonpathogens. Other microorganisms cause infection and disease, and are called **pathogens**, or germs.

A **parasite** is an organism that lives in or on an organism of another species (its host) and benefits by getting nutrients at the host's expense. Parasitic infections can be spread through contaminated water, food, waste, soil, and blood. Some parasites are spread by insects that act as a vector, or carrier, of the disease.

To grow and reproduce, microorganisms need certain things. Most microorganisms prefer a warm environment, and body temperature is ideal. Most microorganisms also prefer darkness, and many are killed quickly by sunlight. In addition, a source of food and moisture is needed. Some microorganisms, called aerobic organisms, require oxygen to live. Others, called anaerobic organisms, live and reproduce without oxygen. The human body is the ideal supplier of all the requirements of microorganisms.

There are many different classes of microorganisms and worms. In each class, some are pathogenic (harmful) to humans:

- **Bacteria** are simple, single-celled organisms that multiply rapidly (**Figure 11–1**). Diseases caused by different types of bacteria include tuberculosis, tetanus, pertussis (whooping cough), botulism, diphtheria, and typhoid. Antibiotics are used to kill bacteria, but because they have been overused, some strains of bacteria have now become antibiotic-resistant. This means that most antibiotics are no longer effective against them. If a bacterium becomes resistant to several drugs, it is called multidrug-resistant, or a "superbug". Methicillin-resistant *Staphylococcus aureas* (MRSA) is an example. All antibiotic-resistant bacteria are a major concern because they are difficult to treat, cause increased hospital stays, and increase the cost of health care.



FIGURE 11–1 Rod-shaped bacteria called *Enterobacteriaceae*, which are part of the normal intestinal microbiome. They are also the causative agents of different infections.

- **Rickettsiae** are parasitic bacteria that can only live inside the cells of another living organism. They are commonly found in fleas, lice, ticks, and mites, and are transmitted to humans by the bites of these insects. Rickettsiae cause diseases such as typhus fever and Rocky Mountain spotted fever. Antibiotics are effective against many different rickettsiae.

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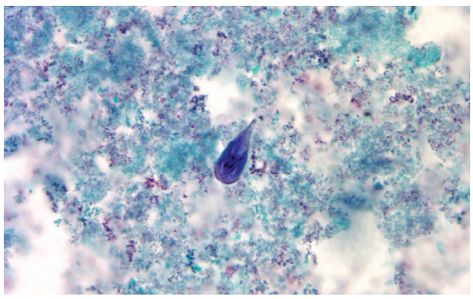


FIGURE 11–2 An intestinal protozoan, *Giardia intestinalis*, is the blue mass in the center of the photo.

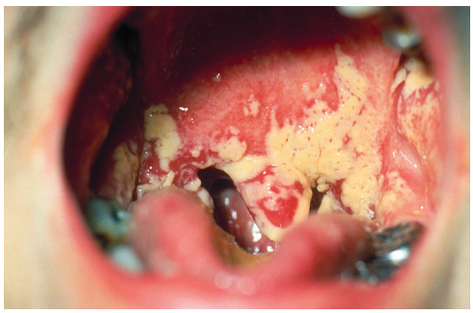
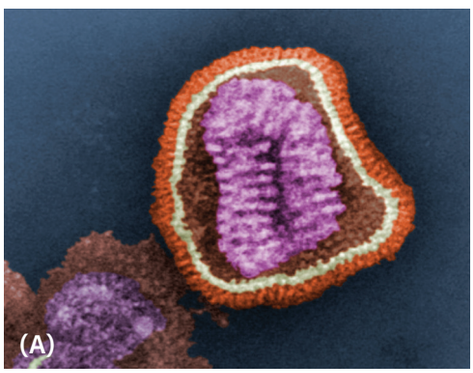


FIGURE 11–3 The yeast (fungus) called *thrush* causes these characteristic white patches on the tongue and in the mouth.



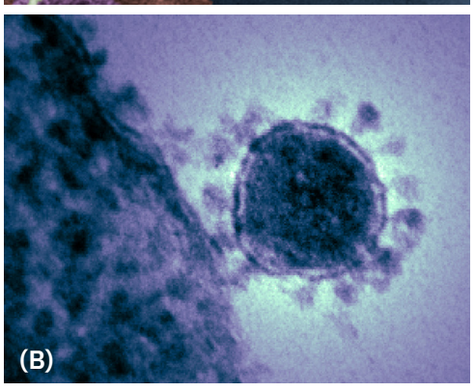


FIGURE 11–4 (**A**) Electron micrograph of the influenza virus. (**B**) Electron micrograph of a coronavirus.

- **Protozoa** are single-celled animal-like organisms often found in decayed materials, animal or bird feces, insect bites, and contaminated water (**Figure 11–2**). Many contain flagella (long tails), which allow them to move freely. Protozoa cause diseases such as malaria, amebic dysentery (intestinal infection), trichomonas, and African sleeping sickness. Treatment of protozoa infections can be lengthy and is not always successful.
- **Fungi** are simple, plant-like organisms that live on dead organic matter and can infect humans. Yeasts and molds are two common forms that can cause diseases such as ringworm, athlete's foot, histoplasmosis, yeast vaginitis, and thrush (**Figure 11–3**). Antifungal medications are available for many of the pathogenic fungi, but they are expensive, must be taken for a long period, and may cause liver damage.
- **Viruses** are visible only using an electron microscope. They cannot reproduce unless they are inside a living cell. They are spread from human to human by blood and other body secretions. Viruses are more difficult to kill because they are resistant to many disinfectants and are not affected by antibiotics. Viruses cause many diseases, including the common cold, measles, mumps, chickenpox, herpes, warts, influenza (**Figure 11–4A**), and polio. New and different viruses, like the new coronavirus that caused COVID-19 (**Figure 11–4B**), emerge constantly because viruses are prone to mutating and changing their genetic information. Viruses that infect animals can mutate to infect humans, often with lethal results.
- **Helminths** are multicellular parasitic organisms commonly called worms or flukes. They are transmitted to humans when humans eat the eggs or larvae in contaminated food, eat meat contaminated with

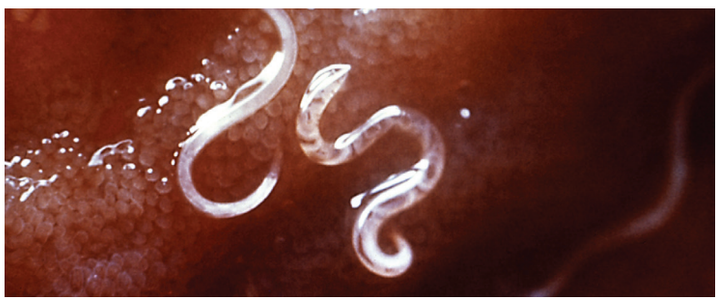


FIGURE 11–5 Hookworms attached to the mucosal lining of the intestine are one type of helminth.

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the worms, or get bitten by infected insects. Some worms can also penetrate the skin to enter the body. Examples of helminths include hookworms, which attach to the small intestine and can infect the heart and lungs (**Figure 11–5**), ascarids, which live in the small intestine and can cause an obstruction of the intestine, and pinworm, which mainly affects young children. Specific drugs are used to treat helminth infections. When one individual in a family is found to be infected, other family members should be treated as well, particularly in cases such as threadworm.

TYPES OF INFECTION

Microorganisms can cause infection and disease in different ways. Some produce poisons, called toxins, which harm the body. Some cause an allergic reaction in the body, resulting in a runny nose, watery eyes, and sneezing. Other microorganisms attack and destroy the living cells they invade.

Infections and diseases are also classified as endogenous, exogenous, health care-associated, or opportunistic:

- An **endogenous** infection is an infection that originates within the body. An example is tuberculosis, infection by a microorganism which is dormant in the body.
- An **exogenous** infection is an infection that originates outside the body. An example is a staphylococcal skin infection, pathogenic organisms that invade the body.
- A **health care-associated** infection (also called nosocomial or hospital-acquired) is an infection acquired by an individual in a health care facility. An example is *Pseudomonas* in a wound infection.
- **Opportunistic** infections are those that occur when the body's defenses are weak. These diseases do not usually occur in individuals with intact immune systems. An example is the development of a yeast infection called candidiasis.

VACCINES

Vaccines are used to prevent disease. A vaccine stimulates the immune system to produce antibodies, similar to the antibodies made by the body after exposure to a disease. They are made from very small amounts of weakened or dead germs or part of them. After getting vaccinated, an individual develops immunity to that disease without having to get the disease first.

Vaccinations protect both the individuals getting them and the community from the disease. Germs can travel quickly through a community and cause a major outbreak of a disease. If enough people are vaccinated against acertain disease, the germs cannot travel as easily from person to person, and the entire community is less likely to get the disease.

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CHAIN OF INFECTION

For disease to occur and spread from one individual to another, certain conditions must be met. These conditions are commonly called the **chain of infection** (**Figure 11–6**). The parts of the chain include:

- An **infectious agent**: A pathogen, such as a bacterium or virus that can cause a disease.
- A **reservoir**: An area where the infectious agent can live, like the human body, animals, and contaminated objects (for example, doorknobs, bedpans, urinals, linens, instruments, and specimen containers).

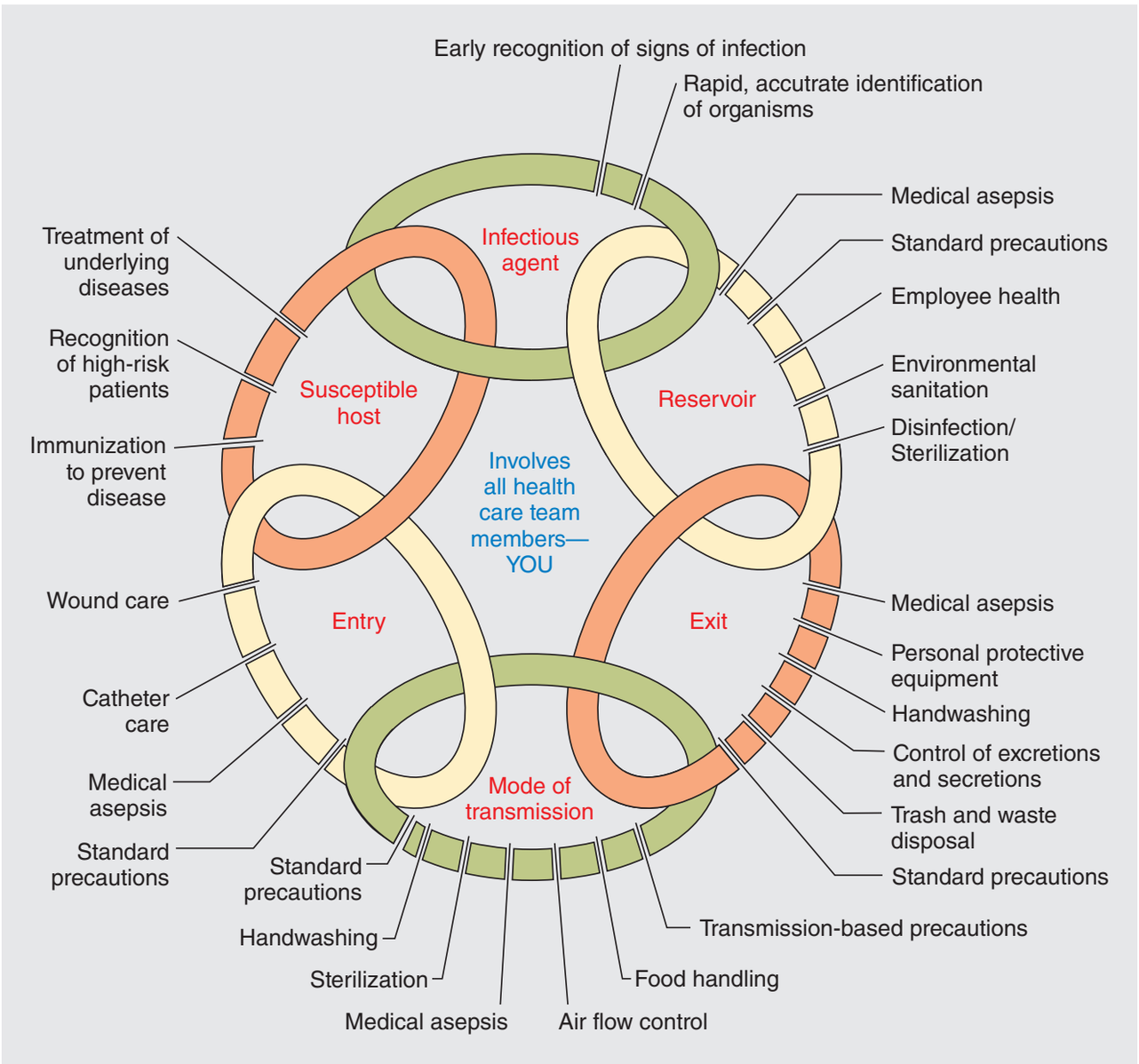


FIGURE 11–6 The components in the chain of infection and the ways in which the chain can be broken.

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- An **exit**: A way for the infectious agent to escape from the reservoir where it has been growing. In the human body, pathogens can leave the body through urine, feces, saliva, blood, tears, mucous discharge, other bodily secretions, and draining wounds.
- A **mode of transmission**: A way that the infectious agent can be transmitted to another reservoir or host where it can live. The pathogen can be transmitted by:
  - Direct contact, which includes person-to-person contact, like contaminated hands.
  - Indirect contact, from contaminated substances such as food, air, soil, insects, feces, clothing, instruments, and equipment.
- An **entry**: A way for the infectious agent to enter a new reservoir or host, for example through breaks in the skin or by breathing it in.

BODY DEFENSES

If body defenses are intact and the immune system is functioning, a human can fight off infection and not contract a disease.

Body defenses include:

- **Mucous membranes**: Linings of the respiratory, digestive, and reproductive tracts that trap pathogens.
- **Cilia**: Tiny, hair-like structures that line the respiratory tract and push pathogens out of the body.
- **Coughing and sneezing**: Expel pathogens out of the body.
- **Hydrochloric acid**: Destroys pathogens in the stomach.
- **Tears in the eye**: Contain chemicals that kill bacteria.
- **Fever**: High body temperatures destroy some pathogens.
- **Inflammation**: White blood cells, destroy pathogens.
- **Immune response**: The body produces antibodies, protective proteins that combat pathogens.

If your body defenses are weak, you are more likely to get an infection or disease. If any part of the chain is eliminated, the spread of disease or infection will be stopped. Health care providers should follow practices to interrupt or break this chain and prevent the transmission of disease.

ASEPTIC TECHNIQUES

A major way to break the chain of infection is to use aseptic techniques while providing health care. Terms used in this field:

- **Asepsis** is the absence of disease-producing microorganisms (pathogens).
- **Sterile** means free from all organisms, both pathogenic and nonpathogenic, including spores and viruses.
- **Contaminated** means that organisms and pathogens are present. Any object or area that may contain pathogens is considered to be contaminated.

Aseptic techniques help to eliminate or prevent **contamination**, including:

- Handwashing.
- Use of disposable gloves when contacting body secretions or contaminated objects.
- Proper cleaning of instruments and equipment.
- Thorough cleaning of the environment.

Various levels of aseptic control are possible:

- **Antisepsis**: Antiseptics prevent or inhibit growth of pathogenic organisms but are not effective against spores and viruses. They can usually be used on the skin. Common examples of antiseptics include alcohol and iodine.
- **Disinfection**: Chemical disinfectants are used to destroy or kill pathogenic organisms. They are not always effective against spores and viruses. Disinfectants can irritate or damage the skin and are used mainly on objects, not people. Some common disinfectants are bleach solutions and benzalkonium chloride.
- **Sterilization**: Destroys all microorganisms, both pathogenic and nonpathogenic, including spores and viruses. Steam under pressure, gas, radiation, and chemicals can be used to sterilize objects. An autoclave is the most common piece of equipment used for sterilization.

checkpoint

1. What is the difference between a pathogen and a nonpathogen?
2. How many components are in the chain of infection?

11:2 WASHING HANDS

Precaution

Handwashing is the single most important method used to practice aseptic technique (**Figure 11–7**). Thoroughly washing the hands helps to prevent and control the spread of pathogens from one person to another. It also helps protect health care providers from disease and illness.

The World Health Organization has developed guidelines for handwashing, called *My 5 Moments for Hand Hygiene*. The five essential times for handwashing include:

- Before touching a patient.
- Before a clean or aseptic procedure.
- After body-fluid exposure or risk of exposure.
- After touching a patient.
- After touching the patient's surroundings.



FIGURE 11–7 Handwashing is the most important method used to practice aseptic technique.

In addition, you should wash your hands:

- When you arrive at the facility and before leaving the facility.
- After contact with a patient's intact skin (for example, after taking a blood pressure).
- Before moving from a contaminated body site to a clean body site during patient care (for example, before washing the patient's hands after removing a bedpan).
- Any time the hands become contaminated during a procedure.
- Before applying and immediately after removing gloves.
- Any time gloves are torn or punctured.
- Before and after handling any specimen.
- After contact with any soiled or contaminated item.
- After picking up any item off the floor.
- After personal use of the bathroom.
- After you cough, sneeze, or use a tissue.
- Before and after any contact with your mouth or mucous membranes, such as eating, drinking, applying lip balm, or inserting or removing contact lenses.

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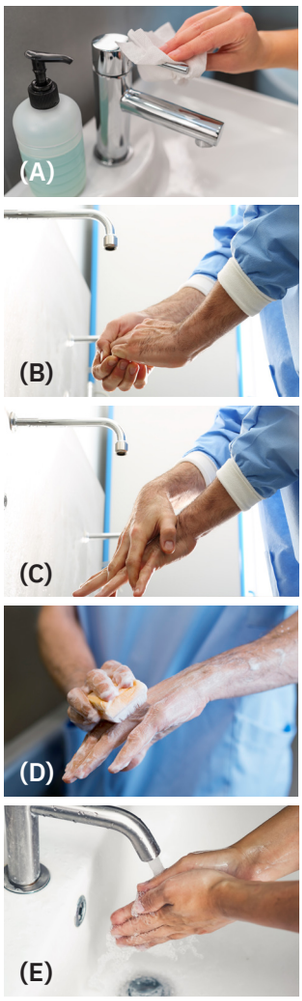


FIGURE 11–8 (**A**) Use a dry towel to turn the faucet on. (**B**) Point the fingertips downward and use the palm of one hand to clean the back of the other hand. (**C**) Interlace the fingers to clean between the fingers. (**D**) A hand brush can be used to clean the nails. (**E**) With the fingertips pointing downward, rinse the hands thoroughly.

HANDWASHING WITH SOAP AND WATER

Follow a standard procedure to ensure thorough cleaning (**Figure 11–8**). The principles that should be observed whenever hands are washed are:

- Soap is used as a cleansing agent because it aids in the removal of germs through its sudsy action and alkali content. Pathogens are trapped in the soapsuds and rinsed away. Liquid soap from a dispenser should be used whenever possible because bar soap can contain microorganisms.
- Warm water should be used. This is less damaging to the skin than hot water. It also creates a better lather with soap than does cold water.
- Friction must be used in addition to soap and water. This action helps rub off pathogens from the surface of the skin.
- All surfaces on the hands must be cleaned. This includes the palms, the backs/tops of the hands, and the areas between the fingers.
- Fingertips must be pointed downward. The downward direction prevents water from getting on the forearms and then running down to contaminate the clean hands.
- Dry paper towels must be used to turn the faucet on and off. This action prevents contamination of the hands from pathogens on the faucet. A dry towel must be used because pathogens can travel more readily through a wet towel.
- Nails also harbor dirt and pathogens; they must be cleaned during the handwashing process.

WATERLESS HANDWASHING

Waterless handwashing with an alcohol-based gel, lotion, or foam has been proved safe for use during routine patient care (**Figure 11–9**). Most waterless handwashing products contain at least 60–90 percent alcohol, and a moisturizer to prevent drying of the skin. Its use is recommended when the hands are not visibly dirty and are not contaminated with blood or body fluids:

- Read the manufacturer's instructions before using any product.
- Apply a small amount of the alcohol-based cleaner to the palm of your hands.
- Rub your hands vigorously so the solution is applied to all surfaces of the hands, fingers, nails, and wrists.
- Rub until your hands are dry, usually at least 20–30 seconds.

Most manufacturers recommend that the hands be washed with soap and water after 6–10 cleanings with the alcohol-based product. In addition, if the hands are visibly soiled, or if there has been contact with blood or body fluid, the hands must be washed with soap and water.



FIGURE 11–9 Waterless handwashing using an alcohol-based cleaner is an effective way to clean hands that are not visibly soiled.

checkpoint

1. What is the single most important method used to practice aseptic technique?
2. What are the World Health Organization's five essential times for handwashing?

11:3 OBSERVING STANDARD PRECAUTIONS

Precaution

To prevent the spread of pathogens, the chain of infection must be broken. Standard precautions must be used in any situation where health care providers may come into contact with:

- Blood or any fluid that may contain blood.
- Body fluids, secretions, and excretions, such as mucus, sputum, saliva, cerebrospinal fluid, urine, feces, or vomit.
- Mucous membranes.
- Nonintact (broken) skin.
- Tissue or cell specimens.

The basic standard precautions include:

- **Handwashing**.
- **Gloves** must be worn whenever contact with blood, body fluids, secretions, excretions, mucous membranes, or nonintact skin is possible; when handling or cleaning any contaminated items or surfaces; when taking blood for testing (**Figure 11–10**). Gloves must be changed after contact with each patient and even between tasks or procedures on the same patient if there is any chance that the gloves are contaminated.

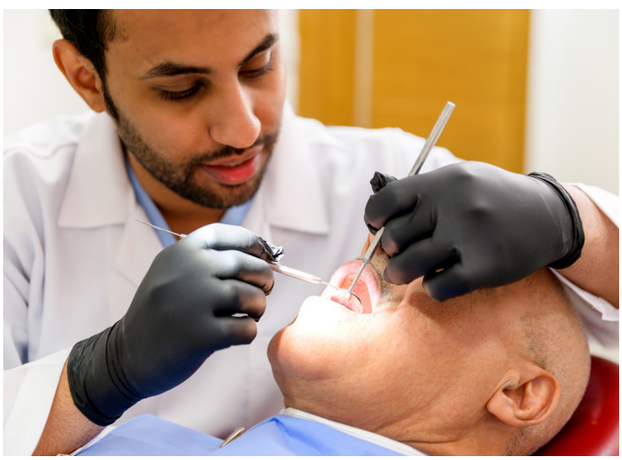


FIGURE 11–10 Gloves must be worn whenever contact with blood, body fluids, secretions, excretions, mucous membranes, or nonintact skin is possible.

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FIGURE 11–11 Gloves, a gown, a mask, and protective eyewear or face shields must be worn during any procedure that may produce splashes or sprays of blood, body fluids, secretions, or excretions.



FIGURE 11–12 The safety syringe is one example of a safer device to prevent needlesticks.



FIGURE 11–13 All needles and sharp objects must be discarded immediately in a leakproof, puncture-resistant sharps container.

- **Gowns** must be worn during any procedure that may cause splashing or spraying of blood, body fluids, secretions, or excretions. This helps to prevent contamination of clothing or uniforms. Gowns should only be worn once and then discarded. Gowns should not be worn out of patient rooms or care areas.
- **Masks** and **protective eyewear** or **face shields** (**Figure 11–11**) must additionally be worn during procedures that may produce splashes or sprays of blood, body fluids, secretions, or excretions. Examples include irrigation of wounds, suctioning, dental procedures, delivery of a baby, and surgical procedures. This prevents exposure of the mucous membranes of the mouth, nose, and eyes to any pathogens. Masks must be used once and then discarded.
- To avoid accidental cuts or punctures, extreme care must be taken while handling **sharp objects**. Whenever possible, safe needles or needleless devices should be used (**Figure 11–12**). Disposable needles must never be bent or broken after use. They must be left uncapped and attached to the syringe and placed in a leakproof, puncture-resistant sharps container (**Figure 11–13**). The sharps container must be labeled with a red biohazard symbol (**Figure 11–14**). Surgical blades, razors, and other sharp objects must also be discarded in the sharps container.
- **Spills or splashes** of blood, body fluids, secretions, or excretions must be wiped up immediately. Gloves must be worn while wiping up the area with disposable cleaning cloths. The area must then be cleaned with a disinfectant solution such as a 10% bleach solution. Furniture or equipment contaminated by the spill or splash must be cleaned and disinfected immediately. For large spills, an absorbent powder may be used to soak up the fluid. After the fluid is absorbed, the powder is swept up and placed in an infectious waste container.
- Mouthpieces or **resuscitation devices** should be used instead of mouth-to-mouth resuscitation. They should be placed in convenient locations and be readily accessible for use. If they are not disposable, they must be disinfected between patient use.

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- **Infectious waste** such as contaminated dressings, gloves, bedpans, and body tissues must be placed in infectious waste or biohazardous material bags. Other waste is placed in plastic bags and incinerated. Soiled linen should be placed in laundry bags to prevent any contamination. Any bag containing contaminated linen must be clearly labeled and color-coded.
- Any cut, injury, needlestick, or splashing of blood or body fluids must be reported immediately. Report and document any **exposure or injury**, record the care given, note any follow-up to the exposure incident, and identify ways to prevent a similar incident.

BLOODBORNE PATHOGENS

One of the main ways in which pathogens are spread is by blood and body fluids. Three pathogens of major concern are the hepatitis B virus (HBV), the hepatitis C virus (HCV), and the human immunodeficiency virus (HIV). Consequently, extreme care must be taken at all times when an area, object, or person is contaminated with blood or body fluids:

- Use PPE such as gloves, gowns, lab coats, masks, and face shields.
- Provide adequate handwashing facilities and supplies.
- Ensure that the worksite is maintained in a clean and sanitary condition.
- Follow measures for immediate decontamination of any surface that comes into contact with blood or infectious materials, and dispose of infectious waste correctly.
- Enforce rules of no eating, drinking, applying cosmetics or lip balm, handling contact lenses, and mouth pipetting or suctioning in any area that can be potentially contaminated by blood or other body fluids.
- Provide appropriate containers that are color-coded (fluorescent orange or orange-red) and labeled for contaminated sharps (needles, scalpels) and other infectious or biohazard wastes.
- Post signs at the entrance to work areas where there is occupational exposure to biohazardous materials.
- Label any item that is biohazardous with the red biohazard symbol (**Figure 11–14**).



FIGURE 11–14
The universal biohazard symbol indicates a potential source of infection.

checkpoint

1. How many times should a mask be used before it is discarded?
2. What is PPE?

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11:4 STERILIZATION, DISINFECTION, ULTRASONIC CLEANING



FIGURE 11–15 An autoclave uses steam under pressure or gas to sterilize items.

