9th EDITION

SIMMERS
DHO
CAREER EXPLORATION AND SKILL DEVELOPMENT
Health Science

COVER: Digital illustration of the upper torso of a human body, highlighting the heart.

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9th EDITION

Simmers
Simmers-Nartker
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Fuller

DHO Health Science

CENGAGE

9th EDITION
ALIGNED WITH PRECISION EXAMS by Jouscience

SIMMERS
DHO
CAREER EXPLORATION AND SKILL DEVELOPMENT
Health Science

hosa future health professionals

NCHSE National Consortium for Health Science Education

Louise Simmers
Karen Simmers-Nartker
Sharon Simmers-Kobelak
Janet Fuller

Cengage, NGL K–12 School
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SIMMERS DHO

CAREER EXPLORATION AND SKILL DEVELOPMENT

Health Science

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CENGAGE

Australia • Brazil • Japan • Korea • Mexico • Singapore • Spain • United Kingdom • United States

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PREFACE

DHO Health Science, ninth edition, was written to provide the beginning student in health science education (HSE) with the basic entry-level knowledge and skills required for a variety of health care careers. Although each specific health care career requires specialized knowledge and skills, some knowledge and skills are applicable to many different health careers. In short, this book was developed to provide the core knowledge and skills that can be used in many different fields.

Health care is in a state of constant change. The scientific foundation presented in this textbook is required in over 200 different health care careers. *DHO Health Science*, together with *Body Structures and Functions and Medical Terminology*, provides a thorough introduction to the health sciences.

ORGANIZATION OF TEXT

DHO Health Science, ninth edition, is divided into two main parts. **Part 1** provides the student with the basic knowledge and skills required for many different health care careers. **Part 2** introduces the student to basic entry-level skills required for some specific health care careers. Each part is subdivided into chapters.

Chapter Organization

Each chapter has a list of learning objectives and a list of key terms (with pronunciations for more difficult words). For each skill included in the text, both the knowledge necessary for the skill and the procedure to perform the skill are provided. By understanding the principles and the procedure, the student will develop a deeper understanding of why certain things are done and will be able to perform more competently. Procedures may vary slightly depending on the type of agency and on the kind of equipment and supplies used. By understanding the underlying principles, however, the student can adapt the procedure as necessary and still observe correct technique.

Information Sections (Textbook): The initial numbered sections for each topic in this text are information sections that provide the basic knowledge the student must acquire. These sections explain why the knowledge is important, the basic facts regarding the particular topic, and how this information is applied in various health care careers. Most information sections refer the student to the assignment sheets found in the student workbook.

Assignment Sheets (Workbook or MindTap): After students have read the information in the initial section of a topic, they are instructed to go to the corresponding assignment sheet. The assignment sheets allow them to test their comprehension and to return to the information section to check their answers. This enables them to reinforce their understanding of the information presented prior to moving on to another information section.

Procedure Sections (Textbook) The procedure sections provide step-by-step instructions on how to perform specific procedures. The student follows the steps while practicing the procedures. Each procedure begins with a list of the necessary equipment and supplies. The terms *Note*, *Caution*, and *Checkpoint* may appear within the procedure. **Note** urges careful reading of the comments that follow. These comments usually stress points of knowledge or explain why certain techniques are used. **Caution** indicates that a safety factor is involved and that students should proceed carefully while doing the step in order to avoid injuring themselves or a patient. **Checkpoints** at the end of each section alert teachers to check in with how students are processing the information. **Final Evaluations** alert students to ask the instructor to check their work at that point in the procedure. Each procedure section refers the student to a specific evaluation sheet in the workbook.

Evaluation Sheets (Workbook or MindTap): Each evaluation sheet contains a list of criteria on which the student's performance will be tested after they have mastered a particular procedure. When a student feels they mastered a particular procedure, they sign the evaluation sheet and give it to the instructor. The instructor can grade the student's performance by using the listed criteria and checking each step against actual performance.

Because regulations vary from state to state regarding which procedures can be performed by a student in health science education, it is important to check the specific regulations for your state. A health care worker should never perform any procedure without checking legal responsibilities. In addition, a student should not perform a procedure unless the student has been properly taught the procedure and has been authorized to perform it.

Special Features

- The text material covers the *National Health Care Foundation Standards*, helping instructors implement the curriculum elements of this important document. An appendix provides a table showing the correlation of chapters in the book to the *National Health Care Foundation Standards*.
- Mandates of the Health Insurance Portability and Accountability Act (HIPAA) have been incorporated throughout the textbook to emphasize the student's responsibilities in regard to this act.
- Learning objectives, included in every chapter, help focus the student on content discussed in the chapter.
- Review questions and activities are at the end of each chapter to enable the student to test their knowledge of information provided in the chapter.
- Career information has been updated and is stressed throughout the textbook to provide current information on a wide variety of health care careers. Careers have been organized according to the National Health Science Career Clusters. Several new careers have been added.
- Additional emphasis has been placed on cultural diversity, technological advances, legal responsibilities, new federal legislation pertaining to health care providers, infection control standards, and safety.
- Various icons have been included throughout the textbook. These icons denote the integration of academics, such as math, science, and communication; occupational safety issues, such as standard precautions; federal requirements such as HIPAA, electronic health records (EHRs), and OBRA; and workplace readiness issues such as career, legal, and technology information. The icons and their meaning are as follows:

Observe Standard Precautions

Instructor's Check—Call Instructor at This Point

Safety—Proceed with Caution

OBRA Requirement—Based on Federal Law for Nurse Assistants

Math Skill

Legal Responsibility

Science Skill

Career Information

Communications Skill

Technology

Health Insurance Portability and Accountability Act

Electronic Health Records

Enhanced Content New to the Ninth Edition

- Case Study Investigations and Case Study Investigation Conclusions offer a real-life scenario of a patient's medical case and are located at the beginning and end of each chapter. Students instantly connect skills they will learn throughout the chapter to real patients and review new concepts to re-analyze the case after the chapter reading.
- Issues in Health Care have been added to discuss timely topics from our modern-day culture. Topics such