STERILIZATION

Sterilization of instruments and equipment is essential in preventing the spread of infection. The autoclave is the safest and most efficient sterilization method. An autoclave is a piece of equipment that uses steam under pressure or gas to sterilize equipment and supplies (**Figure 11–15**). It will destroy all microorganisms, both pathogenic and nonpathogenic, including spores and viruses.

- Equipment to be sterilized must be prepared properly. All items must be washed thoroughly and then rinsed.
- Items that are to remain sterile must be wrapped in a material (for example, muslin, autoclave paper, special plastic or paper bags, and autoclave containers) that will allow for the penetration of steam during the autoclaving process.
- Sterilized items must be stored in clean, dustproof areas.
- Items usually remain sterile for 30 days after autoclaving.
- Some autoclaves are equipped with a special door that allows the autoclave to be used as a dry-heat sterilizer. Dry heat involves the use of a high temperature for a long period. The temperature is usually a minimum of 160–177°C (320–350°F). The minimum time is usually 60 minutes.
- Dry-heat sterilization is a good method for sterilizing instruments that may corrode, such as knife blades, or items that would be destroyed by the moisture in steam sterilization, such as powders.
- An oven can be used for dry-heat sterilization in home situations.

USING CHEMICALS FOR DISINFECTION

Chemicals are frequently used for aseptic control. However, many chemicals do not kill spores and viruses, so chemicals are not a method of sterilization. Because sterilization does not occur, **chemical disinfection** is the correct term (rather than cold sterilization, a term that is sometimes used). A few chemicals kill spores and viruses, but they often require that instruments be submerged in the chemical for 10 hours or more.

- Chemicals are used to disinfect instruments that do not penetrate body tissue, such as dental instruments, tweezers, and scissors (**Figure 11–16**).

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- Chemicals are used to disinfect thermometers and other items that would be destroyed by the high heat used in the autoclave.
- Proper cleaning of all instruments or articles is essential. They must be rinsed thoroughly because the presence of soap can also reduce the effectiveness of chemicals. The articles must be dry before being placed in the disinfectant to keep the chemical at its most effective strength.
- The chemical disinfectant must completely cover the article. This is the only way to be sure that all parts of the article will be disinfected. In addition, the items should be separate so each one will come into contact with the chemical.



FIGURE 11–16 Chemicals are used to disinfect instruments that do not penetrate body tissue, such as dental instruments, tweezers, and scissors.

Before removing items from solutions, health care providers must wash their hands. Sterile gloves or sterile pick-ups or transfer forceps may be used to remove the instruments from the solution. The items should be rinsed with sterile water to remove any remaining chemical solution. After rinsing, the instruments are placed on a sterile towel to dry, and then stored in a drawer or dust-free closet.

CLEANING WITH AN ULTRASONIC UNIT

Ultrasonic units are used to remove dirt, debris, blood, saliva, and tissue from a large variety of instruments before sterilizing them.

- **Ultrasonic cleaning** uses sound waves to clean. When the ultrasonic unit is turned on, the sound waves produce millions of microscopic bubbles in a cleaning solution. When the bubbles strike the items being cleaned, they explode (a process known as cavitation) and drive the cleaning solution onto the article. Accumulated dirt and residue are easily and gently removed from the article.
- Ultrasonic cleaning is not sterilization because spores and viruses remain on the articles. If sterilization is desired, other methods must be used after the ultrasonic cleaning. A general, all-purpose cleaning solution is used most of the time.
- Many different items can be cleaned in an ultrasonic unit, including instruments, dental impression trays, and glass products.

checkpoint

1. What is an autoclave?
2. What kinds of instruments are disinfected using chemicals?

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11:5 USING STERILE TECHNIQUES

While working with sterile supplies, it is important that correct techniques be followed to maintain sterility and avoid contamination. It is also important to recognize sterile surfaces and contaminated surfaces.

- A clean working area is required when working with sterile supplies.
- A sterile object must never touch a nonsterile object. If other objects are in the way, it is easy to contaminate sterile articles. If sterile articles touch the skin or any part of your clothing, they are no longer sterile. Because any area below the waist is considered contaminated, sterile articles must be held away from and in front of the body and above the waist.
- Once a sterile field has been set up, never reach across the top of the field. Microorganisms can drop from your arm or clothing and contaminate the field. Avoid coughing, sneezing, or talking over the sterile field because airborne particles can fall on the field and contaminate it.
- The 5-cm (2-inch) border around the sterile field is considered contaminated, so 5 cm (2 inches) around the outside of the field must not be used when sterile articles are placed on the sterile field.
- All sterile items must be checked carefully before they are used. If an item has been autoclaved and dated, most health care facilities believe the date should not be more than 30 days from autoclaving. If tears or stains are present on the package, the item should not be used because it could be contaminated. If there are any signs of moisture on the package, it has been contaminated and should not be used.



FIGURE 11–17 Sterile items can be dropped from the wrapper onto the sterile field.

- Organisms and pathogens travel quickly through a wet surface, so the sterile field must be kept dry. If a sterile towel or article gets wet, contamination has occurred. It is very important to use care when pouring solutions into sterile bowls or using solutions around a sterile field.
- Various techniques can be used to remove articles from sterile wraps, depending on the article being unwrapped. Some common techniques are the drop technique (**Figure 11–17**), used for gauze pads, dressings, and small items; the mitten technique, used for bowls, drapes, linen, and other similar items; and transfer-forceps

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techniques used for cotton balls, small items, or articles that cannot be removed by the drop or mitten techniques.

- Make sure that the sterile tray is open, and you are ready to carry out the sterile procedure before putting the sterile gloves on your hands.
- Sterile gloves are considered sterile on the outside and contaminated on the inside (the side against the skin). Once they have been placed on the hands, it is important to hold the hands away from the body and above the waist to avoid contamination (**Figure 11–18**). Handle only sterile objects while wearing sterile gloves.

DONNING AND REMOVING STERILE GLOVES

1. Check the package for stains, tears, moisture, or evidence of contamination. Do not use the package if there is any evidence of contamination.
2. Remove rings. Wash hands. Dry hands thoroughly.
3. Open the package containing the gloves, taking care not to touch the inside of the inner wrapper. The inner wrapper contains the gloves. Reach in from the sides to open the inner package and expose the sterile gloves (**Figure 11–19A**). The folded cuffs will be nearest to you. If you touch the inside of the package (where the gloves are), get a new package and start again.
4. The glove for the right hand will be on the right side, and the glove for the left hand will be on the left side of the package. With the thumb and forefinger of the nondominant hand, pick up the top edge of the folded-down cuff (inside) of the glove for the dominant hand. Remove the glove carefully (**Figure 11–19B**). Do not touch the outside. This



FIGURE 11–18 Once sterile gloves have been placed on the hands, hold the hands away from the body and above the waist to avoid contamination.

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is sterile. Only the part that will be next to the skin can be touched. Remember: unsterile touches unsterile and sterile touches sterile.

5. Hold the glove by the inside cuff and slip the fingers and thumb of your other hand into the glove. Pull the glove on carefully (**Figure 11–19C**). Hold the glove away from the body. Pull gently to avoid tearing the glove.
6. Insert your gloved hand under the cuff (outside) of the other glove and lift the glove from the package (**Figure 11–19D**). Do not touch any other area with your gloved hand while removing the glove from the package. If contamination occurs, discard the gloves and start again.
7. Holding your gloved hand under the cuff of the glove, insert your other hand into the glove (**Figure 11–19E**). Keep the thumb of your gloved hand tucked in to avoid possible contamination.
8. Turn the cuffs up by manipulating only the sterile surface of the gloves (sterile touches sterile). Go up under the folded cuffs, pull out slightly, and turn the cuffs over and up (**Figure 11–19F**). Do not touch the inside of the gloves or the skin with your gloved hand.
9. Interlace the fingers to position the gloves correctly, taking care not to touch the skin with the gloved hands (**Figure 11–19G**). If contamination occurs, start again with a new pair of gloves.
10. Do not touch anything that is not sterile once the gloves are in place. Gloved hands should remain in position above the waist. Do not allow them to fall below the waist.
11. After the procedure requiring sterile gloves has been completed, dispose of all contaminated supplies before removing the gloves. This reduces the danger of cross-infection caused by handling contaminated supplies without glove protection.
12. To remove the gloves, use one gloved hand to grasp the other glove by the outside of the cuff (**Figure 11–19H**). Taking care not to touch the skin, remove the glove by pulling it down over the hand (**Figure 11–19I**). It will be wrong side out when removed. This prevents contamination of your hands by organisms picked up while performing the procedure. Now the outside of the gloves is contaminated, and the area inside, next to your skin, is clean.
13. Insert your bare fingers inside the second glove (**Figure 11–19J**). Remove the glove by pulling it down gently, taking care not to touch the outside of the glove with your bare fingers (**Figure 11–19K**). It will be wrong side out when removed. Avoid touching your uniform or any other object with the contaminated gloves.
14. Put the contaminated gloves in an infectious waste container immediately after removal (**Figure 11–19L**).
15. Wash your hands immediately and thoroughly after removing gloves.

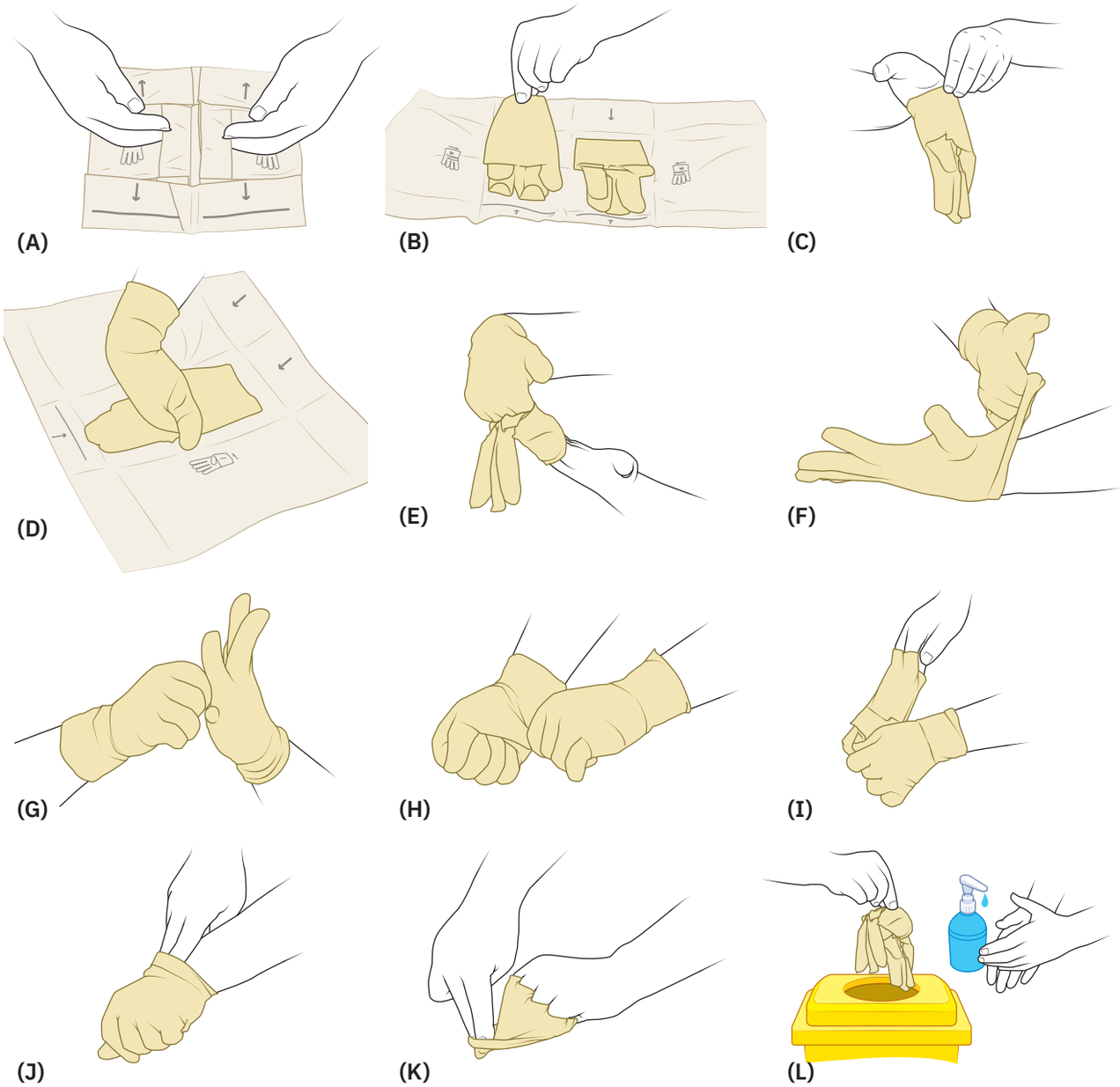


FIGURE 11–19 (**A**) Reach in from the sides to open the inner package and expose the sterile gloves. (**B**) Pick up the first glove by grasping the glove on the top edge of the folded-down cuff. (**C**) Hold the glove securely by the cuff and slip the opposite hand into the glove. (**D**) Slip the gloved fingers under the cuff of the second glove to lift it from the package. (**E**) Hold the gloved hand under the cuff while inserting the other hand into the glove. (**F**) Insert the gloved fingers under the cuff, pull out slightly, and turn the cuffs over and up without touching the inside of the gloves or the skin. (**G**) Interlace the fingers to position the gloves correctly, taking care not to touch the skin with the gloved hands. (**H**) Use a gloved hand to grasp the other glove by the outside of the cuff. (**I**) Remove the glove by pulling it down over the hand and turning it inside out. (**J**) Insert your bare fingers inside the top of the second glove. (**K**) Pull the glove down gently, taking care not to touch the outside of the glove with your fingers. (**L**) Place the gloves in an infectious waste container, and wash your hands immediately.

checkpoint

1. What must a sterile object never touch?
2. Around a sterile field, how wide of a border is considered contaminated?

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11:6 MAINTAINING TRANSMISSION-BASED PRECAUTIONS

Some diseases are **communicable** and require isolation.

- A **communicable** disease is caused by a pathogenic organism that can be easily transmitted to others.
- An **epidemic** occurs when the communicable disease spreads rapidly from person to person in a specific geographic area and affects a large number of people at the same time.
- A **pandemic** exists when the outbreak of disease occurs over a wide geographic area and affects a high proportion of the population.


Precaution

Transmission-based precautions are a method or technique of caring for patients who have communicable diseases. Examples of communicable diseases are tuberculosis, wound infections, and pertussis (whooping cough). Transmission-based precautions are used to provide extra protection against specific diseases or pathogens to prevent their spread.

Communicable diseases are spread in many ways. Examples include:

- Direct contact with the patient.
- Contact with dirty linen, equipment, and/or supplies.
- Contact with blood, body fluids, secretions, and excretions such as urine, feces, and droplets (from sneezing, coughing, or spitting).
- Discharges from wounds.



FIGURE 11–20 Some transmission-based precautions require the use of gowns, gloves, and masks, while others require the use of only a mask.

Transmission-based precautions are used to limit contact with pathogenic organisms. These techniques help prevent the spread of the disease to other people and protect patients, their families, and health care providers.

The type of transmission-based precautions used depends on the causative organism of the disease, the way the organism is transmitted, and whether the pathogen is antibiotic-resistant (not affected by antibiotics). PPE is used to provide protection from the pathogen. Some transmission-based precautions require the use of gowns, gloves, and masks (**Figure 11–20**), while others require the use of only a mask.

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Two terms are extensively used in transmission-based precautions: *contaminated* and *clean*. They refer to the presence of organisms on objects:

- **Contaminated**, or dirty, means that objects contain disease-producing organisms. These objects must not be touched unless the health care provider is protected by gloves, a gown, and other required items. The outside and waist ties of the gown, protective gloves, and mask are considered contaminated.
- **Clean** means that objects or parts of objects do not contain disease-producing organisms and therefore have minimal chance of spreading the disease. Every effort must be made to prevent contamination of these objects or parts of objects. The insides of the gloves and gown are clean, as are the neckband, its ties, and the mask ties.

There are four types of contact: standard, airborne, droplet, and contact. Health care facilities must have a list of conditions that shows the type and duration of precautions needed for each specific disease.

STANDARD PRECAUTIONS

Standard precautions (see Section 11:3) are used for all patients. A patient must be placed in a private room if the patient contaminates the environment or is not able to maintain appropriate hygiene. Health care providers must follow the recommendations for the use of gloves, gowns, and face masks when conditions indicate their use.

AIRBORNE PRECAUTIONS

Airborne precautions are used for patients known or suspected to be infected with pathogens transmitted by airborne droplets. These are small particles of evaporated droplets that contain microorganisms and remain suspended in the air or on dust particles. Examples of diseases requiring airborne precautions are rubella (german measles), varicella (chickenpox), tuberculosis, coronaviruses (such as COVID-19), and severe acute respiratory syndrome (SARS).

Standard precautions are used at all times. In addition, the following precautions must be taken:

- The patient must be placed in an airborne-infection isolation room, and the door should be kept closed.
- Air in the room must be discharged to the outside or filtered before being circulated to other areas.

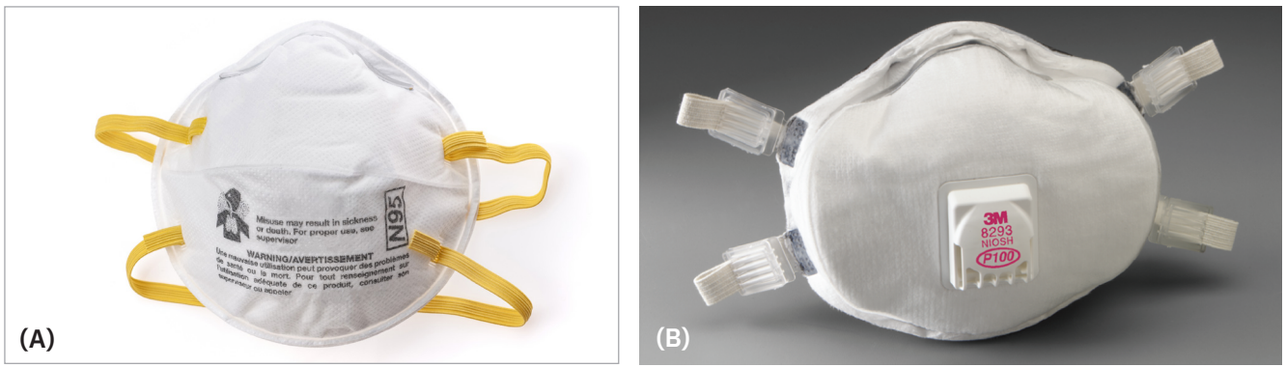


FIGURE 11–21 (**A**) The N95 respirator mask. (**B**) The P100 respirator mask.

- Each person who enters the room must wear respiratory protection in the form of an N95 (**Figure 11–21A**), P100 (**Figure 11–21B**), or more powerful filtering mask such as a HEPA (high-efficiency particulate air) mask. These masks contain special filters to prevent the entrance of small airborne pathogens. Men with facial hair cannot wear a standard filtering mask because a beard prevents an airtight seal and so must use a special HEPA-filtered hood.
- If at all possible, the patient should not be moved from the room. If transportation is essential, however, the patient must wear a surgical mask during transportation to minimize the release of droplets into the air.

DROPLET PRECAUTIONS

Droplet precautions must be followed for a patient known to be, or suspected of being, infected with pathogens transmitted by large-particle droplets expelled during coughing, sneezing, talking, or laughing. An example of a disease requiring these isolation precautions is multidrug-resistant streptococcal meningitis.

Standard precautions are used at all times. In addition, the following precautions must be taken:

- The patient should be placed in a private room. If a private room is not available, and the patient cannot be placed in a room with a patient who has the same infection, a distance of at least 1 meter (3 feet) should separate the infected patient and other patients or visitors.
- Masks must be worn when entering the room.
- If transportation or movement of the patient is essential, the patient must wear a surgical mask.

CONTACT PRECAUTIONS

Contact precautions must be followed for any patients known to be, or suspected of being, infected with epidemiological (capable of spreading rapidly from person to person, an epidemic) microorganisms that can be transmitted by either direct or indirect contact, such as COVID-19. Standard precautions are used at all times. In addition, the following precautions must be taken:

- The patient should be placed in a private room or, if a private room is not available, in a room with a patient who has an active infection caused by the same organism.
- Gloves must be worn when entering the room.
- Gloves must be changed after having contact with any material that may contain high concentrations of the microorganism, such as wound drainage or fecal material.
- Gloves must be removed before leaving the room, and the hands must be washed with an antimicrobial agent.
- A gown must be worn in the room. The gown must be removed before leaving the room, and care must be taken to ensure that clothing is not contaminated after gown removal.
- Movement and transportation of the patient from the room should be for essential purposes only.
- The room and items in it must receive daily cleaning and disinfection.
- If possible, patient-care equipment (bedside commode, stethoscope, sphygmomanometer, thermometer) should be left in the room and used only for this patient. If this is not possible, all equipment must be cleaned and disinfected before being used on another patient.

PROTECTIVE OR REVERSE ISOLATION

Protective or reverse isolation refers to methods used to protect certain patients from organisms present in the environment. It is used mainly for those whose body defenses are not capable of protecting them from infections and disease. Examples of patients who require this protection are patients who are severely burned, patients receiving chemotherapy or radiation treatments for cancer, or patients whose immune systems have failed.

Standard precautions are used at all times. In addition, the following precautions may be taken:

- The patient is placed in a room that has been cleaned and disinfected.
- The room is disinfected frequently while the patient stays there.

- Anyone entering the room must wear clean or sterile gowns, gloves, and masks.
- Equipment or supplies brought into the room are disinfected or sterile.
- Special filters may be used to purify the air that enters the room.
- Every effort is made to protect the patient from microorganisms that cause infection or disease.

checkpoint

1. What is a communicable disease?
2. When should standard precautions be used?

Today's Research — Tomorrow's Health Care

Paint Away Those Germs?

Health care-associated infections are a major problem for health care providers. MRSA is one of the most common health care-associated infections. It is a bacterium that causes severe infections in humans and is difficult to treat because it is resistant to many antibiotics, which means the antibiotics will not eliminate the organism.

Now, thanks to biotechnology research, it is possible to use paint to kill MRSA germs. Researchers studied a naturally occurring enzyme, lysostaphin, that is used by nonpathogenic (nondisease-producing) strains of *Staphylococcus* bacteria to defend themselves against *S. aureus*. Lysostaphin is harmless to humans and toxic only to MRSA. It is not an antibiotic to which bacteria could become resistant, and it does not leach chemicals into the environment.

Lysostaphin kills MRSA bacteria by slicing open the cell wall, causing the MRSA cell to explode and die. One problem encountered during the research was that the lysostaphin was not stable and would not remain in other substances for long periods. The researchers solved this problem by packing the lysostaphin in carbon nanotubes, tiny structures that lock the enzyme in place. The nanotubes containing the enzyme were put in a can of ordinary house paint, which was used to paint a wall. Studies showed that 100% of MRSA organisms were destroyed when they came into contact with the paint. The paint remained effective even after repeated washings. Recently, a microbicidal paint has been created that kills more than 99% of MRSA, *Escherichia coli*, and vancomycin-resistant *Enterococcus faecalis* pathogens within 2 hours of exposure on painted surfaces.

This initial research could provide many benefits for both health care and other commercial products. By creating coatings containing nanotubes of lysostaphin, commercial products could be developed for walls, furniture, medical equipment, food-processing equipment, and even items such as shoes, masks, or hospital gowns. If this happens, a simple, inexpensive, naturally occurring substance could prevent health care-associated infections, save lives, and decrease medical costs.

Case Study Investigation Conclusion

What PPE would allow Fahad and Ayisha to work safely in the emergency department during the COVID-19 pandemic? As health care team members became ill, Fahad and Ayisha had to cross-train in other areas of the hospital, for example, transportation and intensive care. Would these new duties affect the type of PPE and isolation techniques they would need to use?

CHAPTER 11 SUMMARY

- Understanding the basic principles of infection control is essential for any health care provider in any health care field. Disease is caused by a wide variety of pathogens. An understanding of the types of pathogens, methods of transmission, and the chain of infection allows health care providers to take precautions to prevent the spread of disease.
- Asepsis is defined as "the absence of disease-producing microorganisms, or pathogens". Antisepsis refers to methods that prevent or inhibit the growth of pathogenic organisms. Disinfection is a process that uses chemical disinfectants to destroy or kill pathogenic organisms, but it is not always effective against spores and viruses. Sterilization is a process that destroys all microorganisms, including spores and viruses.
- Standard precautions provide guidelines for handwashing, wearing gloves, using gowns, masks, and protective eyewear when splashing is likely, proper handling and disposal of contaminated sharp objects, proper disposal of contaminated waste, and proper methods to wipe up spills of blood, body fluids, secretions, and excretions.
- Sterile techniques are used in specific procedures, such as changing dressings. Health care providers must learn and follow sterile techniques when they are required to perform these procedures.
- Transmission-based precautions are used for patients who have communicable diseases. An awareness of the major types of transmission-based precautions presented in this chapter will help the health care provider prevent the transmission of communicable diseases.
- Infection control must be followed during health care procedures. By following the principles discussed in this chapter, health care providers will protect themselves, patients, and others from disease.

REVIEW QUESTIONS

1. Differentiate between antisepsis, disinfection, and sterilization.

2. Explain the three different methods of cleaning equipment and their uses.

3. Name the different types of PPE and state when each type must be worn to meet the requirements of standard precautions.

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4. Name three methods that can be used to place sterile items on a sterile field. Identify the types of items that can be transferred by each method.

5. What should you do after a procedure requiring sterile gloves has been completed and why?

6. List the three main types of transmission-based precautions and the basic principles that must be followed for each type.

7. What is protective or reverse isolation and when would you use it?

8. What is a bloodborne pathogen? Give three examples.

9. What is the difference between clean and contaminated?

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CRITICAL THINKING

10. List the six classes of microorganisms and infective agents, and describe the characteristics of each. What is the treatment for each type of microorganism? Are there any challenges with treatments?

11. What are body defenses and why do we have them? What happens when your body defenses are weak?

12. How can the chain of infection be broken? Why is this important?

13. What is a health care-associated infection and why are these types of infection more dangerous?

ACTIVITIES

1. With a partner, research the effects of practices of sanitation and disinfection on health and wellness. Include the implications for public health during the COVID-19 pandemic. Present your findings to the class, citing evidence from your investigation.
2. In a small group, pick a disease from the list below. Research the disease. Create a flow chart that lists the six components of the chain of infection as applied to this disease and strategies to break each part of the chain: COVID-19, tuberculosis, dysentery, pneumonia, MRSA infection (from wound drainage).
3. Work with a partner. You will need two pairs of sterile gloves. One person reads out the instructions for donning sterile gloves. The other person should follow the instructions to put on the gloves and then take them off. Now swap roles so each of you gets a turn at putting on the gloves.
4. Write a leaflet explaining to patients how to break the chain of infection.

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Link to digital lesson

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CHAPTER

12 VITAL SIGNS

Case Study Investigation

Salem is a 32-year-old man who is working in construction. He is married with two children and moved to a different city last month. He is 1.9 meters tall and weighs 130 kg. Salem has not seen a doctor in 3 years but goes to the clinic after experiencing a persistent headache and dizziness. Suspecting hypertension, the doctor asks him to stop by the clinic every afternoon for 2 weeks to have his blood pressure monitored. At the end of this chapter, you will be asked why this is a good plan for Salem.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- List the vital signs.
- Identify methods of measuring and recording body temperature, pulse rate, respirations, and blood pressure.

KEY TERMS

blood pressure
pain
pulse
oximeter
respirations
sphygmomanometer
stethoscope
temperature
thermometers
vital signs

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12:1 MEASURING AND RECORDING VITAL SIGNS

Vital signs provide information about a patient's basic health condition. The main vital signs are temperature, pulse, respirations, blood pressure, and pain. Other important vital signs that provide information about the patient's condition include oxygen saturations (measurement of the percentage of oxygen in the blood), the color of the skin, the size of the pupils in the eyes and their reaction to light, the level of consciousness, and the patient's response to stimuli.

- **Temperature** is the balance between heat lost and heat produced by the body. Temperature can be measured in the mouth (oral), rectum (rectal), armpit (axillary), or ear (aural), on the forehead (temporal), or on the surface of the skin with a noncontact thermometer. A low or high reading can indicate infection or disease.
- **Pulse** is the pressure of the blood felt against the wall of an artery as the heart contracts and relaxes, or beats. The rate, rhythm, and volume are also important to record. Rate refers to the number of beats per minute, rhythm refers to regularity, and volume refers to strength, force, or quality. The pulse is usually taken over the radial artery, on the inside of the wrist. Any abnormality can indicate disease.
- **Respirations** reflect the breathing rate of the patient. In addition to the respiration count, the rhythm (regularity) and character (type) of respirations are noted. Abnormal respirations usually indicate that a health problem or disease is present.
- **Blood pressure** is the force exerted by the blood against the arterial walls when the heart contracts or relaxes. Two readings (systolic and diastolic) are noted to show the greatest pressure and the least pressure. Abnormal blood pressure is often the first indication of disease.
- **Pain** is an unpleasant sensation that is perceived in the nervous system when illness or injury occurs. Pain can be acute or chronic. Acute pain lasts for a short time, for example, post-operative pain or pain from a physical injury. Chronic pain is long-term, for example, arthritis or back pain. Pain can be measured using a scale of 0–10, with 0 being no pain, 1 being very mild pain, and 10 being the worst pain imaginable. If the patient is unable to rate their pain with a number, a series of faces ranging from happy to very sad can be shown to describe how they are feeling, or they can choose words in a list that describe how they are feeling (**Figure 12–1**).

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- Another vital sign is the **apical pulse**. This pulse is taken with a **stethoscope** at the apex of the heart. The actual heartbeat is heard and counted. The apical pulse is taken in patients with a weak radial pulse, or in infants or children who generally have a rapid radial pulse that is difficult to count.

Comm

Health care providers are responsible for taking the patient's vital signs, which must be recorded accurately. Any change in vital signs must be reported immediately, as this is often the first indication of a change in the patient's condition.

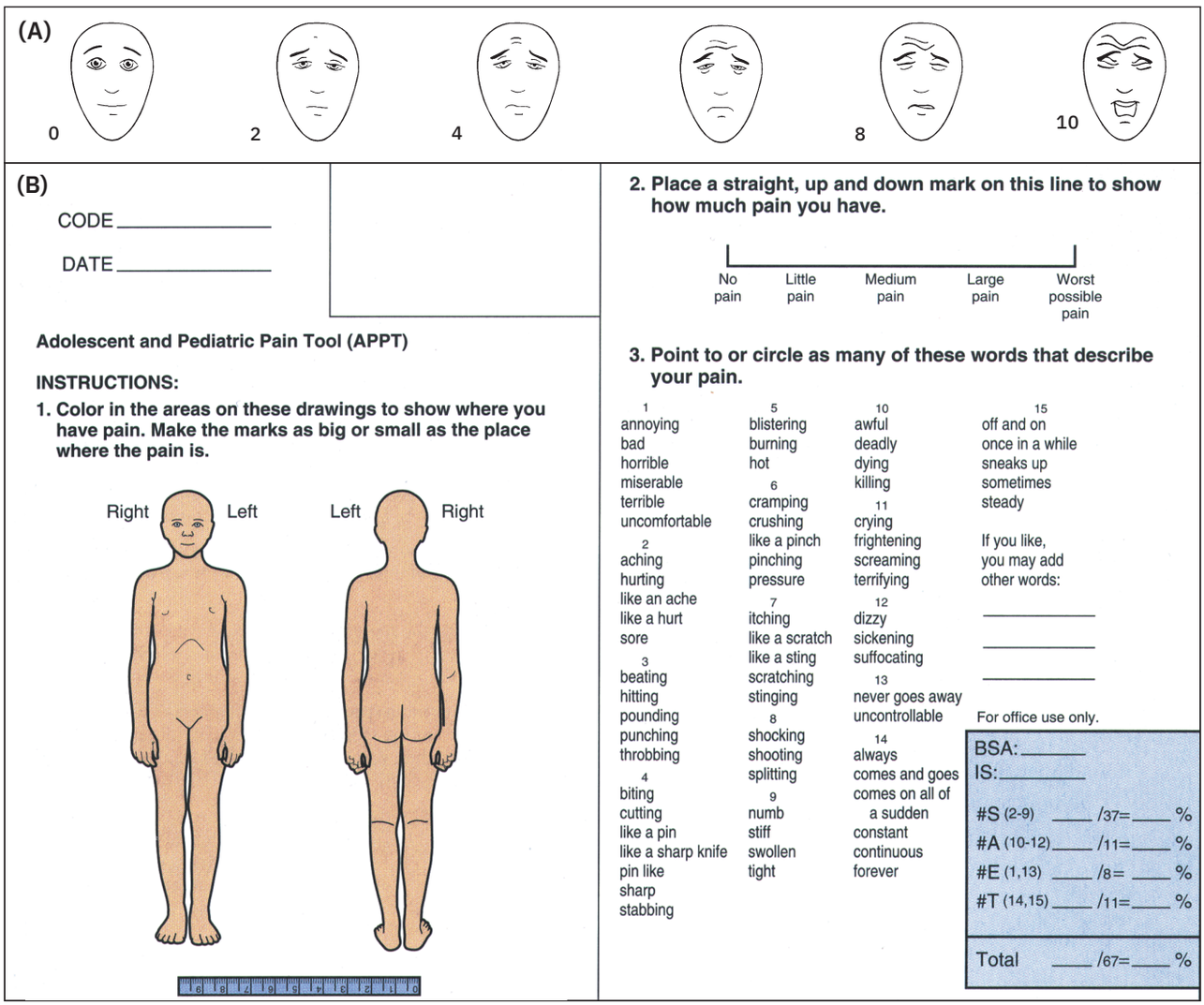


FIGURE 12–1 (**A**) Pain can be measured by asking the patient to rate the level of pain on a scale of 0–10. (**B**) For children, a special scale tool can be used that will allow a child to color an area of the body where they have pain or to choose words in a list that describe how they are feeling.

checkpoint

1. What are the main vital signs?
2. Name two other important vital signs.

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12:2 MEASURING AND RECORDING TEMPERATURE

Heat is lost through perspiration, respiration, and excretion (urine and feces). Heat is produced by the metabolism of food and by muscle and gland activity. A constant state of fluid balance, known as homeostasis, is the body's ideal state of health. The rates of chemical reactions in the body are regulated by body temperature. If body temperature is too high or too low, the body's fluid balance and homeostatic state are affected.

VARIATIONS IN BODY TEMPERATURE

The normal range for body temperature is 36.1–37.8 degrees Celsius (°C), or 97–100 degrees Fahrenheit (°F) (**Figure 12–2**). However, variations in body temperature can occur. Some reasons for variations include:

- Individual differences.
- Time of day: body temperature is usually lower in the morning and higher in the evening.
- Body sites: different body parts register temperature differently, as shown in **Table 12–1**.

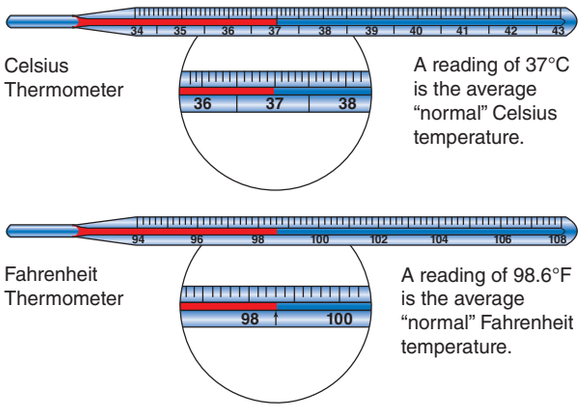


FIGURE 12–2 Normal oral body temperature on Celsius and Fahrenheit thermometers.

TABLE 12–1 Average Temperature Variations by Body Site

Temperature	Oral and/or Tympanic	Rectal, Aural, and/or Temporal	Axillary and/or Groin
Average	37°C (98.6°F)	37.6°C (99.6°F)	36.4°C (97.6°F)
Normal range	36.5–37.5°C (97.6–99.6°F)	37–38.1°C (98.6–100.6°F)	36–37°C (96.6–98.6°F)

Body temperatures can be above or below the normal range for a variety of reasons:

- Causes of increased body temperature: illness, infection, exercise, excitement, and high temperatures in the environment.
- Causes of decreased body temperature: starvation or fasting, sleep, decreased muscle activity, mouth breathing, exposure to cold temperatures in the environment, and certain diseases.

Very low or very high body temperatures are indicative of abnormal conditions:

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- **Hypothermia** is a low body temperature, below 35°C (95°F) measured rectally. It can be caused by prolonged exposure to cold. Death occurs if body temperature drops below 33.9°C (93°F) for a period of time.
- A **fever** is an elevated body temperature, usually above 38.3°C (101°F) measured rectally. Pyrexia is another term for fever. The term "febrile" means that a fever is present; "afebrile" means that no fever is present, or the temperature is within the normal range. Fevers are usually caused by infection or injury.
- **Hyperthermia** occurs when the body temperature exceeds 40°C (104°F) measured rectally. It can be caused by prolonged exposure to hot temperatures, brain damage, and serious infections. Immediate actions must be taken to lower body temperature because temperatures above 41.1°C (106°F) can quickly lead to convulsions, brain damage, and death.

TEMPERATURE-MEASUREMENT SITES

- **Oral temperature** is taken in the mouth. Eating, drinking hot or cold liquids, and/or using inhalers can alter the temperature in the mouth. It is important to make sure the patient has not had anything to eat or drink or has not used an inhaler for at least 15 minutes prior to taking the patient's oral temperature.



FIGURE 12–3 To take an axillary temperature, insert the thermometer in the hollow of the axilla, or armpit.

- **Rectal temperature** is taken in the rectum. Rectal temperatures are frequently taken on infants and small children, and on patients with hypothermia (below-normal body temperature).
- **Axillary temperature** is taken in the armpit, under the upper arm. The arm is held close to the body, and the thermometer is inserted between the two folds of skin (**Figure 12–3**).
- A **groin temperature** is taken between the two folds of skin formed by the inner part of the thigh and the lower abdomen. Both axillary and groin are external temperatures and are less accurate.
- Science **Aural temperature** is taken with a special tympanic thermometer that is placed in the outer ear. The thermometer measures the thermal, infrared energy radiating from blood vessels in the tympanic membrane, or eardrum. Because this provides a measurement of body core temperature, the range is similar to rectal or internal body temperature.

- **Temporal temperature** is taken with a temporal scanning thermometer that is passed in a straight line across the forehead, midway between the eyebrows and upper hairline. The thermometer measures the temperature in the temporal artery and is similar to a rectal temperature because it measures the temperature inside the body or bloodstream.

TYPES OF THERMOMETER

- A **clinical thermometer** consists of a slender glass tube containing mercury or a heat-reactive mercury-free liquid such as alcohol, which expands when exposed to heat. Thermometers containing mercury are banned in many countries. The bulb of the thermometer is inserted under the tongue (**Figure 12–4**).
- An **electronic thermometer** uses a heat sensor to record temperature and displays the temperature on a viewer in a few seconds. Electronic thermometers can be used to take oral, rectal, axillary, and groin temperatures (**Figure 12–5**).
- **Tympanic thermometers** are specialized electronic thermometers that use an infrared sensor to record the temperature in the ear (**Figure 12–6**).
- **Temporal scanning thermometers** are specialized electronic thermometers that use an infrared scanner to measure the temperature in the temporal artery of the forehead (**Figure 12–7**).
- **Noncontact infrared thermometers** use light-wavelength technology to measure the thermal energy radiating from the skin without requiring any physical contact with the person (**Figure 12–8**). This type of thermometer was used widely during the COVID-19 pandemic and is ideal for screening the temperatures of many individuals quickly and accurately with no contamination of the thermometer.
- Plastic or paper **disposable thermometers** contain chemical dots or strips that change color when exposed to specific temperatures. Some types are placed on the forehead, and record skin temperature. Other types are used orally. Both types are used once and discarded.

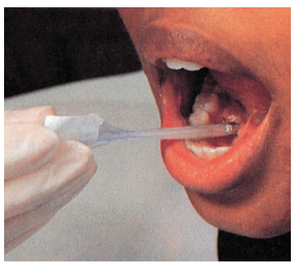


FIGURE 12–4 Insert the bulb of the thermometer under the patient's tongue (sublingually).



FIGURE 12–5 Electronic thermometers can be used to take oral, rectal, axillary, and/or groin temperatures. While taking a temperature, hold the probe of the electronic thermometer in place.



FIGURE 12–6 After inserting the covered probe of the tympanic thermometer into the ear canal, press the scan or activation button and hold the thermometer steady until the temperature reading is displayed.



FIGURE 12–7 To take a temporal temperature, hold the scan button while lightly sliding the thermometer across the forehead midway between the eyebrow and hairline.



FIGURE 12–8 Non-contact infrared thermometers can measure the thermal energy radiating from the skin.

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FIGURE 12–9 A clinical thermometer is held at eye level to find the solid column of mercury or mercury-free liquid.

READING AND RECORDING TEMPERATURE

Electronic, tympanic, temporal, and noncontact infrared thermometers are easy to read because they have digital displays. To read a glass clinical thermometer, it is held at eye level and rotated slowly to find the solid column of mercury or mercury-free liquid (**Figure 12–9**). The thermometer is read at the point where the liquid line ends.

CLEANING THERMOMETERS

Thermometers must be cleaned thoroughly after use. Glass clinical thermometers can be washed and rinsed. Cool water is used to prevent breakage and to avoid destroying the column of liquid. The thermometer is then soaked in a disinfectant solution (frequently 70% alcohol) for a minimum of 30 minutes before it is used again. Some clinical thermometers are covered with a plastic sheath that is discarded after use.

The probe on electronic thermometers is covered with a plastic sheath that is discarded after each use. These covers prevent the thermometers from coming into contact with the patient's mouth and prevent transmission of germs.

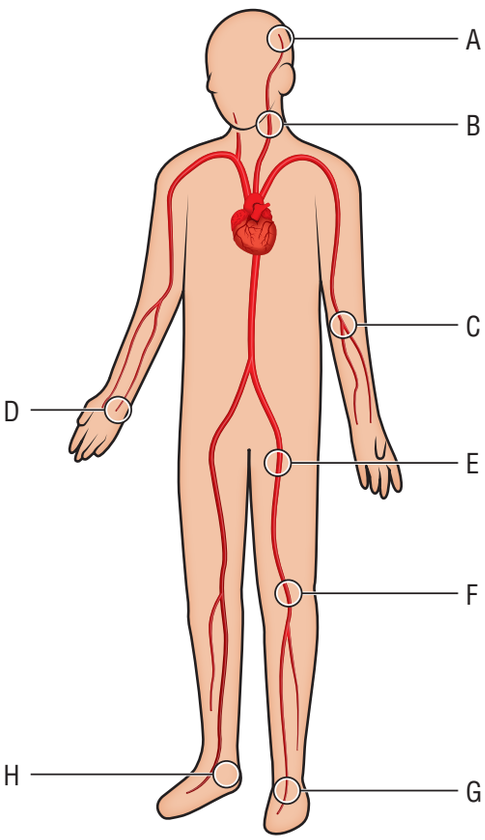


FIGURE 12–10 Major pulse sites.

checkpoint

1. What are three reasons for variation in body temperature?
2. What is a tympanic thermometer?

12:3 MEASURING AND RECORDING PULSE

Science

Pulse refers to the pressure of the blood pushing against the wall of an artery as the heart beats and rests. The pulse is felt more easily in arteries that lie fairly close to the skin and can be pressed against a bone by the fingers.

The pulse can be felt at different arterial sites on the body. Some of the major sites are shown in **Figure 12–10**:

- Temporal (A): on either side of the forehead.
- Carotid (B): at the neck on either side of the trachea.
- Brachial (C): at the inner forearm in the antecubital space (crease of the elbow).

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- Radial (D): at the inner wrist, on the same side as the thumb, taken over the radial artery (**Figure 12–11**).
- Femoral (E): at the upper thigh where the thigh joins the trunk of the body.
- Popliteal (F): behind the knee.
- Dorsalis pedis or pedal (G): at the top of the arch of the foot.
- Posterior tibial (H): just below and behind the medial malleolus (the bony part of the ankle that sticks out on the inner side of the leg).



FIGURE 12–11 To count a radial pulse, put the tips of two or three fingers on the thumb side of the patient's wrist.

Each time a pulse is measured, three different facts must be noted: the rate, the rhythm, and the volume of the pulse.

- The **rate** of the pulse is measured as the number of beats per minute. Pulse rates vary among individuals, depending on age, gender, and body size (**Table 12–2**).
- The **rhythm** of the pulse refers to how regular (normal) or irregular (abnormal) a pulse is. *Arrhythmia* is the medical word for an irregular or abnormal rhythm.
- The **volume**, or the strength, force, quality, or intensity of the pulse, is also noted. It is described by words such as bounding, strong, weak, or thready.

TABLE 12–2 Pulse Rates

Individuals	Range of Pulse Rate (Beats Per Minute)
Adults generally	60–100
Adult men	60–70
Adult women	65–80
Children aged over 7	70–100
Children aged 1–7	80–110
Infants	100–160
Bradycardia (slow heart rate)	Under 60
Tachycardia (fast heart rate)	Over 100 (except in children)

Various factors will change pulse rate:

- Increased, or accelerated, rates can be caused by exercise, stimulant drugs, excitement, fever, dehydration, shock, nervous tension, and other similar factors.
- Decreased, or slower, rates can be caused by sleep, depressant drugs, heart disease, coma, physical training, and other similar factors.



FIGURE 12–12 A pulse oximeter measures the percentage of oxygen in the blood. Many oximeters also measure the pulse rate per minute.

Another vital sign that is taken is the measurement of the **oxygen level** of the blood using a pulse **oximeter** (**Figure 12–12**). Pulse oximeters are simple clip-like devices that are placed on a finger, toe, or ear lobe. Oximeters use light to determine the percentage of oxygen in the blood and display the result on the screen. In addition, many oximeters also measure pulse rate. A normal range of blood oxygen saturation level is 95–100%. Levels below 90% are considered to be hypoxia, a deficiency of oxygen reaching the tissues, and may indicate the need for supplemental oxygen.

checkpoint

1. What artery site is usually used to obtain a pulse?
2. What is the normal range of pulse rate for adult women?

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12:4 MEASURING AND RECORDING RESPIRATIONS

Science

Respiration is the process of taking in oxygen (O_2) and expelling carbon dioxide (CO_2) from the lungs and respiratory tract. One respiration consists of one inspiration (breathing in) and one expiration (breathing out).

Each time respiration is measured, three different facts must be noted: the rate, the character, and the rhythm of respirations. These three facts provide complete information about how the patient is breathing. For example, a respiration measurement of 18, deep and regular, is much different to a measurement of 18, very shallow and irregular.

- The **respiration rate** counts the numbers of breaths per minute.
  - The normal respiration rate in adults is 12–20 breaths per minute.
  - In children, respirations are slightly faster than those for adults and average 16–30 per minute.
  - In infants, the rate may be 30–50 per minute.
- **Character** refers to the depth and quality of respirations. Words used to describe character include *deep*, *shallow*, *labored*, *difficult*, *stertorous* (abnormal sounds like snoring), and *moist*.
- **Rhythm** refers to the regularity of respirations, or equal spacing between breaths. It is described as regular or irregular.

The following terminology is used to describe abnormal respirations:

- **Dyspnea**: difficult or labored breathing.
- **Apnea**: absence of respirations, usually a period of no respirations.
- **Tachypnea**: rapid, shallow respiratory rate above 25 respirations per minute.
- **Bradypnea**: slow respiratory rate, usually below 10 respirations per minute.
- **Orthopnea**: severe dyspnea in which breathing is very difficult when lying flat.
- **Rales**: bubbling, crackling, or noisy sounds caused by fluids or mucus in the air passages.

- **Wheezing**: difficult breathing, with a high-pitched whistling or sighing sound during expiration; caused by a narrowing of the airway (for example, in asthma).
- **Cyanosis**: a dusky, bluish discoloration of the skin, lips, and/or nail beds as a result of decreased oxygen and increased carbon dioxide in the bloodstream.

Respirations must be counted in such a way that the patient is unaware of the procedure. Because respirations are partially under voluntary control, patients may breathe more quickly or more slowly when they become aware of the fact that respirations are being counted.

checkpoint

1. What three facts provide complete information about respirations?
2. What is apnea?

12:5 MEASURING AND RECORDING APICAL PULSE

An **apical pulse** is a pulse count taken with a **stethoscope** at the apex (the lower left side) of the heart. A stethoscope is an instrument which amplifies sounds, making them louder so they are easier to hear. Parts of the stethoscope include the earpieces, tubing, and the bell or thin, flexible disk called a *diaphragm* (**Figure 12–13**).



FIGURE 12–13 Parts of a stethoscope.



FIGURE 12–14 An apical pulse is frequently taken on infants and small children because their pulses are more rapid.

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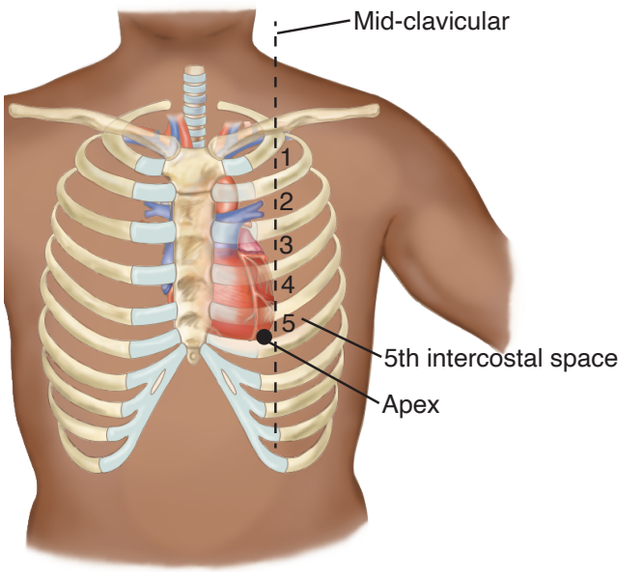


FIGURE 12–15 Locate the apex of the heart at the fifth intercostal (between the ribs) space by the midclavicular (middle of the collarbone) line.

An apical pulse is taken for patients with irregular heartbeats, hardening of the arteries, or weak or rapid radial pulses. Because children and infants have very rapid radial pulse counts, apical pulse counts are usually taken (**Figure 12–14**). It is generally easier to count a rapid pulse using a stethoscope than by feeling it with your fingers. Place the diaphragm 5–7 cm to the left of the breastbone. Use your index finger to locate the fifth intercostal (between the ribs) space at the midclavicular (middle of the collarbone) line (**Figure 12–15**). Listen for heart sounds.

Science

Two separate heart sounds are heard while listening to the heartbeat. The sounds resemble a "lubb-dupp." Each lubb-dupp counts as one heartbeat. The sounds are caused by the closing of the heart valves as blood flows through the chambers of the heart. Any abnormal sounds or beats should be reported immediately.

checkpoint

1. What are the three parts of a stethoscope?
2. Why are apical pulse counts usually taken in children?

12:6 MEASURING AND RECORDING BLOOD PRESSURE

Science

Blood pressure is a measurement of the pressure that the blood exerts on the walls of the arteries during the various stages of heart activity.

There are two types of blood pressure measurements: systolic and diastolic:

- Systolic pressure is the pressure of the left ventricle of the heart as it is contracting and pushing blood into the arteries.
- Diastolic pressure is the pressure when the left ventricle of the heart is at rest, or between contractions. During the rest period, the volume of blood in the arteries has decreased.
- Normal values and classifications for diastolic and systolic pressure are shown in **Table 12–3**.

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Blood pressure is recorded as a fraction. The systolic reading is the top number, or numerator. The diastolic reading is the bottom number, or denominator. For example, a systolic reading of 120 and a diastolic reading of 80 are record3d as 120/80.

TABLE 12–3 Classifications of Blood Pressure in Adults in Millimeters of Mercury (mmHg)

Category	Systolic (mmHg)		Diastolic (mmHg)
Normal blood pressure	<120	and	<80
Elevated	120–129	and	<80
Stage 1	130–139	or	80–89
Stage 2	>140	or	>90
Hypertensive crisis	>180	and/or	>120

Note: < = less than; > = greater than.

- **Elevated blood pressure** is when systolic blood pressure is between 120 and 129 millimeters (mm) of mercury (Hg), and diastolic is less than 80 mmHg. Elevated blood pressure is a warning that high blood pressure will develop unless steps are taken to prevent it. Elevated blood pressure can harden arteries and block vessels that nourish the heart. Proper nutrition and regular exercise are the main treatments for elevated blood pressure.
- **Hypertension**, or high blood pressure, is indicated when pressures are greater than 130 mmHg systolic and 80 mmHg diastolic:
  - *Stage 1 hypertension*: systolic between 130 and 139 mmHg or a diastolic between 80 and 89 mmHg. People in this category take medication if they have had a heart attack or cerebrovascular accident (stroke), or have an underlying condition. They are also recommended to make lifestyle changes like eating a low-salt diet and exercising more.
  - *Stage 2 hypertension* occurs when blood pressure is a systolic of more than 140 mmHg or a diastolic of more than 90 mmHg. Stage 2 hypertension is treated with medication and lifestyle changes.
  - A *hypertensive crisis* occurs when blood pressure is measured at a systolic over 180 mmHg and/or a diastolic over 120 mmHg. Immediate medication changes are indicated, and possible hospitalization, as this level of blood pressure can damage blood vessels and cause stroke. Common causes include obesity, high salt intake, kidney disease, thyroid deficiency, and vascular conditions such as arteriosclerosis (hardening of the arteries).
  - Hypertension is often called a "silent killer" because most individuals do not have any signs or symptoms of the disease. Common causes include a poor diet, lack of exercise, being overweight, genetic predisposition, use of some medications, and some diseases such as diabetes or kidney disease. If hypertension is not treated, it can lead to stroke, kidney disease, and/or heart disease.

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- **Hypotension**, or low blood pressure, is indicated when pressures are less than 90 mmHg systolic and 60 mmHg diastolic. Hypotension can be caused by strenuous exercise, endocrine problems, hormonal changes, excessive heat, low blood volume, widening of blood vessels, anemia, vitamin B_{12} deficiency, anaphylaxis, heart problems, or use of some medications. Hypotension may also occur with heart failure, dehydration, depression, severe burns, hemorrhage, and shock.
  - Orthostatic, or postural, hypotension occurs when there is a sudden drop in both systolic and diastolic pressure when an individual moves from a lying to a sitting or standing position. It is caused by the inability of blood vessels to compensate quickly to the change in position. The individual becomes light-headed and dizzy, and may experience blurred vision.

Many factors can influence blood pressure readings. These factors can cause blood pressure to be high or low. Some examples include:

- Factors causing changes in readings: force of the heartbeat, resistance of the arterial system, elasticity of the arteries, volume of blood in the arteries, and position of the patient (lying down, sitting, or standing).
- Factors that may increase blood pressure: excitement, anxiety, nervous tension, exercise, eating, pain, obesity, and/or stimulant drugs.
- Factors that may decrease blood pressure: rest or sleep, depressant drugs, shock, dehydration, hemorrhage (excessive loss of blood), and fasting.
- Stress triggers the body to produce hormones that temporarily increase the blood pressure by causing the heart to beat faster and the blood vessels to narrow. This can cause "white-coat" hypertension, when blood pressure readings are higher at the doctors' office than in other settings.

TAKING A BLOOD PRESSURE READING

Blood pressure is read on an instrument known as a **sphygmomanometer**. There are three main types of manual sphygmomanometers: mercury, aneroid, and electronic. Blood pressure and pulse readings are shown on a digital display after a cuff is placed on the patient. Automatic sphygmomanometers are also available (**Figure 12–16**).

To obtain accurate blood pressure readings, the patient should sit quietly for at least 5 minutes before blood pressure is taken, so they are not stressed. Two separate readings should be taken and averaged, with a minimum wait of 30 seconds between readings.

The size and placement of the sphygmomanometer cuff are also important (**Figure 12–17**). The cuff contains a rubber bladder that fills



FIGURE 12–16
Automatic sphygmomanometers provide a digital display of blood pressure and pulse readings.

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with air to apply pressure to the arteries. Cuffs that are too wide or too narrow give inaccurate readings. A cuff that is too small will give an artificially high reading; if it is too large, it will give an artificially low reading.

The bell/diaphragm should be placed directly over the brachial artery on the antecubital area (the inside of the elbow) and held securely but with as little pressure as possible.

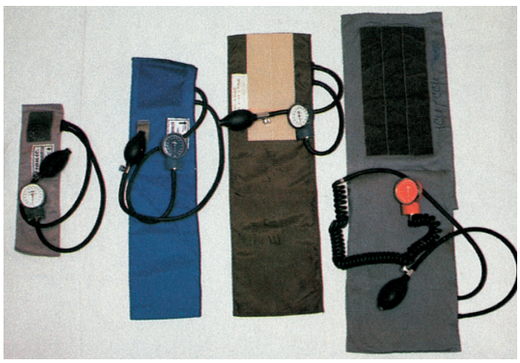


FIGURE 12–17 It is important to use the correct size cuff because cuffs that are too wide or too narrow will result in inaccurate readings.

checkpoint

1. Blood pressure is read in millimeters of what?
2. Which artery is used to obtain a blood pressure reading?

Today's Research — Tomorrow's Health Care

An Artificial Heart That Eliminates the Need for Heart Transplants?

Artificial hearts have been in use for many years. They are used to keep a patient alive until a heart transplant can be found. Researchers have developed a new type of artificial heart. By using miniaturized electronics and high-capacity lithium batteries, scientists have created a heart that allows a patient to wear a battery pack on their waist. Electrical energy passes through the patient's skin to power the implanted heart. This allows the patient to resume many normal daily activities. The patient is no longer attached by wires to a power source. Patients have lived for many months with this type of heart while waiting for a suitable transplant.

Most of these devices are called ventricular-assist devices (VADs) (**Figure 12–18**) because they work with the patient's diseased heart to maintain circulation in the body. Researchers are now working on an artificial heart that will work in place of a patient's damaged heart. Currently, one total artificial heart is available in the United States. It consists of two ventricles and four valves that allow blood to be pumped through the body. It has a preset rate of 125 beats per minute. It works efficiently, but it is still meant to be a temporary replacement while a patient waits for a heart transplant. It requires a person to carry a backpack containing an external air compressor that pumps the implanted heart from the outside. The compressor can be powered with batteries or plugged into an electrical source. Research now is directed toward creating a total artificial heart with an internal compressor and/or electrical source. This total artificial heart will have computerized intelligence to understand when additional blood is needed by the body. It will be able to respond to the demands of the body and increase or decrease the heart rate as needed. It will be created from materials that will not cause a rejection reaction in the body. And finally, it will last for many years.

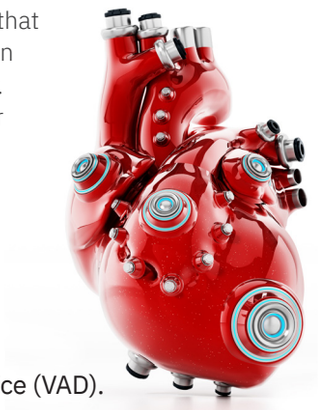


FIGURE 12–18
A ventricular-assist device (VAD).

Case Study Investigation Conclusion

What were possible reasons for monitoring Salem's blood pressure for 2 weeks? What psychological reasons may be impacting his blood pressure? What other possible factors do you think the doctor may have considered when having Salem monitored before prescribing medication?

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CHAPTER 12 SUMMARY

- Vital signs are important indicators of health states of the body. The main vital signs are temperature, pulse, respiration, blood pressure, and pain.
- Temperature is a measurement of the balance between heat lost and heat produced by the body. It can be measured orally, rectally, aurally (in the ear), temporally, and between folds of skin, such as the axillary or groin area.
- Pulse is the pressure of the blood felt against the wall of an artery as the heart contracts or beats. It can be measured at various body sites, but the most common site is the radial pulse, at the wrist.
- An apical pulse is taken at the apex of the heart by listening to the heart with a stethoscope.
- Blood oxygen levels can be measured with pulse oximeters.
- Respiration refers to the breathing process. Each respiration consists of an inspiration (breathing in) and an expiration (breathing out).
- Blood pressure is the force exerted by the blood against the arterial walls when the heart contracts or relaxes. Two measurements are noted: systolic and diastolic.
- Pain is an unpleasant sensation that is perceived by the nervous system when illness or injury occurs. Pain can be acute or chronic and is assessed using a pain scale or a list of descriptive words.

REVIEW QUESTIONS

1. What is hyperthermia and why is it dangerous?

2. What is pain and how can it be assessed?

3. Define each of the following: oral; axillary; aural.

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4. What three factors must be noted about every pulse?

5. Why is an apical pulse taken?

6. How is hypoxia defined when measured on a pulse oximeter?

7. Define each of the following: bradycardia, arrhythmia; dyspnea; tachypnea; rales.

8. How does systolic pressure differ from diastolic pressure? What are the normal levels for each?

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9. What factors influence blood pressure readings?

10. Differentiate between hypertension and hypotension, and list the causes of each.

CRITICAL THINKING

1. Describe why the assessment of vital signs is important.

2. What factors increase your pulse rate? What could you do to lower your pulse rate?

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3. Using the Internet, research different types of thermometer. Write a presentation for the class about choosing a thermometer.

4. How can a patient express the degree of pain they are in? What tools can you use to help them?

ACTIVITIES

1. With a partner, create a spreadsheet listing the adult normal range for oral, axillary, and rectal temperature; pulse; respirations; systolic and diastolic blood pressure.
2. Working in pairs, find your partner's radial pulse and count the beats. Make a note of the result. Now ask your partner to walk quickly round the room (or run if that is possible). Take their pulse again, and compare this number with the resting pulse rate. Now swap roles. Was the pulse rate faster after the exercise? If so, why?
3. Working in a small group, make a list of as many descriptive words for pain as you can think of. Can you make your list longer than the other groups in your class?

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Link to digital lesson

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CHAPTER

13 FIRST AID

Case Study Investigation

Khalid and Abdullah were playing soccer in the park with friends. Suddenly, two players, Mohammed and Rashed, ran into each other; Mohammed was knocked down and got right up, but Rashed stayed down and complained of left leg pain. At the end of this chapter, you will be asked what Khalid and Abdullah should do for their teammates until help arrives.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Identify the basic principles of first aid.
- Demonstrate cardiopulmonary resuscitation.
- Describe first aid for:
  - Bleeding and wounds.
  - Shock.
  - Poisoning.
  - Burns.
  - Heat and cold exposure.
  - Bone and joint injuries, including fractures.
  - Sudden illness including heart attack, stroke, fainting, convulsions, and diabetic reactions.

KEY TERMS

abrasion
burn
cardiopulmonary resuscitation (CPR)
defibrillator
diabetic coma
dislocation
first aid
fracture
heart attack
hemorrhage
infection
poisoning
shock
stroke
wound

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13:1 PROVIDING FIRST AID

First aid is not full and complete treatment but is the immediate care that is given to a person who has been injured or is suddenly taken ill. This is to minimize the effect of the injury or illness until medical professionals can take over their care. Application of correct first aid can often mean the difference between life and death, or recovery versus permanent disability. In addition, by knowing the proper first-aid measures, you can help yourself and others in a time of emergency.

BASIC PRINCIPLES OF FIRST AID

Comm

In any situation where first-aid treatment is necessary, it is essential that you remain calm. Avoid panic. Evaluate the situation thoroughly. Always have a reason for anything you do. The treatment you provide will vary, depending on the type of injury or illness, the environment, others present, equipment or supplies on hand, and the availability of medical help.

Step 1

Recognize that an emergency exists. Sometimes, signs of an emergency are clearly evident. Other times, signs are less obvious and require an alert individual to note that something is different or wrong.
Many senses can alert you to an emergency:

- Listen for unusual *sounds*, such as screams, calls for help, breaking glass, or screeching tires.
- Look for unusual *sights*, such as damaged electrical wires, a stalled car, smoke, or fire.
- Note any unusual, unfamiliar, or strange *odors*, such as those of chemicals, natural gas, or pungent fumes.
- Watch for unusual appearances or *behaviors* in others, such as difficulty in breathing, clutching of the chest or throat, abnormal skin *colors*, slurred or confused speech, unexplained confusion or drowsiness, excessive perspiration, signs of pain, and any symptoms of distress.



FIGURE 13–1 Check the scene and make sure it is safe to approach before checking any accident victim.

Step 2

Safety

Check the scene and make sure it is safe to approach (**Figure 13–1**):

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- A quick glance at the area can provide information on what has occurred, dangers present, number of people involved, and other important factors.
- If the scene is not safe, call the appropriate emergency service.
- Do not endanger your own life or the lives of other bystanders.
- Allow professionals to handle fires, dangerous chemicals, damaged electrical wires, and other life-threatening situations.

Step 3

If the scene appears safe, **approach** the person. Determine whether they are conscious:

- Shake the person by tapping their shoulder; ask, "Are you OK?"
- If they do not respond, call the emergency medical services (EMS) immediately.

If the person is conscious, breathing, and able to talk, reassure them and try to determine what has happened:

- Ask about pain or discomfort.
- Check for other types of injuries, such as fractures (broken bones), burns, shock, and specific injuries.
- Note any abnormal signs or symptoms.
- Check vital signs.
- Note the temperature, color, and moistness of the skin.
- Check and compare the pupils of the eyes.
- Look for fluids or blood draining from the mouth, nose, or ears.
- Gently examine the body for cuts, bruises, swelling, and painful areas.
- Report any abnormalities noted to the EMS when they arrive.


Safety

Never move an injured person unless they are in a dangerous area, such as an area filled with fire and/or smoke, flood waters, carbon monoxide, or poisonous fumes, or one with dangerous traffic, where vehicles cannot be stopped. If it is necessary to move the person, do so as quickly and as carefully as possible. People have been injured more severely by improper movement at the scenes of accidents, so avoid any unnecessary movement.

Step 4


Comm

In an emergency, it is essential to **call the EMS** as soon as possible. The time factor is critical. Early access to advanced medical care increases the person's chance of survival:

- Dial 997 to contact the EMS ambulance service.
- Describe the situation, actions taken, exact location, telephone number from which you are calling, assistance required, number of people involved, and the condition of the person(s).
- Do not hang up until the EMS has all the necessary information.
- If you are alone, call the EMS immediately before attempting to provide any care to:

  - An unconscious adult.

  - An unconscious adolescent.

  - An unconscious infant or child with a high risk for heart problems.

  - Anyone who you see with a sudden cardiac arrest.
- If you are alone, call the EMS and start **cardiopulmonary resuscitation** (CPR) if needed for:

  - Any unconscious infant or child from 1 year of age to puberty.

  - Any victim of submersion or near drowning.

  - Anyone with cardiac arrest caused by trauma.
- Continue providing care by giving 5 cycles of CPR (about 2 minutes) until the EMS arrive.

Step 5

After calling for help, **provide care** to the person:

- If possible, obtain the person's permission before providing any care.
- Introduce yourself and ask if you can help.
- If they are a child or adolescent, and a parent is present, obtain permission from the parent.
- If the person is unconscious, confused, or seriously ill and unable to consent to care, and no other relative is available to give permission, you can assume that you have permission.
- Remember that every individual has the right to refuse care.
- If a person refuses to give consent for care, do not proceed.
- If possible, have someone witness the refusal of care.
- If a life-threatening emergency exists, call the EMS, alert them to the situation, and allow the professionals to take over.

Step 6

At times, it may be necessary to **triage** the situation. Triage is a method of prioritizing treatment. If a person has more than one injury or illness, the most severe injury or illness must be treated first. If two or more people are involved, triage also determines which person is treated first. Life-threatening emergencies must be treated first. Examples include:

- No pulse.
- No breathing or difficulty in breathing.
- Severe bleeding.
- Persistent pain in the chest or abdomen.
- Vomiting or passing blood.
- Poisoning.
- Head, neck, or spine injuries.
- Open chest or abdominal wounds.
- Shock.
- Severe partial-thickness and all full-thickness burns.

Step 7


Comm

Obtain **information** regarding the accident, injury, or illness. This information can then be given to the correct authorities:

- Information can be obtained from the person or other people present, or by examination of items present at the scene.
- Emergency medical identification contained in a bracelet, necklace, or medical card is an important source of information.
- Empty medicine containers, and in case of poison, bottles of chemicals or solutions, or similar items can also reveal important information.
- Be alert to all such sources of information.

General Principles

Some general principles of care should be observed when first aid is necessary:

- Obtain qualified assistance as soon as possible.
- Report all information obtained, observations noted, treatment given, and other important facts to the correct authorities.
- Avoid any unnecessary movement of the injured/ill person.
- Reassure the person. A calm attitude will help relieve their anxiety.

- If the person is unconscious or vomiting, do not give them anything to eat or drink. It is best to avoid giving anything to eat or drink while providing first-aid treatment, unless the specific treatment requires that fluids or food be given.
- Protect the person from cold or chilling but avoid overheating them.
- Work quickly but in an organized and efficient manner.
- Do not make a diagnosis or discuss the person's condition with observers at the scene. It is essential to maintain confidentiality and protect the person's right to privacy while providing treatment.
- Make every attempt to avoid further injury.

checkpoint

1. What is the first step of first aid?
2. What is triage?

13:2 PERFORMING CARDIOPULMONARY RESUSCITATION

When you administer CPR, you breathe for the person and circulate the blood. The purpose is to keep oxygenated blood flowing to the brain and other vital body organs until the heart and lungs start working again, or until medical help is available.

Clinical death occurs when the heart stops beating, and the person stops breathing. Biological death refers to the death of the body cells. Biological death occurs 4–6 minutes after clinical death and can result in permanent brain damage, as well as damage to other vital organs. If CPR can be started immediately after clinical death occurs, the person may be revived.

COMPONENTS OF CPR

CPR is a life-saving technique used for people who have no pulse and have stopped breathing. A common sequence is *circulation*, *airway*, *breathing*, *defibrillation*. The goal is to start compressions within 10 seconds of recognizing cardiac arrest. This sequence is used for adults, children, and infants, and includes:

- **Circulation**: By applying pressure to a certain area of the sternum (breastbone), the heart is compressed between the sternum and vertebral column. Blood is squeezed out of the heart and into the blood vessels. In this way, oxygen is supplied to body cells.

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FIGURE 13–2 Open the airway by using the head-tilt/chin-lift method.



FIGURE 13–3 Use a CPR barrier mask to prevent the transmission of disease while giving respirations.



FIGURE 13–4 When cardiac arrest occurs, an automated external defibrillator (AED) can be used to analyze the electrical rhythm of the heart and to apply a shock to try to restore the normal heart rhythm.

- **Airway**: To open the airway, use the head-tilt/chin-lift method (**Figure 13–2**):
  - Put one hand on the person's forehead and put the fingertips of the other hand under the bony part of the jaw, near the chin.
  - Tilt the head back without closing the person's mouth. This action prevents the tongue from falling back and blocking the air passage.
- **Breathing**: While using a barrier device, you breathe into the person's mouth or nose to supply needed oxygen or provide ventilations:
  - Each breath should take about 1 second, and the chest should rise.
  - Rapid or forceful breaths should be avoided because they can force air into the esophagus and stomach, causing gastric distension (expansion of the stomach when air enters it). This can cause serious complications, such as vomiting, aspiration of fluids into the lungs, and even pneumonia.
  - Health care providers should use a CPR pocket face mask with a one-way valve to provide a barrier and prevent the transmission of disease while giving respirations (**Figure 13–3**). Special training is required for the use of this mask.
- **Defibrillation**: One of the most common causes of cardiac arrest is ventricular fibrillation, which is an arrhythmia, or abnormal electrical conduction pattern in the heart. When the heart is fibrillating, it does not pump blood effectively. A **defibrillator** is a machine that delivers an electric shock to the heart to try to restore the normal electrical pattern and rhythm. Automated external defibrillators (AEDs) are now available for use by trained emergency medical responders, emergency medical technicians, and even citizens (**Figure 13–4**):

- Electrode pads are positioned on the patient's chest (follow the placement diagrams shown on the AED or the pads).
- The AED determines the heart rhythm, recognizes abnormal rhythms that may respond to defibrillation, and sounds an audible or a visual warning telling the operator to push a "shock" button.
- Some AEDs are fully automatic and even administer the shock.
- Anytime a shock is administered with an AED, it is essential to make sure that no one is touching the patient.
- The rescuer should state, "Clear the victim," and look carefully to make sure no one is in contact with the person before pushing the shock button.
- Serious injuries, such as cardiac arrest, could occur in other rescuers if they are shocked by the AED.
- The sooner the defibrillation is provided, the greater the chances of survival are from a cardiac arrest caused by an arrhythmia.
- CPR should continue until an AED is available.

BASIC PRINCIPLES OF CPR

Extreme care must be taken to evaluate the injured/ill person's condition before CPR is started:

- They should be assessed for responsiveness first (see Step 3 above).
- Position the person on their back. If you must turn them, support their head and neck, and keep their body in as straight a line as possible.
- Check the pulse and breathing simultaneously.
- At the same time, check breathing by watching for the chest to rise and fall.
- If you *do not* feel a pulse within 5–10 seconds, or you are *not sure* if you feel a pulse, start compressions:
  - Correct hand placement is essential before performing chest compressions. For adults, place one hand in the middle of the chest, place the heel of the other hand on top of the first hand, and interlock the fingers with your hands to ensure pressure is not applied on the ribs, the abdomen, and the lower tip of the breast bone. (**Figure 13–5**).



FIGURE 13–5 To position hands correctly for chest compressions, place one hand in the middle of the chest, place the heel of the other hand on top of the first hand, and interlock the fingers with your hands to ensure pressure is not applied on the ribs, the abdomen, and the lower tip of the breast bone.

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FIGURE 13–6 Straighten your arms and align your shoulders directly over your hands. Push straight down on the sternum with a hard, fast motion.



FIGURE 13–7 If the victim is not breathing, or not breathing normally, open the airway.

Precaution

Measuring in this manner minimizes the danger of applying pressure to the tip of the sternum, called the xiphoid process, which can be broken off quite easily and should not be pressed.

- After positioning your hands on the sternum, straighten your arms and align your shoulders directly over your hands (**Figure 13–6**). To give compressions, push straight down on the sternum with a hard, fast motion. On an adult, the sternum should be compressed between 5 and 6 cm (2 inches).
- After each compression, allow the chest to recoil completely. Deliver compressions at a rate of at least **100–120 compressions per minute** and minimize interruptions in compressions. Proper administration of compressions will produce adequate blood flow and improve the person's chances of survival.
- Once 30 chest compressions are delivered, open the airway by using the head-tilt/chin-lift method. This step will sometimes start the person breathing.
- If the person is not breathing, or not breathing normally, open the airway using two fingers on the chin and hand on the forehead, use a barrier device and give two breaths, each breath lasting approximately 1 second (**Figure 13–7**).
- Make sure the breaths are effective by watching for the person's chest to rise. Do not give breaths too quickly or with too much force for young children and infants because this can cause gastric distension (stomach expansion due to air accumulation).
- Pause very briefly between breaths to allow air flow back out of he lungs.
- After giving two breaths, immediately return to compressions.

- Once CPR is started, it must be continued unless one of the following situations occurs:
  - The person recovers and starts to breathe.
  - Qualified medical help arrives and takes over.
  - A physician or other legally qualified person orders you to discontinue the attempt.

- The rescuer is so physically exhausted that CPR cannot be continued.
- The scene suddenly becomes unsafe.

CPR FOR ADULTS

CPR should be performed on adults, children, and infants at a rate of 30 compressions followed by 2 ventilations, for a cycle ratio of 30:2. Five 30:2 cycles should be completed every 2 minutes. Pressure should be applied straight down to compress the sternum between 5 cm (2 inches) and 6 cm (2.4 inches).

CPR FOR INFANTS AND CHILDREN

CPR is different for infants and children because of their size:

Infants:

- Check the brachial pulse site in the arm (**Figure 13–8A**).
- Give compressions by placing two fingers on the lower half of the sternum just below an imaginary line drawn between the nipples (**Figure 13–8B**).
- Compress the sternum at least one third the depth of the chest, approximately 4 cm (1½ inches) at a rate of at least 100–120 per minute.
- Once 30 compressions have been given, open the airway using the head-tilt/chin-lift method. The infant's head should be in a neutral position and not tilted as far back as an adult's because this can obstruct the infant's airway.
- Give ventilations by using a barrier device and covering both the infant's nose and mouth, until the infant's chest visibly rises (**Figure 13–8C**). Extreme care must be taken to avoid overinflating the lungs and/or forcing air into the stomach.

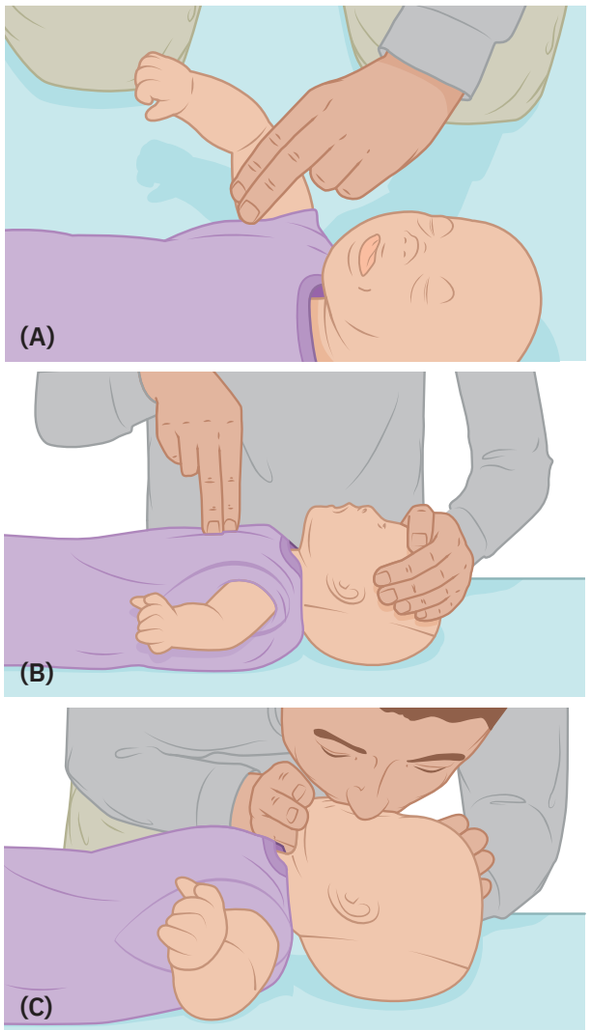


FIGURE 13–8 (**A**) Use the brachial pulse site in the arm to check for a pulse in an infant. (**B**) Use two fingers to give hard and fast compressions to the infant, at a rate of at least 100–120 compressions per minute. (**C**) If the infant is not breathing, give two breaths.

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- A lone rescuer gives 30 compressions followed by 2 ventilations in a ratio of 30:2. The infant's back must be supported at all times when giving compressions.
- If two rescuers are available to perform CPR on an infant, a two-thumb technique can be used by one rescuer to perform compressions while the second rescuer gives breaths. The rescuer providing compressions stands at the infant's feet and places their thumbs next to each other on the lower half of the sternum just below the nipple line. The rescuer then wraps their hands around the infant to support the infant's back with the fingers.

Children:

Cardiopulmonary resuscitation for children depends on the size of the child. Health care providers should use child CPR methods for any child from 1 year of age to puberty (approximately 12 years of age). If a child shows signs of puberty, adult CPR methods should be used. The initial steps of CPR for a child are the same steps used in adult CPR, except that the head is not tilted as far back when the airway is opened. The main differences relate to compressions:

- The heel of one hand (or two hands) is placed on the lower half of the sternum in the same position used for adult compressions.
- If only one hand is used, the other hand remains on the forehead to keep the airway open. The sternum is compressed at least one third the depth of the chest, approximately 5 cm (2 inches). Compressions are given at a rate of at least 100–120 per minute.
- After each set of 30 compressions, 2 breaths are given until the chest visibly rises. This provides a 30:2 ratio.
- Approximately five cycles of CPR should be completed every 2 minutes. For two-rescuer child CPR, a ratio of 15:2 is used.
- If a child has a pulse and is receiving rescue breathing, a ventilation rate of 25 per minute (1 breath every 2–3 seconds) is recommended.

CHOKING

A person who is choking has an **obstructed airway** (an object blocking the airway). Special measures must be taken to clear this obstruction.

- If an adult is conscious, coughing, talking or making noise, and/or able to breathe, the airway is not completely obstructed. Encourage the person to remain calm. Encourage them to cough hard. Coughing is the most effective method of expelling the object from the airway.

- If the adult is conscious but not able to talk, make noise, breathe, or cough, the airway is completely obstructed. The person usually grasps their throat and appears cyanotic (blue discoloration of the skin). Immediate action must be taken to clear the airway. Call the EMS, give up to five firm blows between their shoulder blades (**Figure 13–9A**), then give abdominal thrusts to provide a force of air to push the object out of the airway:
  - Stand behind the choking person.
  - Wrap both arms around their waist.
  - Make a fist of one hand (**Figure 13–9B**). Place the thumb side of the fist in the middle of the choking person's abdomen, slightly above the navel (umbilicus) but well below the xiphoid process at the end of the sternum.
  - Grasp the fist with your other hand.
  - Use quick, upward thrusts to press into the abdomen (**Figure 13–9C**). The thrusts should be delivered hard enough to cause a force of air to push the obstruction out of the airway.
  - Continue the cycle of up to five back blows followed by five chest thrusts until the EMS arrive or the person becomes unresponsive.
- If the adult has an obstructed airway and becomes unresponsive, administer adult CPR. The rescuer should look in the mouth for the object. If the object is visible, the rescuer should remove it. If the object is not seen, the rescuer should try to administer breaths and then continue with chest compressions.
- If the adult is pregnant or obese, or you cannot reach around them to give abdominal thrusts, perform chest thrusts.

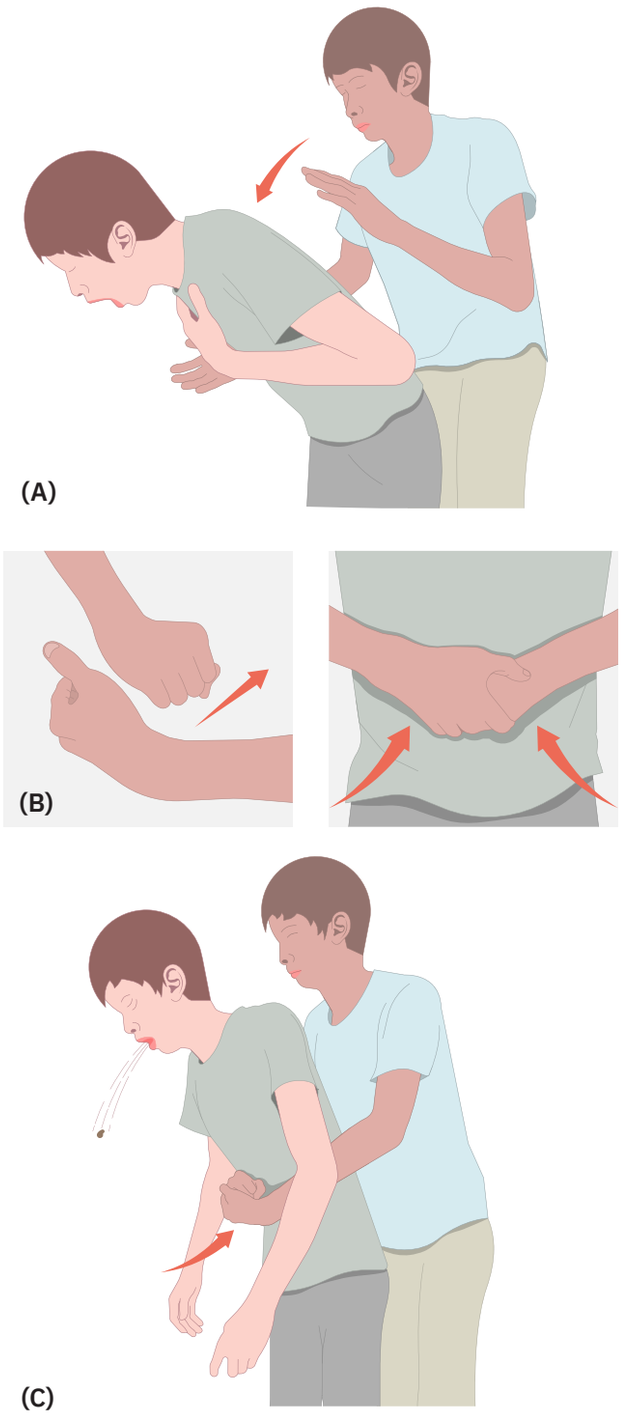


FIGURE 13–9 (**A**) Give up to five back blows. (**B**) Make a fist of one hand. Place the thumb side of the fist above the umbilicus but well below the xiphoid process at the end of the sternum. (**C**) Grasp the fist with your other hand and use quick, upward thrusts to press into the victim's abdomen.

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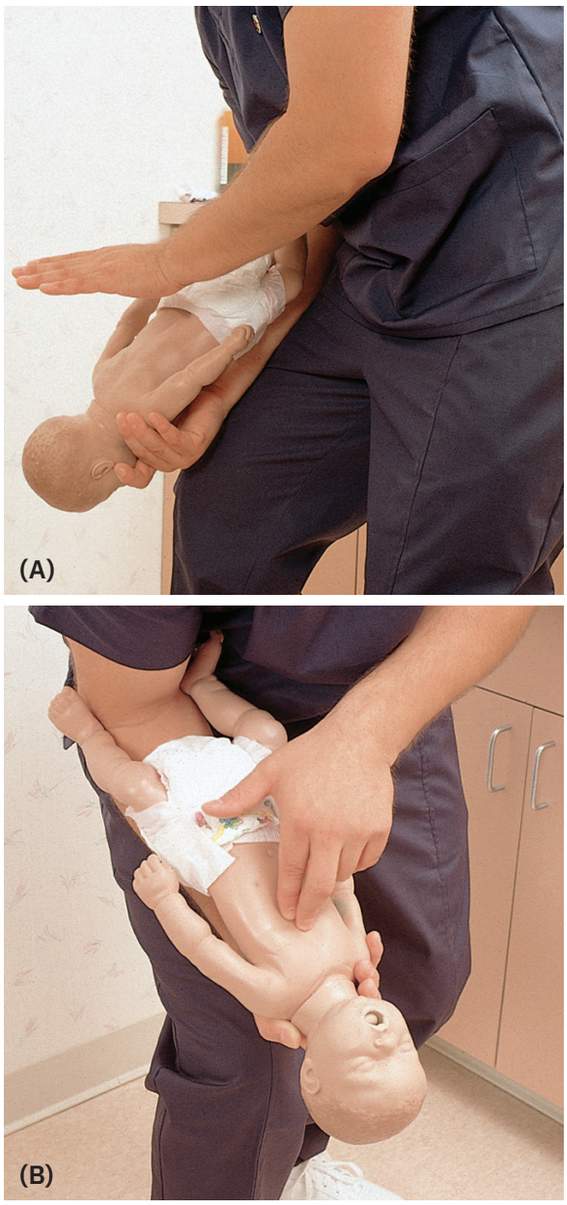


FIGURE 13–10 (**A**) To give an infant back blows, position the infant face down, with the head lower than the chest. (**B**) Give the infant up to five chest thrusts, keeping the head lower than the chest.

If an infant (birth to 1 year) has an obstructed airway, a different sequence of steps is used to remove the obstruction:

- Quickly bare the infant's chest to expose the sternum (breastbone).
- Give up to five back blows. Hold the infant face down, with your arm supporting the infant's body and your hand supporting the infant's head and jaw.
- Position the head lower than the chest (**Figure 13–10A**). Use the heel of your other hand to give up to five back blows between the infant's shoulder blades.
- Support the infant's head to turn the infant face up. Hold the infant with your forearm resting on your thigh. Keep the infant's head lower than the chest.
- Give up to five chest thrusts: Position two to three fingers on the sternum just below an imaginary line drawn between the nipples. Press straight down up to five times (**Figure 13–10B**), each time with the intention of creating enough force to dislodge the obstruction.
- Continue the cycle of up to five back blows followed by up to five chest thrusts until the EMS arrive or the infant becomes unresponsive.
- If the infant becomes unresponsive, place the infant on a firm surface. Open the airway and look for an object. If an object is visible, remove it. Then perform CPR starting with compressions—do not check for a pulse. Follow the normal procedure for an infant, except look in the mouth every time you are ready to give breaths.

If a child aged 1 to puberty (approximately 12 years of age) has an obstructed airway, the same sequence of steps used for an adult is followed. A finger sweep of the mouth is not performed unless the object can be seen in the mouth.

checkpoint

1. What is the usual ratio of compressions to breaths in CPR?
2. What is a defibrillator?

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13:3 PROVIDING FIRST AID FOR BLEEDING AND WOUNDS

A **wound** involves injury to the soft tissues. Wounds are usually classified as open or closed:

- With an open wound, there is a break in the skin or mucous membrane.
- With a closed wound, there is no break in the skin or mucous membrane but injury occurs to the underlying tissues. An example of a closed wound is a bruise or hematoma.

Wounds can result in bleeding, **infection**, and/or tetanus (lockjaw, a serious infection caused by bacteria). First-aid care must be directed toward controlling bleeding before the bleeding leads to death, and toward either preventing or obtaining treatment for infection.

TYPES OF OPEN WOUNDS

Open wounds are classified into types according to the injuries that occur:

- **Abrasion**: The skin is scraped off. Bleeding is limited, but infection must be prevented because contaminants often enter the wound.
- **Incision**: A cut or injury caused by a sharp object, such as a knife, scissors, or razor blade. The edges of the wound are smooth and regular (**Figure 13–11A**). If the cut is deep, bleeding can be heavy and can lead to excessive blood loss. In addition, damage to muscles, nerves, and other tissues can occur.
- **Laceration**: Tearing of the tissues by way of excessive force. The wound often has jagged, irregular edges (**Figure 13–11B**). Bleeding may be heavy. If the wound is deep, contamination may lead to infection.
- **Puncture**: An injury caused by a sharp object, such as a pin, nail, or pointed instrument.
- **Avulsion**: Tissue is torn, separated, or hanging from the body. Bleeding is heavy and usually extensive. It is important to preserve the body part while treating the wound as a surgeon may be able to reattach it.
- **Amputation**: A body part is cut off and separated from the body. Bleeding can be heavy and extensive. Care must be taken to preserve the amputated part because a surgeon may be able to reattach it. The part should be wrapped in a cool, moist dressing and placed in a plastic bag. The plastic bag should be kept cool or placed in ice water and transported with the injured person. The body part should never be placed directly on ice because ice can freeze the tissue.

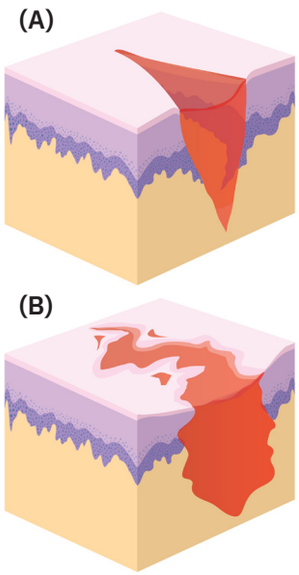


FIGURE 13–11 Open wounds include (**A**) an incision that has smooth, regular edges and (**B**) a laceration that has jagged, irregular edges.

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CONTROLLING BLEEDING

Controlling bleeding is the first priority in caring for wounds because it is possible for someone to bleed to death in a short period of time. Bleeding can come from arteries, veins, and capillaries. It is possible to differentiate between the types of bleeding, as follows:

- **Arterial blood** usually spurts from a wound, results in heavy blood loss, and is bright red. Arterial bleeding is life-threatening and must be controlled quickly.
- **Venous blood** is slower, steadier, and dark red or maroon. Venous bleeding is constant and can lead to a large blood loss, but it is easier to control.
- **Capillary blood** "oozes" from the wound slowly, is less red than arterial blood, and clots easily.

The main methods for controlling bleeding are listed in the order in which they should be used: direct pressure, pressure bandage, and a tourniquet in extreme emergencies.


Precaution

CAUTION: If possible, use some type of protective barrier, such as gloves or plastic wrap while controlling bleeding. If this is not possible in an emergency, use thick layers of dressings, and try to avoid contact of blood with your skin. Wash your hands thoroughly and as soon as possible after giving first aid to someone who is bleeding.



FIGURE 13–12 Use some type of protective barrier, such as gloves or plastic wrap, while applying direct pressure to control bleeding.

- **Direct pressure**: Using your gloved hand over a thick dressing or sterile gauze, apply pressure directly to the wound (**Figure 13–12**). If no dressing is available, use a clean cloth or linen-type towel. In an emergency, it may be necessary to use a piece of clothing or another material from the environment. Continue to apply pressure for 5–10 minutes or until the bleeding stops. If blood soaks through the dressing, apply a second dressing over the first, and continue to apply direct pressure. Do not disturb blood clots once they have formed. Direct pressure will usually stop most bleeding.
- **Pressure bandage**: Apply a pressure bandage to hold the dressings in place. Maintain direct pressure while applying the pressure bandage.
- **Tourniquet**: A tourniquet should not be used unless all other methods to control bleeding have not been effective, it is a life-threatening situation, medical help will be delayed, or you have been instructed on how to apply it. Commercial tourniquets are available in many first-aid kits. Follow the directions provided with it.

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After severe bleeding has been controlled, obtain medical help. Do not disturb any blood clots or remove the dressings that were used to control the bleeding because this may result in additional bleeding. Make no attempt to clean the wound because this too is likely to result in additional bleeding.

MINOR WOUNDS

In treating minor wounds that do not involve severe bleeding, prevention of infection is the first priority:

- Wash your hands thoroughly before treating the wound.
- Put on gloves to avoid contamination from blood or fluid draining from the wound.
- Use clean water and sterile gauze, if possible, to wash the wound. Wipe in an outward direction, away from the wound. Discard the wipe after each use. Rinse the wound thoroughly with cool water. Use sterile gauze to gently blot the wound dry.
- Apply a sterile dressing or bandage.
- Watch for any signs of infection. Medical help should be sought if any signs of infection appear.

Infection can develop in any wound. It is important to recognize the signs of infection and to seek medical help if they appear. Some signs and symptoms are swelling, heat, redness, pain, fever, pus, and red streaks leading from the wound. Prompt medical care is needed if any of these symptoms occur.

Tetanus bacteria can enter an open wound and lead to serious illness and death. Tetanus infection is most common in puncture wounds and wounds that involve damage to tissue underneath the skin.

With some wounds, objects can remain in the tissues or become embedded in the wound. Examples of such objects include splinters, small pieces of glass, small stones, and other similar objects. If the object is at the surface of the skin, remove it gently with sterile tweezers or tweezers wiped clean with alcohol or a disinfectant. Any objects embedded in the tissues should be left in the skin and removed by a physician.

CLOSED WOUNDS

Closed wounds (those not involving breaks in the skin) can occur anywhere in the body as a result of injury (**Figure 13–13**). If the wound is a bruise, cold applications can be applied to reduce swelling. Other closed wounds can be extremely serious and cause internal bleeding that may lead to death. Signs and symptoms may include pain, tenderness, swelling, deformity, cold and clammy skin, rapid and weak pulse, a drop in blood



FIGURE 13–13 Closed wounds can occur anywhere in the body as a result of injury.

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pressure, uncontrolled restlessness, excessive thirst, vomited blood, or blood in the urine or feces. Get medical help as soon as possible. Check breathing, treat for shock, avoid unnecessary movement, and avoid giving any fluids or food.

While caring for anyone with severe bleeding or wounds, always be alert for the signs of shock (see Section 13:4). Be prepared to treat shock while providing care to control bleeding and prevent infection in the wound. At all times, remain calm while providing first aid. Reassure the person. Obtain appropriate assistance or medical care as soon as possible in every case requiring additional care.

checkpoint

1. List four types of wounds.
2. If a finger is amputated, how would you handle the severed part?

13:4 PROVIDING FIRST AID FOR SHOCK

Shock is a state that can exist with any injury or illness requiring first aid. It is important that you are able to recognize it and provide treatment.

Shock, also called hypoperfusion, is a clinical set of signs and symptoms associated with an inadequate supply of blood to body organs, especially the brain and heart. If it is not treated, shock can lead to death, even when the injuries or illness might not themselves be fatal. After just 4–6 minutes of hypoperfusion, brain cells are damaged irreversibly.

CAUSES OF SHOCK

Many different things can cause shock: **hemorrhage** (excessive loss of blood); excessive pain; infection; heart attack; stroke; poisoning by chemicals, drugs, or gases; lack of oxygen; psychological trauma; and dehydration (loss of body fluids) from burns, vomiting, or diarrhea. All types of shock impair circulation and decrease the supply of oxygen to body cells, tissues, and organs.

The main types of shock and their causes are:

- Anaphylactic: Hypersensitive or allergic reaction to a substance, such as food, medications, insect stings or bites, or snake bites.
- Cardiogenic: Damage to heart muscle from heart attack or cardiac arrest.
- Hemorrhagic: Severe bleeding or loss of blood plasma.
- Hypovolemic: Excessive loss of fluids due to bleeding, prolonged diarrhea, excessive vomiting, protracted diaphoresis, and severe burns.

- Metabolic: Loss of fluids from severe vomiting, diarrhea, or a heat illness; or disruption in acid–base balance as occurs in diabetes.
- Neurogenic: Injury and trauma to the brain and/or spinal cord.
- Psychogenic: Emotional distress, such as anger, fear, or grief.
- Respiratory: Trauma to respiratory tract; respiratory distress or arrest (chronic disease, choking).
- Septic: Acute infection (toxic shock syndrome).

SIGNS AND SYMPTOMS

When shock occurs, the body attempts to increase blood flow to the brain, heart, and vital organs by reducing blood flow to other body parts. This can lead to the following signs and symptoms that indicate shock:

- Skin is pale or cyanotic (blue) in color. Check the nail beds and the mucous membrane around the mouth.
- Skin is cool to the touch.
- Excessive perspiration may result in a wet, clammy feeling when the skin is touched.
- Pulse is rapid, weak, and difficult to feel. Check the pulse at one of the carotid arteries in the neck.
- Respirations are rapid, shallow, and may be irregular.
- Blood pressure is very low or below normal, and may not be obtainable.
- General weakness: As shock progresses, the person becomes listless and confused. Eventually, they lose consciousness.
- Anxiety and extreme restlessness.
- Excessive thirst, nausea, and/or vomiting.
- Blurred vision: As shock progresses, the eyes may appear sunken and have a vacant or confused expression. The pupils may dilate or become large.

TREATMENT FOR SHOCK

It is essential to get medical help as soon as possible because shock is a life-threatening condition. Treatment for shock is directed toward:

1. Eliminating the cause of shock.
2. Improving circulation, especially to the brain and heart.
3. Providing an adequate oxygen supply.
4. Maintaining body temperature.

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Some of the basic principles for treatment include:

- Reduce the effects of or eliminate the cause of shock: control bleeding, provide oxygen if available, ease pain through position change, and/or provide emotional support.

Safety

CAUTION: If neck or spine injuries are suspected, the person should not be moved unless it is necessary to remove them from danger.

- The position for treating shock must be based on the person's injuries.
- The best position for treating shock is usually for the person to lie flat on their back because this improves circulation. Raising the feet and legs approximately 30 cm (12 inches) can also provide additional blood for the heart and brain (**Figure 13–14**). However, if they are vomiting or have bleeding and injuries of the jaw or mouth, the person should be positioned on their side to prevent them from choking on blood or vomit.

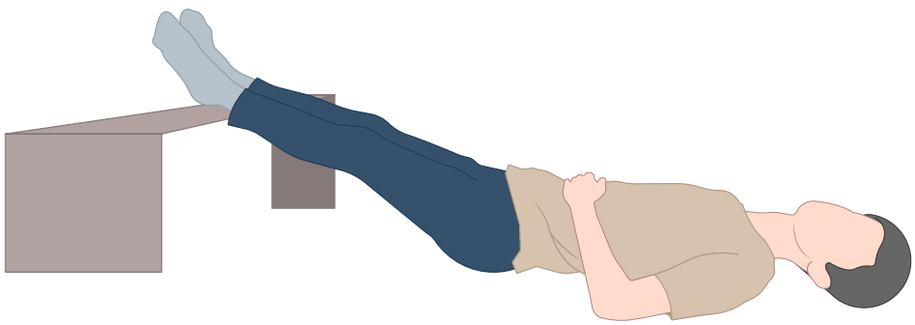


FIGURE 13–14 Position a shock victim flat on the back and elevate the feet and legs approximately 30 cm. Do not use this position if the victim is vomiting or has bleeding and injuries of the jaw or mouth.

- If a person is experiencing breathing problems, it may be necessary to raise their head and shoulders to make breathing easier. If there is a head (not neck) injury, and the person has difficulty breathing, they should be positioned lying flat or with the head raised slightly. It is very important to position the person according to the injury or illness involved.
- Cover the person with blankets or additional clothing to prevent chilling or exposure to the cold. Blankets may also be placed between the ground and the injured person. However, it is important to avoid overheating them. If the skin is very warm to the touch and perspiration is noted, remove some of the blankets or coverings.
- Avoid giving anything to eat or drink. If the injured person complains of excessive thirst, a wet cloth can be used to provide some comfort by moistening the lips and mouth.

Remember that it is important to look for signs of shock while providing first aid for any injury or illness. Provide care that will reduce the effect of shock. Obtain medical help as soon as possible.

checkpoint

1. List three causes of shock.
2. What does *cyanotic* mean?

13:5 PROVIDING FIRST AID FOR POISONING

Poisoning can occur anywhere, anytime—not only in health care settings, but also in your daily life. Poisoning is a condition that occurs when contact is made with any chemical substance that causes injury, illness, or death. It can be caused by ingesting (swallowing) various substances, inhaling poisonous gases, injecting substances, or contacting the skin with poison. Any substance that causes a harmful reaction when applied or ingested can be called a poison. Anaphylactic shock is a common reaction to poisoning. Immediate action is necessary for any poisoning victim. Treatment varies depending on the type of poison, the injury involved, and the method of contact.

If the person is unconscious, check for pulse and breathing. Provide CPR if there is no pulse and/or artificial respiration if they are not breathing. Obtain medical help as soon as possible. If the unconscious person is breathing, position them on their side so that fluids can drain from the mouth. Obtain medical help quickly.

INGESTION POISONING


Comm

If a poison has been swallowed, immediate care must be provided before the poison can be absorbed into the body. Basic steps of first aid include:

- Call 911, the unified emergency telephone number or a physician immediately.
- Save the label or container of the substance taken so this information can be given to the poison control center or physician.
- Calculate or estimate how much was taken and the time at which the poisoning occurred.
- If the person vomits, save a sample of the vomit.

INHALATION POISONING



If poisoning is caused by inhalation of dangerous gases, the person must be removed immediately from the area before being treated. A commonly inhaled poison is carbon monoxide, an odorless, colorless gas that is very difficult to detect. If excessive amounts of gas or fumes are present, and the scene is not safe, do not enter the area. Wait for the EMS to arrive. If a quick rescue can be achieved without inhaling the gases, the basic steps of first aid include:

- Before entering the danger area, take a deep breath of fresh air, and do not breathe the gas while you are removing the person from the area.
- After rescuing the person, immediately check for pulse and breathing.
- Provide CPR and/or artificial respiration if needed.
- Obtain medical help immediately; death may occur very quickly with this type of poisoning.

CONTACT POISONING

If poisoning is caused by chemicals or poisons coming into contact with a person's skin, care includes:

- Use large amounts of water to wash the skin for at least 15–20 minutes to dilute the substance and remove it from the skin.
- Remove any clothing and jewelry that contain the substance.
- Call the poison control center or a physician for additional information.
- Obtain medical help as soon as possible for burns or injuries that may result from contact with the poison.

Contact with a poisonous plant can cause a serious skin reaction if not treated immediately. Basic steps of first aid include the following:

- Wash the area thoroughly with soap and water.
- If the condition is severe and affects large areas of the body or face, obtain medical help.

INJECTION POISONING

Injection poisoning occurs when an insect or spider stings or a snake bites an individual. If a person's arm or leg is affected, place the limb in a gravity-neutral position, close to heart level.

For an insect sting, first-aid treatment includes:

- Remove any embedded stinger by scraping the stinger away from the skin with the edge of a rigid card, such as a credit card, or a tongue depressor. Do not use tweezers because tweezers can puncture the venom sac which is attached to the stinger, injecting more poison into body tissues.
- Wash the area well with soap and water.
- Apply a sterile dressing and a cold pack to reduce swelling.

For a snakebite or spider bite, first-aid treatment includes:

- Wash the wound.
- Immobilize the injured area, and place the limb in a gravity-neutral position, close to heart level.
- Do not cut the wound or apply a tourniquet.
- Monitor the person's breathing, and give artificial respiration if necessary.
- Obtain medical help as soon as possible.
- If possible, try to obtain a description of the snake so it can be identified, and the correct anti-snake venom can be given.

For any type of injection poisoning, watch for allergic reaction (**Figure 13–15**). Signs and symptoms of allergic reaction include redness and swelling at the site, itching, hives, pain, swelling of the throat, difficult or labored breathing, dizziness, and a change in the level of consciousness. Maintain respirations and obtain medical help as quickly as possible for anyone who experiences an allergic reaction.

Comm

In all cases of poisoning, observe the person for signs of anaphylactic shock, and treat for shock, if necessary. Try to remain calm and confident while providing first aid for poisoning. Reassure as needed. Act quickly and in an organized, efficient manner.



FIGURE 13–15 Watch for allergic reactions in injection-poisoning victims.

checkpoint

1. What are three ways that a person can be poisoned?
2. What agency do you contact when poisoned?

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13:6 PROVIDING FIRST AID FOR BURNS

TYPES OF BURNS

A **burn** is an injury that can be caused by fire, heat, chemical agents, radiation, and/or electricity. Burns are classified as superficial, partial thickness, or full thickness (**Figure 13–16**).

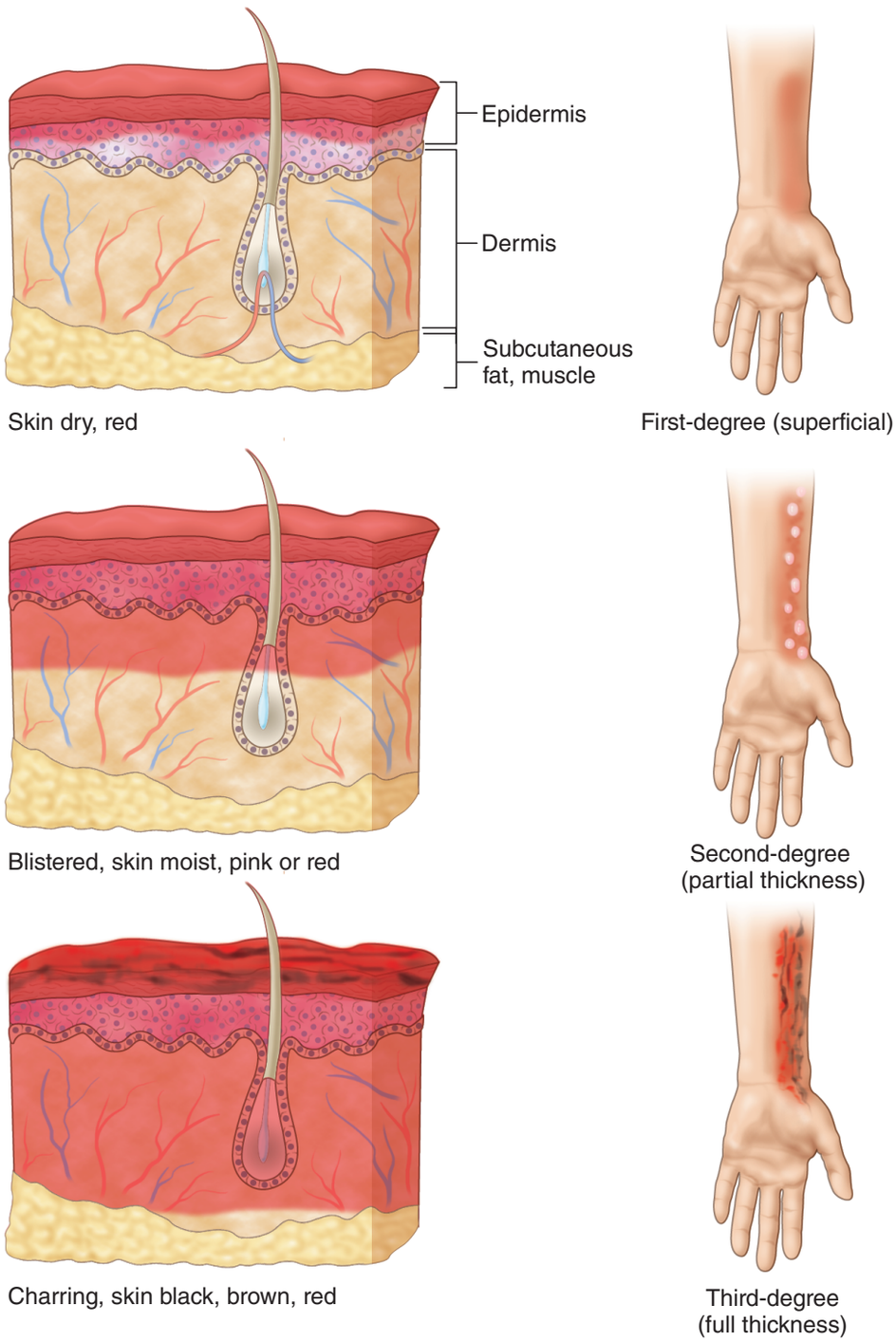


FIGURE 13–16 Types of burns.

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The characteristics of each type of burn are as follows:

- **Superficial** (or first-degree) burn, the least severe type of burn. This involves only the top layer of skin, the epidermis, and usually heals in 5–6 days without permanent scarring. The skin is usually reddened or discolored. There may be some mild swelling and pain. Three common causes are overexposure to the sun (sunburn), brief contact with hot objects or steam, and exposure of the skin to a weak acid or alkali.
- **Partial-thickness** (or second-degree) burn: This type of burn involves injury to the top layers of skin, including both the epidermis and dermis. A blister forms, and the skin is red or has a mottled (blotchy with many shades of color) appearance. Swelling usually occurs, and the surface of the skin frequently appears to be wet. This is a painful burn and may take 3–4 weeks to heal. Frequent causes include excessive exposure to the sun, a sunlamp, or artificial radiation; contact with hot or boiling liquids; and contact with fire.
- **Full-thickness** (or third-degree) burn: This is the most severe type of burn and involves injury to all layers of the skin plus the underlying tissue. The area involved has a white or charred appearance. This type of burn can be either extremely painful or, if nerve endings are destroyed, relatively painless. Full-thickness burns can be life-threatening because of fluid loss, infection, and shock. Frequent causes include exposure to fire or flames, prolonged contact with hot objects, contact with electricity, and immersion in hot or boiling liquids.

TREATMENT

First-aid treatment for burns is directed toward removing the source of heat, cooling the affected skin area, covering the burn, relieving pain, observing and treating for shock, and preventing infection. Medical treatment is not usually required for superficial and mild partial-thickness burns. However, medical care should be obtained if more than 15% of the surface of an adult's body is burned (10% in a child).

The "rule of nines" is used to calculate the percentage of body surface burned (**Figure 13–17**). For example, if an adult has burns on both legs, this would equal 18% of the body surface, and medical treatment should be obtained. Medical care should also be obtained if the burns affect the face or respiratory tract; if the person has difficulty breathing; if burns cover more than one body part; if the person has a partial thickness burn and is under 5 or over 60 years of age; or if the burns resulted from chemicals, explosions, or electricity. Anyone with full-thickness burns should receive medical care.

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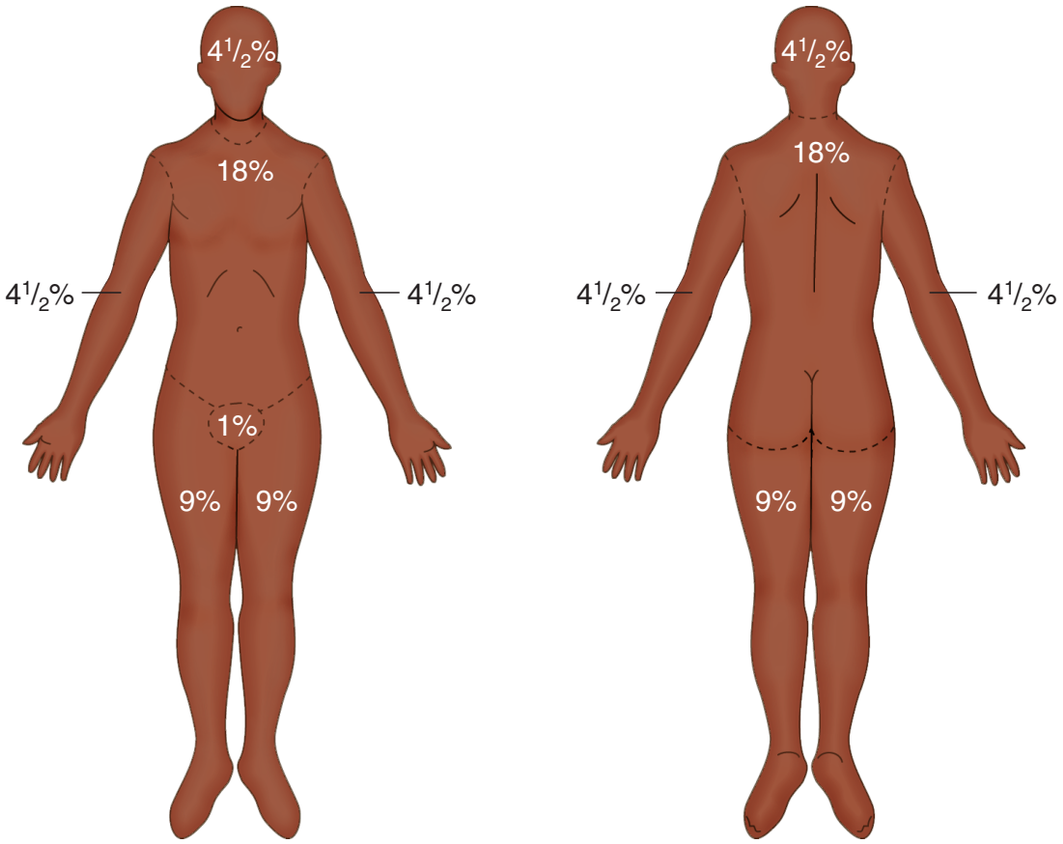


FIGURE 13–17 The rule of nines is used to calculate the percentage of body surface burned.

Superficial and mild partial-thickness burns are treated as follows:

- Cool the area by flushing it with large amounts of cool water. Do not use ice or ice water on burns because doing so causes the body to lose heat.
- Apply a dry, sterile dressing to prevent infection.
- If possible, elevate the affected part to reduce swelling caused by inflammation. If necessary, obtain medical help.

Severe partial-thickness and full-thickness burns are treated as follows:

- Call for medical help immediately if the person has severe partial-thickness or full-thickness burns.
- Cover the burned areas with thick, sterile dressings.
- Elevate the hands or feet if they are burned.
- If the feet or legs are burned, do not allow the person to walk.
- If clothing is attached to the burned areas, do not attempt to remove it.
- Watch the person closely for signs of respiratory distress and shock.

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- Provide artificial respiration and treatment for shock, as necessary.
- Watch the patient closely until medical help arrives.

Chemical burns are treated as follows:

- For burns caused by chemicals splashing on the skin, use large amounts of water to flush the affected areas for a minimum of 20 minutes or until medical help arrives.
- Remove any clothing, socks and shoes, or jewelry that contains the chemical to minimize the area of injury.
- Continue flushing the skin with cool water and watch for signs of shock until medical help can be obtained.
- If the eyes have been burned by chemicals or irritating gases, flush the eyes with large amounts of water for a minimum of 20 minutes or until medical help arrives (**Figure 13–18**).
- If only one eye is injured, be sure to tilt the head in the direction of the injury so the injured eye can be properly flushed. Start at the inner corner of the eye and allow the water to run over the surface of the eye and to the outside. Continue flushing the eye with cool water and watch the person for signs of shock until medical help can be obtained.



FIGURE 13–18 To irrigate an eye, hold the eyelid open and irrigate from the inner part of the eye toward the outer part.

checkpoint

1. Which type of burn involves injury to the top layer of skin, including both the epidermis and dermis?
2. What should you do if burns cover more than one body part?

13:7 PROVIDING FIRST AID FOR HEAT EXPOSURE

Excessive exposure to heat or high external temperatures can lead to a life-threatening emergency. Overexposure to heat can cause a chemical imbalance in the body that can eventually lead to death. Harmful reactions can occur when fluids such as water or electrolytes (minerals found in the blood) such as salt are lost through perspiration or when the body cannot eliminate excess heat.

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- **Heat cramps** are muscle pains and spasms that result from the loss of fluids and electrolytes through perspiration. Firm pressure applied to the cramped muscle will provide relief from the discomfort. Rest and moving to a cooler area, in addition to small sips of water or an electrolyte solution, such as sport drinks, will help to relieve symptoms.
- **Heat exhaustion** occurs when a person experiences a loss of fluids through sweating. Signs and symptoms include pale and clammy skin, profuse perspiration (diaphoresis), fatigue or tiredness, weakness, headache, muscle cramps, nausea and vomiting, dizziness and fainting. Body temperature is about normal or just slightly elevated. If heat exhaustion is not treated, it can develop into heat stroke. Treatment includes:

  - Moving the person to a cooler area whenever possible.
  - Loosening or removing excessive clothing.
  - Applying cool, wet cloths.
  - Laying the person down and elevating their feet 30 cm (12 inches); and giving them small sips of cool water, approximately 118 milliliters (ml) (4 fluid ounces) every 15 minutes if they are alert and conscious. If they vomit, develop shock, or experience respiratory distress, medical help should be obtained immediately.

- **Heat stroke** is caused by prolonged exposure to high temperatures. It is a medical emergency. The body is unable to eliminate the excess heat, and the internal body temperature rises to 40.6°C (105°F) or higher. Normal body defenses such as the sweating mechanism no longer function. Signs and symptoms in addition to the high body temperature include red, hot, and dry skin. The pulse is usually rapid but may remain strong. The person may lose consciousness. Treatment is to cool the body quickly because a high body temperature can cause convulsions or death in a very short period of time. The person can be placed in a tub of cool water, or the skin can be sponged with cool water. Ice or cold packs can be placed on their wrists, ankles, in each axillary (armpit) area, and in the groin. Be alert for signs of shock at all times. Obtain medical help immediately.
- After someone has recovered from any condition caused by heat exposure, they must be warned to avoid abnormally warm or hot temperatures for several days. They should also be encouraged to drink sufficient amounts of water or electrolyte solutions.

checkpoint

1. What are the three main conditions that can occur from heat exposure?
2. What is the body's internal temperature in heat stroke?

13:8 PROVIDING FIRST AID FOR COLD EXPOSURE

Exposure to cold external temperatures can cause body tissues to freeze and body processes to slow. If treatment is not provided immediately, the exposed person can die. Factors such as wind velocity, amount of humidity, and length of exposure all affect the degree of injury.

HYPOTHERMIA

Prolonged exposure to the cold can result in hypothermia, a condition in which the body temperature falls below 35°C (95°F). Elderly individuals are more susceptible to hypothermia than are younger individuals.

SIGNS AND SYMPTOMS:

- Shivering, numbness, weakness, or drowsiness.
- Low body temperature.
- Poor coordination.
- Confusion.
- Loss of consciousness.
- If prolonged exposure, body processes slow down, and death can occur.

FIRST AID:

- Move the patient to a warm area.
- Remove wet clothing.
- Slowly warm the patient by wrapping in blankets or putting on dry clothing.
- If the patient is fully conscious, give warm noncaffeinated liquids by mouth.
- Avoid warming a hypothermic person too quickly—this can cause dangerous heart arrhythmias.



FIGURE 13–19 Frostbite is actual freezing of tissue fluids accompanied by damage to the skin and underlying tissues.

FROSTBITE

Frostbite is actual freezing of tissue fluids accompanied by damage to the skin and underlying tissues (**Figure 13–19**). It is caused by exposure to freezing or below-freezing temperatures. Small areas of the body are often affected by frostbite. Common sites include the fingers, toes, ears, nose, and cheeks.

SIGNS AND SYMPTOMS:

- Initially, redness and tingling.
- Pale, glossy skin that is white or grayish yellow in color.
- Blisters.
- Skin that is cold to the touch.
- Numbness.
- Pain that gradually subsides until the person does not feel any pain.
- If exposure continues, the person may become confused, lethargic, and incoherent.
- Shock may develop, followed by unconsciousness and death.

FIRST AID:

- Maintain respirations.
- Treat for shock.
- Warm the affected parts. Because people with frostbite do not usually feel pain, the part must be warmed carefully, taking care not to burn the injured tissue. The parts affected may be immersed in warm water at 37.8–40°C (100–104°F) until normal color returns to the skin and/or feeling returns.
- Prevent further injury. Extreme care must be taken to avoid further injury to areas damaged by frostbite.
- Get medical help as quickly as possible.

checkpoint

1. What does the term "hypothermia" mean?
2. What temperature should the water be for immersing a frostbitten part of the body?

13:9 PROVIDING FIRST AID FOR BONE AND JOINT INJURIES

Injuries to bones and joints are common in accidents and falls. Examples of injuries to bones and joints include fractures, dislocations, sprains, and strains.

FRACTURES

A **fracture** is a break in a bone. A closed, or simple, fracture is a bone break that is not accompanied by an external or open wound on the skin. A compound, or open, fracture is a bone break that is accompanied by an open wound on the skin.

SIGNS AND SYMPTOMS:

- Deformity.
- Limited motion or loss of motion.
- Pain and tenderness at the fracture site.
- Swelling and discoloration.
- The protrusion of bone ends through the skin.
- The injured person heard a bone break or snap, or felt a grating sensation (crepitation).
- Abnormal movements within a part of the body.

FIRST AID:

- Maintain respirations.
- Treat for shock.
- Keep the broken bone from moving.
- Prevent further injury.
- Use a sling to prevent movement of the injured part.
- Obtain medical help whenever a fracture is evident or suspected.

DISLOCATIONS

A **dislocation** is when the end of a bone is either displaced from a joint or moved out of its normal position within a joint. This injury is frequently accompanied by a tearing or stretching of ligaments, muscles, and other soft tissue.

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SIGNS AND SYMPTOMS:

- Deformity.
- Limited or abnormal movement.
- Swelling.
- Discoloration.
- Pain and tenderness.
- A shortening or lengthening of the affected arm or leg.

FIRST AID:

- Same as for fractures.
- No attempt should be made to reduce the dislocation (replace the bone in the joint).
- The affected part must be immobilized in the position it was found.
- Immobilization is accomplished by using splints and/or slings.
- Movement of the injured part can lead to additional injury to nerves, blood vessels, and other tissue in the area.
- Obtain medical help immediately.

SPRAINS

A sprain is an injury to the tissues surrounding a joint; it usually occurs when the part is forced beyond its normal range of movement. Ligaments, tendons, and other tissues are stretched or torn. Common sites for sprains include the ankles and wrists.

SIGNS AND SYMPTOMS:

- Swelling.
- Pain.
- Discoloration.
- Impaired motion.
- May resemble a fracture or dislocation.
- If in doubt, treat the injury as a fracture.

FIRST AID:

- Apply a cold application to decrease swelling and pain; place a barrier, for example, a thin towel between the cold container and the skin.
- Elevate the affected part.

- Encourage the person to rest the affected part.
- Apply an elastic bandage to provide support for the affected area but avoid stretching the bandage too tightly.
- Obtain medical help if swelling is severe or if a fracture is suspected.

STRAINS

A strain is the overstretching of a muscle; it is caused by overexertion or lifting. A frequent site for strains is the back.

SIGNS AND SYMPTOMS:

- Sudden pain.
- Swelling.
- Bruising.

FIRST AID:

- Encourage the person to rest the affected muscle while providing support.
- Recommend bed rest with a backboard under the mattress for a strained back.
- Apply cold applications to reduce the swelling; place a barrier, for example, a thin towel, between the cold container and the skin.
- After the swelling decreases, apply warm, wet applications because warmth relaxes the muscles.
- Obtain medical help for severe strains and all back injuries.

SLINGS

Slings are available in many different forms. Commercial slings usually have a series of straps that extend around the neck and/or thoracic (chest) region (**Figure 13–20**). A common type of sling used for first aid is the triangular bandage. Slings are usually used to support the arm, hand, forearm, and shoulder. They may be used when casts are in place. In addition, they are also used to provide immobility if a fracture of the arm, collarbone, or shoulder is suspected.



FIGURE 13–20 Commercial slings usually have a series of straps that extend around the neck and/or thoracic region.

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NECK AND SPINE INJURIES

Injuries to the neck or spine are the most dangerous types of injuries to bones and joints.

Safety

CAUTION: If a person who has injuries to the neck or spine is moved, permanent damage resulting in paralysis can occur. If at all possible, avoid any movement of a person with neck or spinal injuries. Wait until a backboard, cervical collar, and adequate help for transfer are available.

checkpoint

1. What is a fracture?
2. What is a sling used for?

13:10 PROVIDING FIRST AID FOR SUDDEN ILLNESS

The victim of a sudden illness requires first aid until medical help can be obtained. Sudden illness can occur in any individual. At times, it is difficult to determine the exact illness being experienced. However, by knowing the signs and symptoms of some major disorders, you should be able to provide appropriate first-aid care. Information about a specific condition or illness may also be obtained from the person themself, medical alert bracelets or necklaces, or medical information cards. Be alert to all of these factors while caring for someone who has a sudden illness.

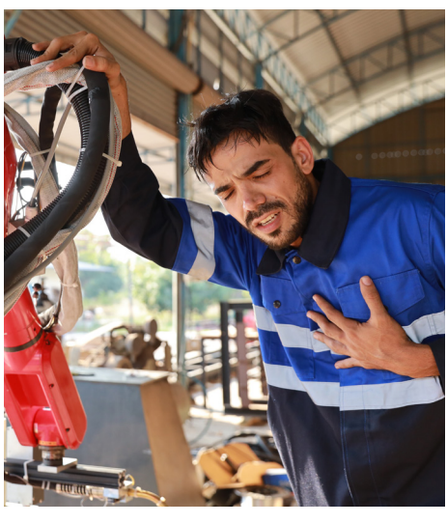


FIGURE 13–21 Severe pressure under the sternum with pain radiating to the shoulders, arms, neck, and jaw is a common symptom of a heart attack.

HEART ATTACK

A **heart attack** is also called a coronary thrombosis, coronary occlusion, or myocardial infarction. It may occur when one of the coronary arteries supplying blood to the heart is blocked. If the attack is severe, the person may die. If the heart stops beating, CPR must be started.

SIGNS AND SYMPTOMS:

- Signs and symptoms vary, depending on the amount of heart damage.
- Severe, painful pressure under the breastbone (sternum) with pain radiating to the shoulders, arms, neck, and jaw (**Figure 13–21**).
- Intense shortness of breath.
- Pale or cyanotic skin, especially near the lips and nail beds.

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- The patient feels very weak but is also anxious and apprehensive.
- Nausea, vomiting, diaphoresis (excessive perspiration), and loss of consciousness may occur.
- The signs and symptoms of a heart attack in females are often more subtle:
  - They may experience unusual fatigue and sleep disturbances for weeks prior to the attack.
  - Cold sweats are common, as is pain in other areas than the chest, such as the arms, back, stomach, neck, and jaw.
  - Heart attacks are often misdiagnosed in females.

FIRST AID:

- Encourage the patient to relax.
- Place the person in a comfortable position to assist breathing.
- Obtain medical assistance as soon as possible.
- Shock frequently occurs, so provide treatment for shock.
- Prevent any unnecessary stress and avoid excessive movement because any activity places additional strain on the heart.
- Reassure the person constantly.

CEREBROVASCULAR ACCIDENT OR STROKE

A **stroke** is also called a cerebrovascular accident, or CVA, apoplexy, or cerebral thrombosis. It is caused by the presence of a clot in a cerebral artery that provides blood to the brain, or hemorrhage from a blood vessel in the brain.

SIGNS AND SYMPTOMS:

- Signs and symptoms vary, depending on the part of the brain affected.
- Numbness (especially on one side of the body).
- Paralysis (especially on one side of the body).
- Eye pupils unequal in size.
- Mental confusion.
- Sudden severe headache.
- Loss of balance or coordination.
- Slurred speech.
- Nausea and vomiting.
- Difficulty breathing and swallowing.
- Loss of consciousness.

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A quick and easy way to remember the signs and symptoms of stroke is to think FAST:

- **F = Face**: Ask the person to smile. If one side of the face appears to be drooping or crooked, it may be a sign of stroke.
- **A = Arms**: Ask the person to raise both of their arms. If they have difficulty lifting one, or keeping one raised, it may be a sign of stroke.
- **S = Speech**: Ask the person to speak. If the words are slurred or they have difficulty speaking, it may be a sign of stroke.
- **T = Time**: If they have any of these symptoms, call 997 (EMS) immediately.

FIRST AID:

- Maintain respirations.
- Lie the person flat on the back with the head slightly elevated or on the side to allow secretions to drain from the mouth.
- Avoiding giving any fluids by mouth.
- Reassure the person, prevent any unnecessary stress, and avoid any unnecessary movement.


Comm

Always remember that although the person may be unable to speak or may appear to be unconscious, they may be able to hear and understand what is going on.

- It is very important to know exactly when the symptoms started and to obtain medical help as quickly as possible. Immediate care during the first 3 hours can help prevent brain damage.

FAINTING

Fainting occurs when there is a temporary reduction in the supply of blood to the brain. It may result in partial or complete loss of consciousness. The person usually regains consciousness after being in a supine position (lying flat on their back).

SIGNS AND SYMPTOMS:

- Dizziness.
- Extreme pallor.
- Excessive sweating for no apparent reason (called diaphoresis).
- Coldness of the skin.
- Nausea.
- Numbness and tingling of the hands and feet.

FIRST AID:

- Help the patient to lie down or to sit in a chair and position their head at the level of the knees.
- If the patient loses consciousness, try to prevent injury.
- Keep the patient in a supine position (lying down). If no neck or spine injuries are suspected, use a pillow or blankets to elevate their legs and feet by 30 cm (12 inches).
- Loosen any tight clothing and maintain an open airway.
- Use cool water to gently bathe their face.
- Check for any injuries that may have been caused by the fall.
- Permit the patient to remain flat and quiet until color improves and they have recovered.
- Then, allow the patient to get up gradually.
- If recovery is not prompt, if other injuries occur or are suspected, or if fainting occurs again, obtain medical help. Fainting can be a sign of a serious illness or condition that requires medical attention.

CONVULSION

A convulsion, which is a type of seizure, is a strong, involuntary contraction of muscles. Convulsions may occur in conjunction with high body temperatures, head injuries, brain disease, and brain disorders such as epilepsy.

SIGNS AND SYMPTOMS:

- Convulsions cause a rigidity of muscles followed by jerking movements.
- During a convulsion, a person may stop breathing, bite the tongue, lose bladder and bowel control, and injure body parts.
- The face and lips may develop a cyanotic color.
- The person may lose consciousness.
- After regaining consciousness at the end of the convulsion, the person may be confused and disoriented, and complain of a headache.

FIRST AID:

- Help to prevent self-injury.
- Remove dangerous objects from the area.
- Provide artificial respiration as necessary.
- Do not try to place anything between the teeth. This can cause severe injury to your fingers, and/or damage to the person's teeth or gums.

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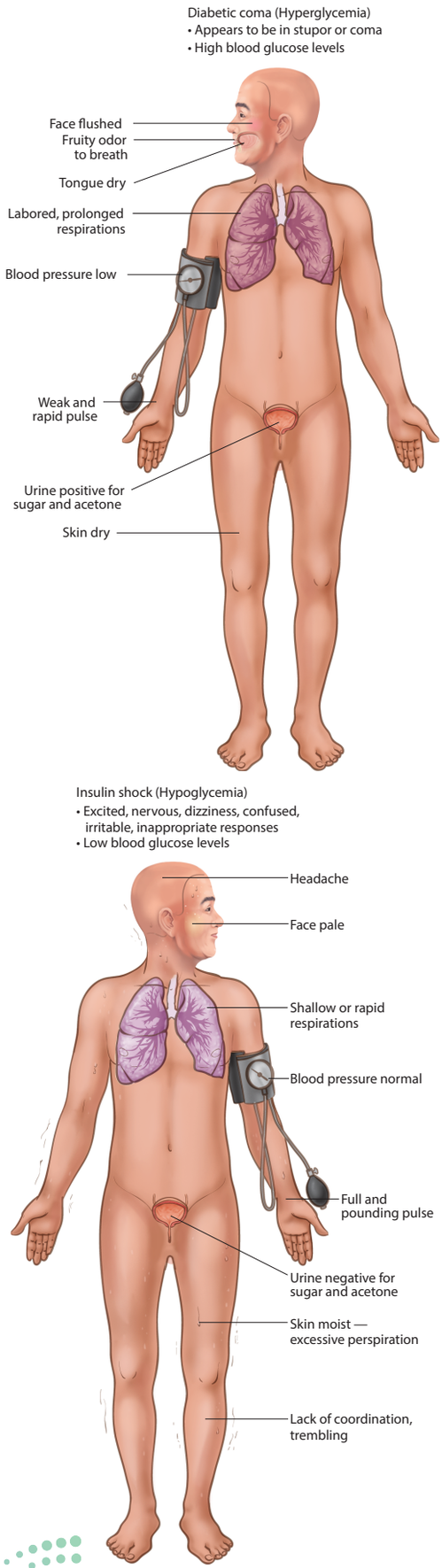


FIGURE 13–22 Diabetic coma (hyperglycemia) versus insulin shock (hypoglycemia).

- Do not use force to restrain or stop the muscle movements; this only causes the contractions to become more severe.
- When the convulsion is over, watch the person closely. If fluid, such as saliva or vomit, is in the mouth, position the person on their side to allow the fluid to drain from the mouth. Allow them to sleep or rest.
- Obtain medical help if the seizure lasts more than a few minutes, if there are repeated seizures, if other severe injuries are apparent, if the person does not have a history of seizures, or if they do not regain consciousness.

DIABETIC REACTIONS

Diabetes mellitus is a metabolic disorder caused by an insufficient production of insulin (a hormone produced by the pancreas). Insulin helps the body transport glucose, a form of sugar, from the bloodstream into body cells, where the glucose is used to produce energy. When there is a lack of insulin, sugar builds up in the bloodstream. Insulin injections can reduce and control the level of sugar in the blood. Individuals with diabetes are in danger of developing two conditions that require first aid: **diabetic coma** and insulin shock (**Figure 13–22**).

Diabetic Coma

Diabetic coma, or hyperglycemia, is caused by an increase in the level of glucose in the bloodstream. It may result from an excess intake of sugar, failure to take insulin, or insufficient production of insulin.

SIGNS AND SYMPTOMS:

- Confusion.
- Weakness or dizziness.
- Nausea and/or vomiting.
- Rapid, deep respirations.
- Dry, flushed skin.
- A sweet or fruity odor to the breath.

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FIRST AID:

- The person will eventually lose consciousness and die unless the condition is treated.
- Medical assistance must be obtained as quickly as possible.

Insulin Shock

Insulin shock, or hypoglycemia, is caused by an excess amount of insulin (and a low level of glucose) in the bloodstream. It may result from failure to eat the recommended amounts, vomiting after taking insulin, or taking excessive amounts of insulin.

SIGNS AND SYMPTOMS:

- Muscle weakness.
- Mental confusion.
- Restlessness or anxiety.
- Diaphoresis.
- Pale, moist skin.
- Hunger pangs.
- Palpitations (rapid, irregular heartbeats).
- The person may lapse into a coma and may develop convulsions.

FIRST AID:

- The onset of insulin shock is sudden, and the person's condition can deteriorate quickly.
- Immediate care is required.
- If the person is conscious, give them a drink containing sugar, such as sweetened orange juice. A cube or teaspoon of granulated sugar can also be placed in the mouth. If the person is confused, avoid giving hard candy. Unconsciousness could occur, and they could choke on the hard candy. Many individuals with diabetes use tubes of glucose that they carry with them. If the person is conscious and can swallow, and a glucose tube is available, it can be given to them.
- The intake of sugar should quickly control the reaction. If the person loses consciousness or convulsions start, provide care for the convulsions and obtain medical assistance immediately.

By observing symptoms carefully and obtaining as much information as possible from the person, you can usually determine whether the condition is diabetic coma or insulin shock. Ask, "Have you eaten today?" and "Have you taken your insulin?" If the person has taken insulin but has not eaten, insulin shock is developing because there is too much

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insulin in the body. If they have eaten but not taken insulin, diabetic coma is developing. In cases when you know that the person is diabetic, but they are unconscious, and there are no definite symptoms of either condition, you may not be able to determine whether the condition is diabetic coma or insulin shock. In such cases, the recommendation is to put granulated sugar under the person's tongue and contact the EMS. If the patient is in diabetic coma, the blood-sugar level can be lowered as needed when the person is transported for medical care. If the person is in insulin shock, however, brain damage can occur if the blood-sugar level is not raised immediately. Medical care cannot correct brain damage.

checkpoint

1. What is a myocardial infarction?
2. When evaluating stroke, what does the acronym FAST stand for?

Today's Research — Tomorrow's Health Care

A Skin Gun to Treat Burns?

Researchers have developed a device that is similar to a paint spray gun or airbrush. The process begins with surgeons using a dermatome, a special knife that can remove a very thin layer of the patient's healthy skin. Skin stem cells are isolated from this layer of skin and put into a water solution for approximately 90 minutes. This mixture of cells and water is put into syringes and inserted into the nozzle of the gun. The gun is attached to a processor-controlled pneumatic (air) device that produces an even flow of solution. The skin cells are then sprayed directly onto the burn.

The sprayed wound is covered with a specially created dressing that contains tubes connected to a source of nutrients and antibiotics that provide nourishment for the cells and help prevent infections. The process takes less than 2 hours for most patients. In clinical trials, the burns heal in days instead of weeks for skin grafts. In addition, there is less scarring of the tissue.

Research continues to improve the method so it can be used to treat full-thickness burns. Instead of a full skin graft, a very small donor skin sample is taken from the patient. Stem cells from the sample are then suspended in a special solution, which is then gently sprayed onto the wound. In addition, researchers are working on finding a way to restore full pigmentation on patients with darker skin pigmentation.

With these new devices, treatment of burns will be more efficient and effective in the future. In addition, researchers are hopeful that they will be able to treat other types of skin damage or scarring, such as acne scarring and wounds, and surgical incisions that fail to heal with traditional treatments.

Case Study Investigation Conclusion

What did you decide Khalid and Abdullah should do? If Rashed is bleeding because of his injury, what should they do? Do they need to check Mohammed for injury? Who is responsible for calling the EMS? What items could they use to improvise if they don't have medical supplies?

CHAPTER 13 SUMMARY

- First aid is the immediate care that is given to a person who has been injured or is suddenly taken ill to minimize the effect of the injury or illness until medical professionals can take over their care.
- The basic principles of first aid are outlined in this chapter. Methods of cardiopulmonary resuscitation (CPR) for infants, children, adults, and choking victims have been described. Proper first aid for bleeding, shock, poisoning, burns, heat exposure, bone and joint injuries, and sudden illness has been covered.
- By learning and following the suggested methods, the health care provider can administer correct first-aid treatment in emergency situations until the help of experts can be obtained.

REVIEW QUESTIONS

1. What is the first step in administering CPR?

2. What other condition would you assess for when your patient has a large blood loss?

3. What is anaphylactic shock?

4. What are four causes of a burn injury?

5. What is heat exhaustion, and what are the signs and symptoms?

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6. What is frostbite?

7. What causes a heart attack?

8. List two possible causes of insulin shock.

9. What is a sling?

10. Define a compound fracture.

CRITICAL THINKING

1. If there is a bleeding injury, why should you not attempt to clean the wound?

2. You are driving on a quiet road. The car ahead of you loses control, goes off the road, and hits a lamp-post. When you get to the car, the driver is slumped over the wheel. His arm is twisted at an odd angle. You notice a small fire at the rear of the car. In the back seat, a small child in a car seat is crying.

a. What problems in this situation need to be addressed?
b. In what order of priority would you triage these problems?

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3. Umar took his two sons, Ahmad and Saad, to the playground. As they were leaving, 2-year-old Ahmad was running to catch up with his father and big brother, and fell, catching himself with his arm before he hit his head. He started screaming and crying, holding his left arm. When Umar looked at it, it was oddly shaped.

a. Why do you want to immobilize the area involved?

b. What materials might Umar use to splint Ahmad's arm?

c. What should Umar do next?

4. How would you differentiate between a diabetic coma and hypoglycemia? How should you treat someone if you cannot tell which condition they are suffering from?

ACTIVITIES

1. With a partner, pick one of the first aid skills. Create a scenario and skill checklist that would use one or more of those skills.

2. In a small group, create a checklist for how to perform CPR on an adult. Using a mannequin, ask another group to work through your checklist and make suggestions for improving it.

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CHAPTER

14

PREPARING FOR THE WORLD OF WORK

Case Study Investigation

Nuha has just finished respiratory therapy college and is applying for her first job at Community Hospital. She has interned there for the past 10 months. Nuha wants to be prepared for her interview. She will have her résumé and references ready, but is worried about doing and saying the right thing during the actual interview. At the end of this chapter, you will be asked how Nuha can optimize her chances of landing this job and starting her career.

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Identify at least five skills that employers consider to be essential for job retention.
- Write a cover letter or letter of introduction and prepare a résumé containing all necessary information and meeting professional standards.
- Demonstrate how to complete a job application form that meets standards of neatness and accuracy.
- Demonstrate how to participate in a job interview meeting professional standards.
- Determine gross and net income, and calculate a personal budget for a one-month period.

KEY TERMS

budget
deductions
externships
fixed expenses
gross income
income
internships
net income
résumé
variable expenses

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14:1 DEVELOPING JOB-KEEPING SKILLS

PREPARING FOR A JOB

When you have completed your health science education, you will be ready to obtain a position in health care. Two things that may help you prepare for a health care position are internships and externships, which are work experiences that offer you the opportunity to gain experience in your chosen field.

Externships may be required as a part of a health science education program. They are usually set up and managed by the department of the college that is responsible for training. An externship is usually unpaid, but it will allow you to go to a health care facility to observe and/or perform the skills you have learned. It is important that you make every effort to work to the best of your ability during your externships because employers frequently select future employees from externs.

Internships usually come toward the end of a health science program and can serve as a "bridge" between the training program and professional life. An internship may be paid, unpaid, or partially paid. An intern is supervised, but the intern is usually allowed to apply the knowledge and skills learned in an actual work situation. Again, employers often hire the best interns after their internships are completed.

When looking for a job, make sure you do all of the following:

- Assess your strengths and weaknesses to help determine the type of job for which you would be best suited. If you have completed an externship or internship, use those experiences to help determine the positions that allow you to excel.
- Determine the type of job you would like, the hours you are available to work, the location or area where you would like to work, potential health care agency employers, and positions you are qualified to hold.
- Develop a positive attitude—be proud of what you have accomplished and be prepared to discuss your achievements.
- Do a job search, prepare a letter of introduction and **résumé**, complete all information for your portfolio, and prepare for a job interview.

CHARACTERISTICS OF A GOOD EMPLOYEE

To obtain and keep a job, you must develop certain characteristics to be a good employee. Employers envision new employees improving over time. Employees must always strive toward personal development and meeting employer expectations. Some of those expectations include being loyal and flexible, and having integrity. Employers also expect every employee to understand the organizational structure and to follow the chain of command. Questions

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and problems can be resolved in a quick and efficient manner if the correct person is consulted. Effective decision-making is the mark of a well-educated, experienced, and valued employee.

It is essential that you develop good job-keeping skills to be successful in a health care career. Being aware of and striving to achieve the qualities needed for employment are as important as acquiring the knowledge and skills required in your chosen health care profession.


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Job-keeping skills include:

- **Use correct grammar at all times**, in the written and spoken word, as you may be judged on how well you communicate with patients and colleagues. Because you will be completing legal written records for health care, the use of correct spelling, punctuation, and sentence structure is also essential. Use a dictionary to check spelling, or use the spell-check tool on a computer.
- **Report to work on time and when scheduled**. Because many health care facilities provide care 7 days a week, 365 days a year, and often 24 hours a day, an employee who is frequently late or absent can cause a major disruption in the provision of patient care. Absenteeism (frequently missing work) may result in losing your job.
- **Be prepared to work hard**. Observe all legal and ethical responsibilities. Follow the policies and procedures of your health care facility. Be willing to learn new procedures and techniques, but always ask for help if you are unsure of what to do. Try to use your initiative and do jobs that you see need doing.
- **Practice teamwork**. Because health care typically involves a team of different professionals working together to provide patient care, it is important to be willing to work with others. If you are willing to help others when they need help, they will likely be willing to help you.
- **Promote a positive attitude**. By being positive, you create a good impression and encourage the same attitude in others. Every job has some bad points that are easy to criticize. However, this leads to a negative attitude and may create poor morale in everyone. Try to concentrate on the good aspects of your job and the rewards it can provide, and you will get more satisfaction from your efforts.
- **Accept responsibility for your actions**. Although it can be difficult, it is essential to take responsibility for mistakes. If you make a mistake, report it to your supervisor, and make every effort to correct the error. Honesty is essential in health care. Not accepting responsibility for your actions is dishonest. It is often a reason for dismissal and can prevent you from obtaining another position.
- **Be willing to learn**. Health care changes constantly because of advances in technology and research. Always be willing to learn new things and adapt to change. Participating in staff-development

programs (**Figure 14–1**); taking courses at technical schools, colleges, or online; attending special seminars or meetings; reading professional journals; and asking questions of other qualified individuals are all ways to improve your knowledge and skills.

To keep a job, it is important to develop the qualities employers need in their employees. Be courteous, responsible, enthusiastic, cooperative, reliable, punctual, and efficient. Demonstrating these personal qualities can result in job advancement, increased salary, and personal satisfaction.



FIGURE 14–1 Participating in staff-development programs is one way to improve your knowledge and skills.

RESIGNING FROM A JOB

As you progress through your career, there will most likely come a time when you will need to resign from your current position. There are many reasons for needing to resign, and these include:

- A job offer with better hours, more pay, better benefits, more educational and advancement opportunities, or better job security.
- A job offer that allows you to use more of your education and skills or is in a specialized area in which you are interested, such as pediatrics or obstetrics.
- Personal reasons, such as marriage, moving, illness, or pregnancy.

It is always best to have a new position before resigning from a current position. If you do not, make sure that you have adequate funds to live on until you have a new position. Handle your resignation in a professional manner. Make sure you treat your current employer well because you may need to rely on them for a reference.

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When resigning:

- Always give notice.
- Make sure the first person you tell is your supervisor or the person in charge—it is not a good idea to let them hear the news from your other team members.
- Be positive about your reasons for leaving and emphasize how your current position has benefited you.
- Work to the best of your ability until your resignation date. Make sure you complete all open assignments and leave detailed progress reports for your supervisor and team members.
- Offer to train your replacement.
- Ask for a letter of recommendation to put in your portfolio.

When resigning, a letter of resignation must be submitted and must include:

- The date you are submitting your resignation letter.
- Your supervisor or the person in charge of your department; copies of the letter should be given to any other people who should be notified in your health care facility.
- The date from which the resignation is effective.
- The reason for leaving—keep this brief and positive.
- A note thanking them for giving you the opportunity to work at their health care facility—be sure to end the letter on a positive note.
- Your signature.

In the event that you are fired or laid off:

- Stay positive, no matter how difficult.
- Do not blame others—look for the reason within yourself, and learn from the experience. In future interviews, you can tell potential employers how you learned from your error. Accept responsibility for whatever caused you to be fired.
- Do not criticize the health care facility to others. Do not make any statements or express any opinions that you may later regret.
- Ask the employer if a letter of resignation would be accepted instead of being fired. It looks better to future employers if you resigned instead of being fired. If the employer agrees, be sure to thank them.

Before you leave, make sure you have contact information for key supervisors and other team members who you want to keep as part of your network of contacts. Be sure to thank them for having had the

opportunity to work with them. Throughout your health care career, you may need to call on former colleagues and employers for consultations, recommendations, advice, and help. The health care world is very interconnected, so it is important you make your career decisions with respect and dignity.

checkpoint

1. List five job-keeping skills.
2. When you are resigning your position, who is the first person you should tell?

14:2 WRITING A COVER LETTER AND PREPARING A RÉSUMÉ

Before you look for a job, evaluate your interests and abilities. Decide what type of job you would like. Make sure you obtain the education needed to perform the job. There are many different sources for finding job openings. Some of them include:

- Trusted job search websites.
- Job listings posted by health care facilities on their websites.
- Job fairs sponsored by schools, employment agencies, or health care facilities.
- Recommendations from practicum shadowing clinical sites, externships, and internships.
- Personal networking: supervisors, mentors, and acquaintances.
- Joining professional social networking sites such as *www.linkedin.com*. These sites allow you to search for available jobs and network with other health care professionals. You are also able to "follow" health care agencies you are interested in to see when they have new job openings available.
- Advertisements in newspapers.
- Recommendations from friends and relatives.
- School counselors or bulletin boards.
- Employment agencies.
- Professional organizations: check their websites or contact the local organizations.

Once you have identified possible places of employment, prepare to apply for the position. In most cases, this involves writing a cover letter or letter of introduction, and a résumé.

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COVER LETTER OR LETTER OF INTRODUCTION

The purpose of a cover letter or letter of introduction is to obtain an interview. You must create a good impression in the letter so that the employer will be interested in hiring you. In many cases, you will be responding to a job advertised either on the Internet or through other sources. However, a résumé (also called a curriculum vitae or CV) may be sent to potential employers, even though they have not advertised a job opportunity. A cover letter or letter of introduction should accompany all résumés.

The letter should be completed on a computer and printed on good-quality paper that is white or light in color. It must be neat, complete, and written according to correct form for letters. Care must be taken to ensure that the spelling and punctuation are correct. Remember, this letter is the employer's first impression of you.


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If possible, the letter should be addressed to the correct individual. If you know the name of the agency or company, call to obtain this information or try to locate it on their website. Be sure you obtain the correct spelling of the person's name as well as the person's correct title. If you are responding to a box number, follow the instructions in the advertisement or posting. Another possibility is to address the letter to the director of human resources or the head of a particular department.

The letter usually contains three or four paragraphs. The contents of each paragraph are described as follows:

Paragraph 1: State your purpose for writing, and express interest in the position for which you are applying. If you are responding to an advertisement or posting, state the name and date of the publication or posting site. If you were referred by another individual, give this person's name and title.

Paragraph 2: State why you believe you are qualified for the position. You might also state why you want to work for this particular employer. Information should be brief because most of the information will be included on your résumé.

Paragraph 3: State that a résumé is included or attached if you are submitting your cover letter and résumé online. You may also want to draw the employer's attention to one or two important features on your résumé. If you are not including a résumé, state that one is available on request. Whenever possible, it is best to include a résumé.

Paragraph 4: Close the letter with a request for an interview. Be sure to state clearly how the employer can contact you for additional information. Include a telephone number, e-mail address, and the times you will be available to respond to a telephone call. When including an e-mail address, it is very important that you create a professional e-mail account name that has your first name, last name, and no nicknames or slang. Outlook and Google offer

free e-mail accounts. Finally, include a sentence thanking the potential employer for considering your application.

Figure 14–2 shows a sample cover letter to serve as a guide to writing a good letter. However, remember this is only one guide. Letters must be varied to suit each circumstance.

Nasser Al-Ahmed
2332 Ali Ibn Abi Talib St.
Almanar
Riyadh, 13348
June 3, 20--

Mr. Prospective Employer
Director of Human Resources
Health Care Facility
King Salman Rd.
Alrawdah
Dammam, 32256

Dear Mr. Employer

Peace, mercy, and blessings of God be upon you.

In response to your advertisement in the _____
on _____, 20 _____, I would like to apply for the position of _____.

I recently graduated from _____. I majored in _____ and feel I am well qualified for this position. I enjoy working with people and have a sincere interest in additional training in _____.

My résumé is enclosed. I have also enclosed a specific list of skills that I mastered during my school experience. I feel that previous positions noted on the résumé have provided me with a good basis for meeting your job requirements.

Thank you for considering my application. I would appreciate a personal interview at your earliest convenience to discuss my qualifications. Please contact me at the above address or via e-mail at NasserAl-Ahmed@gmail.com.

I look forward to hearing from you.

Sincerely,

Nasser Al-Ahmed

FIGURE 14–2 A sample cover letter.

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RÉSUMÉ

A résumé is a record of information about an individual. It is a thorough yet concise summary of an individual's education, skills, accomplishments, and work experience. It is used to provide an employer with basic information that details your qualifications as an employee. At the same time, a good résumé will help you clarify your job objective and be better prepared for a job interview.

A résumé should be prepared on a computer using a word-processing program so that it can be easily changed or updated, and it should be attractive in appearance. Like a cover letter, a résumé creates an impression on the employer. Information should be presented in an organized fashion. At the same time, the résumé should be concise and pertinent. Good-quality paper that is white or light in color, correct spelling and punctuation, straight, even margins, and an attractive style are essential. It is also a good idea to prepare a digital copy of your résumé so it can be attached to an e-mail without changing its formatting or design.

Résumé format can vary. Review sample sources and find a style that you feel best presents your information. A one-page résumé is usually sufficient.

Parts of a résumé can also vary. Some of the most important parts that should be included are shown in **Figure 14–3** and are described as follows:

- Personal identification (your name, address, telephone number including the area code, and/or e-mail address).
- Employment objective, job desired, or career goal (title of the position for which you are applying).
- Educational background (name and address of your high school, and any special courses if they relate to the job position).
- Skills (special knowledge, computer, technology, and work skills you have that can be used in the job you are seeking).
- Work or employment experience (previous positions of employment, starting with the most recent position, including the name and address of the employer, dates employed, your job title, and a brief description of your duties).
- Other activities (organizations of which you are a member, offices held, community service, special awards received, volunteer work, hobbies, special interests, and other similar facts).
- Credentials (certification, if relevant).
- References (always be sure you have an individual's permission before using that person as a reference).

Honesty is always the best policy, and this is particularly true regarding résumés. Never give information that you think will look good but is

exaggerated or only partly true. Inaccurate or false information can cost you a job.

Before preparing your résumé, list all of the information you wish to include. Then select the format that best presents this information.

Nasser Al-Ahmed

2332 Ali Ibn Abi Talib St., Almanar Riyadh, 13348
nasserAl-Ahmed@gmail.com
+966 55 012 3456

CAREER GOAL:	Position as a dental assistant in general practice with a goal of becoming a certified dental assistant
EDUCATION:	**Best Technical School, Riyadh** Graduated in June 2022 Majored in Dental Assistant Program for two years
SKILLS:	Identification of teeth, charting conditions of the tooth, mixing dental cements and bases, pouring models and custom trays, preparing anaesthetic syringe, setting up basic dental trays, sterilizing of instruments, developing and mounting radiographs, typing business letters, completing insurance forms
WORK EXPERIENCE:	**Dental lab assistant, Smile Dental Lab Products, Al Orouba Road, Riyadh** Employed September 2021 to present as dental lab assistant, proficient in models, custom trays, and prosthetic devices
	Salesperson, Dawa Pharmacy, Grand Mall, Riyadh Employed June 2020 to August 2021. Experience in custom relations, inventory, register, and sales promotion
ACTIVITIES:	Volunteer worker during dental health week; hobbies include football, swimming, and reading
PERSONAL TRAITS:	Dependable, considerate of others, willing to learn, adaptable to new situations, respectful and honest, adept at dental terminology, able to perform a variety of dental skills

References on request

FIGURE 14–3 A sample résumé.

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CAREER PASSPORT OR PORTFOLIO

A career passport or portfolio is a professional way to highlight your knowledge, abilities, and skills as you prepare for employment or extended education. It allows you to present yourself in an organized and efficient manner when you interview for schools or employment. Final content will vary for each individual, but most career passports or portfolios will contain the following types of information:

- Introductory letter: a brief synopsis of yourself including your background, education, and future goals.
- Résumé.
- Skill list and competency level: a list of skills you have mastered and the level of competency for each skill.
- Letter(s) of recommendation: letters of recommendation from your instructors, guidance counselors, supervisors in clinical areas, or agencies where you perform volunteer work.
- Copies of work-based learning evaluations and documentation of hours.
- Credentials: copies of a school transcript or a recent grade card, and copies of any certificates, such as CPR certification or first aid certification.
- Service projects: documentation of service learning or community service and any associated credentials or recognition you may have been awarded for that effort.

Organize the information in a neat binder, portfolio, or computer file. Use tab dividers or electronic folders to separate it into organized sections. Make sure that you use correct grammar and punctuation on all written information. The effort you put into creating a professional portfolio or passport will be beneficial when you have this document ready to present during a school or job interview. It is also a good idea to keep an electronic version of your portfolio for easy updates, so you have a back-up of all the information in case anything happens to your portfolio, or in case an employer asks you to send your résumé and portfolio for them to review before your interview.

checkpoint

1. How many paragraphs should be included in a cover letter or letter of introduction?
2. How should your résumé be prepared?

14:3 COMPLETING JOB APPLICATION FORMS

Even though you provide each potential employer with a résumé, most employers still require you to complete an application form. Application forms are used by employers to collect specific information. Forms vary from employer to employer, but most request similar information.

Before completing any application form, it is essential that you first read the entire form. Note areas where certain information is to be placed. Read instructions that state how the form is to be completed. Some forms request that the applicant complete the application in handwritten form, but most now provide the application in a computerized format to be completed on a computer and either printed out or submitted electronically by e-mail.

Some employers will send you the application form before your interview so you have time to fill it out and print it or submit it electronically (unless they require you to do it in handwritten form). If they do not send it to you in advance, make sure you have all the required information with you when you go for a job interview.


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Basic rules for completing a job application form include:

- Fill out each item neatly and completely.
- Do not leave any areas blank. Put "none" or "NA" (meaning "not applicable") when the item requested does not apply to you.
- Ensure that addresses include all the required information.
- Watch spelling and punctuation. Always use a spell-checker when completing an application on a computer. Errors will not impress the potential employer.
- Complete the form in the manner requested (on a computer or handwritten). Use a blue pen if handwritten.
- If the application is not available electronically, scan the application into a computer word program, key in all information, check for accuracy, and then print the completed application form. Use a spell-checker. This method allows for easy correction of errors.
- Make sure all information is legible.
- Do not write in spaces that state "office use only" or "do not write below this line". Employers often judge how well you follow directions by your reaction to these sections.
- Ensure all information is correct and truthful. Remember, material can be checked and verified. A simple half-truth can cost you a job.

- Proofread your completed application. Check for completeness, spelling, proper answers to questions, and any errors.
- If references are requested, be sure to include all information, such as title, address, telephone number, and e-mail address. Before using anyone's name as a reference, it is best to obtain that person's permission. Be prepared to provide reference information when you go for a job interview. Most sources suggest listing at least three references on a separate sheet of the same type of paper used for the résumé.

Even though questions vary on different forms, some basic information is usually requested on all of them. You could save this information on your smartphone so you have easy access to it while filling out an application. Remember that employers use application forms as a screening method. To avoid being eliminated from consideration for a position of employment, be sure that your application creates a favorable impression.

checkpoint

1. If you fill out an application on paper, what color ink should you use?
2. How many references should you have?

14:4 PARTICIPATING IN A JOB INTERVIEW

A job interview is what you are seeking when you send a cover letter or letter of introduction and a résumé. You must prepare for an interview just as hard as you did when composing your résumé. A poor interview can mean a lost job.

A job interview is usually the last step before getting or being denied a particular position of employment. Usually, you have been screened by the potential employer and selected for an interview as a result of your résumé and application form. Keep in mind that most employers now also check an applicant's social media accounts, such as LinkedIn, Instagram, Snapchat, and Twitter, in the prescreening process, so it is very important to make sure your social media accounts reflect a professional image. A potential employer will not be impressed by pictures of you smoking or acting inappropriately. Make sure you clean up your social media accounts before applying for a job. To the employer, the interview serves at least two main purposes:

- Provides the opportunity to evaluate you in person, obtain additional information, and ascertain whether you meet the job qualifications.
- Allows the employer to tell you about the position in more detail.

Careful preparation is needed before going to an interview. Be sure you have all the required information. Your résumé and completed

application form (if it was given to you in advance) must be ready. If you have completed a career passport or portfolio, be sure to take it to the interview. If possible, find out about the position and the agency offering the job. In this way, you will be more aware of the agency's needs.

Be sure of the scheduled date and time of the interview. Know the name of the individual you must contact and the exact place of the interview. Write this information down and take it with you or save it on your smartphone for easy access.

It is best to arrive 5–10 minutes early for your interview. Late arrival could mean a lost job. Allow for traffic, trains blocking the road, and other complications that might interfere with your arriving on time. Do not bring any friends or relatives to the interview with you. Before your interview starts, turn off all mobile devices.

During the interview, observe all of the following points:

- Greet the interviewer by name when you are introduced. Introduce yourself and smile.
- Remain standing until the interviewer asks you to sit. Be aware of your posture and sit straight.
- Use correct grammar, and avoid using slang words.
- Speak slowly and clearly; do not mumble.
- Be polite and practice good manners.
- Maintain eye contact. Avoid looking at the floor, ceiling, or away from the interviewer (**Figure 14–4**). Looking at the middle of the interviewer's forehead or at the tip of the interviewer's nose can help when you are nervous and experiencing difficulty with direct eye contact.



FIGURE 14–4 Avoid looking at the floor, ceiling, or away from the interviewer.

- Listen closely to the interviewer. Do not interrupt in the middle of a sentence. Allow the interviewer to take the lead.
- Answer all questions thoroughly, but do not go into long, drawn-out explanations. Make sure your answers show how you are qualified for the job.
- Smile, but avoid excessive laughter or giggling.
- Be yourself. Do not try to assume a different personality or different mannerisms; doing so will only increase your nervousness.
- Be enthusiastic and display your positive attitude.
- Never discuss personal problems, finances, or other situations in an effort to get the job. This usually has a negative effect on the interviewer.
- Do not criticize former employers or degrade them in any way.
- Answer all questions truthfully to the best of your ability.
- Think before you respond. Try to organize the information you present.
- Be proud of yourself, to a degree. You have skills and are trained. Make sure the interviewer is aware of this. However, be sure to show a willingness to learn and to gain additional knowledge.
- Do not immediately question the employer about salary, fringe benefits, insurance, and other similar items. This information is usually mentioned before the end of the interview. If the employer asks whether you have any questions, have one prepared. Ask about the job description or responsibilities, the type of uniform required, potential for career growth, continuing education or in-service programs, and job orientation. These types of questions indicate a sincere interest in the job rather than a "What's in it for me?" attitude.
- Do not expect a definite answer at the end of the interview. The interviewer will usually tell you that they will contact you.
- Thank the interviewer for the interview as you leave. Smile, be polite, and exit with confidence.
- Never try to extend the interview if the interviewer indicates that they are ready to end it.
- After the interview, it is best to send a follow-up note, letter, or e-mail to thank the employer for the interview. You may indicate that you are still interested in the position. You may also state that you are available for further questioning. When an employer is evaluating several applicants, a thank-you note is sometimes the deciding factor in who gets the job.

You may be asked many different questions during an interview, so it is impossible to prepare all answers ahead of time. However, it is wise to think about some potential questions and your responses to them. The following is a suggested list of questions to review. Additional questions may be found in any book on job interviews.

- Tell me a little about yourself. (Note: Stick to job-related information.)
- What are your strong points/weak points? (Note: Be sure to turn a weakness into a positive point. For example, say, "One of my weaknesses is poor spelling, but I use a dictionary or spell-checker to check spelling and try to learn to spell 10 new words each week.")
- Why do you feel you are qualified for this position?
- What jobs have you held in the past? Why did you leave those jobs? (Note: Avoid criticizing former employers.)
- What school activities are you involved in?
- What kind of work interests you?
- Why do you want to work here?
- What skills do you have that would be of value?
- What is your attitude toward work?
- What do you want to know about this job opening?
- What were your favorite subjects in school and why?
- What does success mean to you?
- How do you manage your time?
- What is your image of the ideal job?
- How skilled are you with computers?
- What are the three most important things to you in a job?
- Do you prefer to work alone or with others? Why?
- How many days of school did you miss last year?
- What do you do in your spare time?
- Do you have any plans for further education?

checkpoint

1. What two principles does an interview serve?
2. How early should you arrive for an interview?

14:5 DETERMINING NET INCOME

Obtaining a job means, in part, that you will be earning your own money. This often means that you will be responsible for your own living expenses. To avoid debt and financial crisis, it is important that you learn about managing your money effectively, including understanding how to determine net income.

The term **income** usually means money that you earn or that is available to you. However, the amount you actually earn and the amount you receive to spend may vary. The following two terms explain the difference.

- **Gross income**: This is the total amount of money you earn for hours worked. It is the amount determined before any **deductions** have been taken out of your pay.
- **Net income**: This is commonly referred to as "take-home pay." It is the amount of money available to you after all payroll deductions (General Organization for Social Insurance [GOSI] annuities for retirement and unemployment insurance—SANED) have been taken out of your salary.

To determine *net income*, you must first determine the amounts of the various deductions that will be taken out of your gross pay. Deduction percentages usually vary depending on your income level.

Gross Pay 10,000.00 SAR:

- Deduction for GOSI annuities is 9% (900 SAR).
- Deduction for GOSI unemployment insurance (SANED) is 0.75% (75 SAR).
- Net income after deductions, then, would be 9,025 SAR. Therefore, before you receive your paycheck, 975 SAR will be deducted from it.

To manage your money effectively, it is essential that you can calculate your net income. Because this is the amount of money you will have to spend, it will to some extent determine your lifestyle.

checkpoint

1. What is gross income?
2. What is net income?

14:6 CALCULATING A BUDGET

To use your net income wisely, it is wise to prepare a **budget**. A budget is an itemized list of living expenses. It must be realistic to be effective. A budget usually consists of two main types of expenses: fixed expenses and variable expenses:

- **Fixed expenses** include items such as rent or house payments, utilities, food, and car payments.
- **Variable expenses** include items such as entertainment, clothing purchases, and donations.

The easiest way to prepare a budget is simply to list all anticipated expenses for a one-month period. Then, determine your net monthly pay. Allow a fair percentage of the net monthly pay for each of the budget items listed.

Savings should be incorporated into every budget. If saving money is regarded as an obligation, it is easier to set aside money for this purpose. When an emergency occurs, money is then available to cover the unexpected expenditure.

Some payments are due once or twice a year. An example is insurance payments. To be realistic, a monthly amount should be budgeted for this purpose. To determine a monthly amount, divide the total yearly cost for the insurance by 12. Then, budget this amount each month. In this way, when insurance payments are due, the money is available for payment, and one month's budget will not have to bear the full amount of the insurance payment.

The following percentage ranges of total net income could be used while preparing a realistic budget:

- Housing: 20–35%.
- Food: 15–30%.
- Utilities: 4–7%.
- Transportation (including car loan, insurance, gas, and maintenance): 6–20%.
- Clothing: 3–10%.
- Personal care (including soap, toothpaste, laundry detergent, cosmetics, etc.): 2–4%.
- Miscellaneous (travel, childcare, entertainment, gifts, etc.): 1–4%.
- Savings: 5–9%.

It is important to remember that these percentages and line items are just suggested guidelines. Each individual must determine their own needs and allocate monies accordingly.

It is important that budgeted expenses do not exceed net monthly income. It may sometimes be necessary to limit expenses that are not fixed, such as entertainment and clothing purchases.

The final step is to live by your budget and avoid any spending over the allotted amounts. If your fixed expenses or net income increases, you will have to revise your budget. Remember, creating a budget leads to careful management of hard-earned money.

checkpoint

1. What is a budget?
2. What are variable expenses?

Today's Research — Tomorrow's Health Care

A Bravery Gene?

Many scientists are researching a genetic basis for fear. Some early research involved the Shumyatsky group at Rutgers University, where they analyzed brain tissue to locate a gene in a tiny prune-shaped region of the brain called the amygdala, an area of the brain that is extremely active when animals or humans are afraid or anxious (**Figure 14–5**). This gene produces a protein called stathmin, which is highly concentrated in the amygdala but hard to detect in other areas of the brain.

Scientists removed this stathmin gene and bred a line of mice that were all missing this gene. Tests showed that this breed of mice was twice as willing to explore unknown territories as unaltered mice. In addition, if the mice were trained to expect a small electrical shock after being presented with a stimulus, such as a sound or sight, this group of mice did not seem as fearful when the sound or sight was given.

Researchers theorized that stathmin helps form fearful memories in the amygdala, the area where unconscious fears seemed to be stored. If the production of stathmin could be halted or inhibited by medication, it is possible that fears would not be stored as unconscious memories.

Recent research has shown that stathmin may also play a crucial role in epileptic seizures. Patients with temporal lobe epilepsy seizures frequently experience pain as an aura or warning that a seizure is going to occur.

In addition, the Shumyatsky group is currently studying the role of other amygdala-enriched genes to determine their role in memory and learned fear.

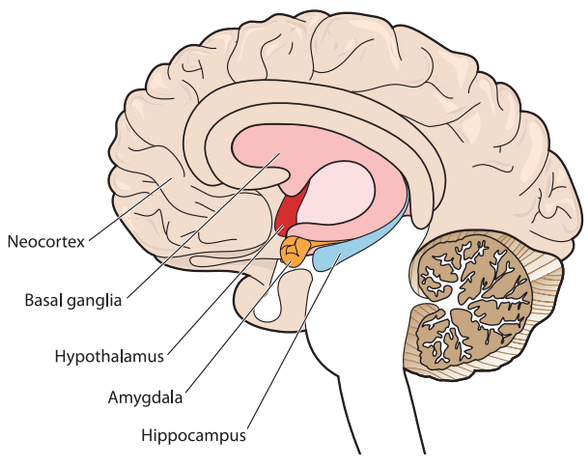


FIGURE 14–5 This diagram shows the position of the amygdala in the brain.

Case Study Investigation Conclusion

How many ideas did you come up with that Nuha could implement? Some things are readily available, and some she will have to work toward. Since she had interned for 10 months, what references might she call on?

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CHAPTER 14 SUMMARY

- Job-keeping skills important to an employer include using correct grammar in oral and written communications, reporting to work on time and when scheduled, being prepared to work, following policies and procedures, having a positive attitude, working well with others, taking responsibility for your actions, and being willing to learn.
- Without good job-keeping skills, no amount of knowledge will help you keep a job.
- It is important to prepare for an interview. Answers should be prepared for common questions.
- Practice completing job application forms. A neat, correct, and thorough application form will also help you get a job.
- Everyone should be able to calculate gross and net income, and develop a budget based on needs and income. Having and following a budget makes it more likely that money earned will be spent wisely.

REVIEW QUESTIONS

1. What is the main purpose of a cover letter or letter of introduction? When is it used?

2. List the main sections of a résumé, and briefly describe the information that should be included in each section.

3. State six principles that must be followed while completing a job application form.

4. What should you do after an interview?

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CRITICAL THINKING

1. Choose five job-keeping skills that you believe you have mastered. Write a paragraph describing why you believe you have mastered these skills, and include examples. Set up your electronic career portfolio, and include this document as part of your writing example.

2. Why is it important to be honest in composing your résumé?

3. Calculate your monthly budget when you get a full-time job as a radiology technician earning 7000 SAR per month. List fixed and variable expenses.

ACTIVITIES

1. Start your personal career portfolio by creating:
   - **a.** A cover letter or letter of introduction.
   - **b.** A résumé.
2. Get an application that your instructor has obtained from local health care facilities. Complete it, meeting the standards of neatness and correctness.
3. With a partner, create a job-interview scenario. Practice presenting this scenario with the candidate completely prepared and then completely unprepared.

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GLOSSARY

A

abbreviations—Shortened forms of words, usually just letters.

abrasion—Injury caused by rubbing or scraping the skin.

absorption—Act or process of sucking up or in; taking in of nutrients.

abuse—Causing physical harm or pain, or mental anguish to another.

accreditation—Ensures that the program of study meets the established quality competency standards and prepares students for employment in the health care career.

affection—A warm or tender feeling toward another; fondness.

alternative therapies—Methods of treatment used in place of conventional biomedical therapies.

antioxidants—Enzymes or organic molecules that help to protect the body from harmful chemicals called free radicals.

assault and battery—Assault is a threat to injure a person, and battery is the unlawful touching of a person without consent.

associate's degree—Degree awarded by a vocational technical school or community college after successful completion of a course of study.

B

bachelor's degree—Degree awarded by a college or university after a person has completed a course of study.

bacteria (singular: bacterium)—Simple, single-celled organisms that multiply rapidly.

balanced diet—A diet that includes all the essential nutrients in the correct amounts.

base of support—Supporting the body by keeping the feet 20–25 cm apart, placing one foot slightly forward, balancing weight on both feet, and pointing the toes in the direction of movement.

Bill of Rights and Responsibilities—A document issued by the Saudi Arabia Ministry of Health aiming to improve patients' and healthcare professionals' experience and focusing on the quality of care provided.

bioethics—Aims to investigate and study how health care decisions are made.

biotechnology—The use of the genetic and biochemical processes of living systems and organisms to develop or modify useful products.

blood pressure—The force exerted by the blood against the arterial walls when the heart contracts or relaxes.

body mass index (BMI)—A calculation that measures weight in relation to height and correlates this with body fat; used to determine whether an individual is underweight, has ideal weight, or is overweight.

body mechanics—The way in which the body moves and maintains balance while making the most efficient use of all its parts.

budget—An itemized list of living expenses.

burn—An injury that can be caused by fire, heat, chemical agents, radiation, and/or electricity.

C

calorie—Unit of measurement of the fuel value of food.

carbohydrates—Group of chemical substances including sugars, cellulose, and starches; nutrients that provide the greatest amount of energy in the average diet.

cardiopulmonary resuscitation (CPR)—An emergency procedure that combines resuscitating a person's heart and lungs.

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cellulose—Fibrous form of carbohydrate.

certification—The issuing of a statement or certificate by a professional organization to a person who has met the requirements of education and/or experience and who meets the standards set by the organization.

chain of infection—Conditions needed for disease to occur and spread from one individual to another.

chemical disinfection—The removal of infection from instruments

cholesterol—Fatlike substance synthesized in the liver and found in body cells and animal fats.

clinics—Health care facilities that are primarily focused on the care of patients out of hospital.

communication—Process of transmission; exchange of thoughts or information.

complementary therapies—Methods of treatment used in conjunction with conventional biomedical therapies.

computed tomography (CT)—A scanning and detection system that uses a minicomputer and display screen to visualize an internal portion of the human body.

computer-assisted instruction—Teaching method in which computer programs are used to control the learning process and deliver the instructional material to the learner.

confidentiality—Keeping information private.

contamination—The presence of organisms andpathogens on a sterile surface.

continuing medical education (CME)—Training required to renew licenses or maintain certification or registration.

contract—To shorten, decrease in size, or draw together; an agreement between two or more persons.

cost containment—Procedures used to control costs or expenses.

cultural diversity—The different values, beliefs, attitudes, and customs shared by groups of people.

D

deduction—Money taken out of gross pay.

defamation—A false statement that causes ridicule or damage to a reputation.

defense mechanisms—Unconscious acts used to help a person deal with an unpleasant situation or socially unacceptable behavior.

defibrillator—A machine that delivers an electric shock to the heart to try to restore the normal electrical pattern and rhythm.

dental offices—Places where dental services are provided, which can include general care provided to all age groups, or specialized care offered to certain age groups, or for certain dental conditions like orthodontics (straighten teeth).

diabetic coma—A condition caused by an increase in the level of glucose in the bloodstream, resulting from an excess intake of sugar, failure to take insulin, or insufficient production of insulin.

diagnosis—Determining what is wrong with a person.

digestion—Physical and chemical breakdown of food by the body in preparation for absorption.

dislocation—A condition where the end of a bone is either displaced from a joint or moved out of its normal position within a joint.

doctorate/doctoral degree—Degree awarded by a college or university after completion of a prescribed course of study beyond a bachelor's or master's degree.

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E

echocardiogram—A cardiac test that uses technology to direct ultra-high-frequency sound waves through the chest wall and into the heart; a computer then converts the reflection of the waves into an image of the heart; usually a reading is taken while the patient is at rest and then another reading is taken after exercise when the heart rate rises to a target level; used to evaluate cardiac function, reveal valve irregularities, show defects in the heart walls, and visualize the presence of fluid between the layers of the pericardium or bleeding.

electrocardiogram (ECG)—Computerized interpretation system of the electrical activity of the heart.

electronic health records (EHRs)—All of a patient's medical information stored on a computer, usually in a hospital.

emergency care services—Special care provided urgently for victims of accidents or sudden (acute) illness.

empathy—Being able to identify with and understand another's feelings, situations, and motives.

energy conservation—Monitoring the use of energy to control costs and conserve resources.

entrepreneur—An individual who organizes, manages, and assumes the risk of a business.

eponyms—Terms used for things that are named after the people who discovered them, or places or things associated with them.

ergonomics—An applied science used to promote the safety and well-being of a person by adapting to the environment and using techniques to prevent injuries.

essential nutrients—Those elements in food required by the body for proper function.

esteem—Place a high value on; respect.

ethics—Principles of right or good conduct.

exercise stress test—A cardiac test involving an ECG run while the patient is exercising; usually involves walking a treadmill or riding an exercise bike until a target heart rate is reached; allows the physician to evaluate the function of the patient's heart during activity.

expressed consents—Consents stated in distinct and clear language, either orally or in writing.

externship—A learning opportunity offered by educational institutions to give students short, practical experiences in their field of study.

F

fats—Also called lipids; nutrients that provide the most concentrated form of energy; highest-calorie energy nutrients.

feedback—A method used to determine whether communication was successful, which occurs when the receiver of a message responds to the message.

fire extinguisher—A metal cylinder filled with water or chemicals used to put out fires.

first aid—Immediate care given to a person who has been injured or is suddenly taken ill to minimize the effect of the injury or illness until medical professionals can take over their care.

fixed expenses—Regular payments for a known amount due, such as rent or house payments, utilities, food, car payments, and insurance payments.

fracture—A break in a bone of the body.

G

geriatric care—Care provided to older individuals.

goal—Desired result or purpose toward which one is working.

good posture—Correct alignment of the body; an essential part of correct body mechanics.

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government health agencies—Bodies that have roles in legislation, making sure that the rules are followed, and supervision.

gross income—The total amount of money earned by an employee for hours worked. It is the amount determined before any deductions have been taken out of the pay.

growth—The process of developing physically, mentally, or spiritually.

H

health clusters—Integrated networks of health care facilities under one administrative structure, each serving around one million people, with mobility of medical professionals within the system.

health insurance plans—Plans that enable many people to pay for the costs of health care; when the insured individual incurs health care expenses covered by the insurance plan, the insurance company pays for the services.

hearing assistive technology—Devices that help a person to hear more clearly.

heart attack—Blockage of one of the coronary arteries supplying blood to the heart, preventing the heart from functioning efficiently. A heart attack, also called a myocardial infarction, happens when a part of the heart muscle doesn't get enough blood.

hemorrhage—Excessive loss of blood.

holistic health care—Care that promotes physical, emotional, social, intellectual, and spiritual wellbeing.

home health care—Any type of health care provided in a patient's home environment.

hospitals—health care facilities that provide treatment on site with specialized staff and equipment.

I

image-guided surgery—A surgical procedure in which a surgeon uses preoperative and intraoperative images on a computer screen to guide or direct the surgery.

implied consents—Obligations that are understood without verbally expressed terms.

income—Money that is earned or available.

infection—Invasion or contamination of the body by disease-producing microorganisms.

informed consent—Permission granted voluntarily by a person who is of sound mind and aware of all factors involved.

internship—On-the-job training, which may be paid, unpaid, or partially paid, that provides a student with an opportunity to gain experience in their field of study.

interpersonal relationships—Relationships between people and groups.

L

laboratories—Rooms or buildings where scientific tests, research, or experiments take place. Devices for patients, such as false teeth, are also prepared in laboratories.

lasers—Light beams that can be focused precisely.

leader—An individual who leads or guides others, or who is in charge or in command of others.

leadership—Ability to lead, guide, and direct others.

licensure—Process by which a government agency authorizes individuals to work in a given occupation.

life stages—periods of growth and development in a person's life.

lipids—Organic compounds commonly called fats and oils; provide the most concentrated form of energy for the body.

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listening—Paying attention to what someone is saying, making an effort to hear someone.

long-term care facilities—Mainly provide assistance and care for elderly patients, usually called residents but also provide care for individuals with disabilities or handicaps and individuals with chronic or long-term illnesses.

M

magnetic resonance imaging (MRI)—Process that uses a computer and magnetic forces to visualize internal organs.

master's degree—Degree awarded by a college or university after completion of one or more years of prescribed study beyond a bachelor's degree.

medical city—A very large medical center with multiple facilities and multidisciplinary health care teams.

metabolism—The use of food nutrients by the body to produce energy.

microorganism—A small, living organism, invisible to the naked eye.

minerals—Inorganic substances essential to life.

N

nanotechnology—A technology that uses techniques to manipulate atoms and molecules to create new materials and devices.

needs—A lack of something that is required or desired.

net income—The amount of money available to an employee after all deductions have been taken out of the salary.

nonverbal communication—The use of facial expressions, body language, gestures, eye contact, and touch to convey messages or ideas; communication that is not spoken.

nutrition—All body processes related to food; the body's use of food for growth, development, and health.

O

obesity—Excessive body weight 20 percent or more above the average recommended weight, or a BMI equal to or greater than 30.

optical centers—Provide vision examinations, prescribe eyeglasses or contact lenses, and check for the presence of eye diseases.

organizational structure—A line of authority or chain of command that indicates areas of responsibility and leads to the efficient operation of a facility.

outpatient services–Services provided to patients who have not been admitted to hospitals or other care facilities.

oximeter—A simple clip-like device used to measure the level of oxygen in the blood.

P

pain—An unpleasant sensation that is perceived in the nervous system when illness or injury occurs.

pandemic—An infectious disease that affects many people over a wide geographic area; a worldwide epidemic.

parasite—An organism that lives in or on an organism of another species (the host) and benefits by obtaining nutrients at the host's expense.

pathogen—A microorganism that causes infection and disease.

patients' rights—Factors of care that all patients can expect to receive.

physiological needs—Basic physical or biological needs required by every human being to sustain life.

poisoning—Contact with any chemical substance that causes a harmful reaction when applied or ingested.

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Preferred Provider Network (PPN)—A group of health service providers approved by the Saudi Arabia Council of Health Insurance to provide health services to an insured person.

prefix—An affix attached to the beginning of a word.

privileged communications—all information given to health care personnel by a patient.

proteins—Basic components of all body cells; one of the essential nutrients needed for growth and repair of tissues.

puberty—Period of growth and development during which secondary sexual characteristics begin to develop.

pulse—The pressure of the blood felt against the wall of an artery as the heart contracts and relaxes, or beats.

R

radiation exposure—Exposure to radiation waves.

radiation therapy—The use of high-energy particles to decrease the size of tumors and treat cancer.

registration—A professional body administers examination and maintains a list of qualified people.

respiration—The action of breathing; inhalation and exhalation.

résumé—A record of information about an individual.

robotic surgery—Performing surgery with a mechanical device that is computer controlled.

S

safety—Needs that are important when physiological needs have been met; include the need to be free from anxiety and fear, and the need to feel secure in the environment.

scope of practice—The actions that health care practitioners are legally permitted to perform within the terms of their professional license.

self-actualization—Achieving one's full potential.

shock—A clinical set of signs and symptomsassociated with an inadequate supply of blood to body organs, especially the brain and heart.

sphygmomanometer—An instrument used to measure blood pressure.

sterilization—A process that destroys all microorganisms using steam under pressure, gas, radiation, or chemicals.

stethoscope—An instrument used to listen to internal body sounds.

stress—Body's reaction to any stimulus that requires a person to adjust to a changing environment.

stroke—The presence of a clot in a cerebral artery that provides blood to the brain, or hemorrhage from a blood vessel in the brain.

suffix—An affix attached to the end of a word.

T

team—A group of people working together to achieve a common goal.

teamwork—Cooperative effort by the members of a group to achieve a common goal.

technology—Applying scientific knowledge for practical purposes to find answers and fix problems.

telemedicine—The use of video, audio, and computer systems to provide medical and/or health care services.

temperature—A measurement of the balance between heat lost and heat produced by the body.

thermometer—A slender glass tube containing mercury, or a heat-reactive mercury-free liquid such as alcohol, which expands when exposed to heat.

time management—System of practical skills that allows an individual to use time in the most effective and productive way.

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U

ultrasonic cleaning—A process that uses high frequency sound waves to clean instruments.

ultrasound—Noninvasive, computerized scanning technique that uses high-frequency sound waves to create pictures of body parts.

V

variable expenses—Items such as entertainment, clothing purchases, and donations.

virus—An infective agent, visible only using an electron microscope.

vital sign—A sign that provides information about the basic body conditions of the patient; the main vital signs are temperature, pulse, respirations, blood pressure, and pain.

vitamins—Organic substances necessary for body processes and life.

voluntary agencies—Agencies that are supported by donations, membership fees, fundraisers, and grants to provide services such as health at national, regional, and local levels.

W

wellness—State of being in good health; being well.

word roots—Main words or parts of words to which prefixes and suffixes can be added.

wound—An injury to the soft tissues of the body.

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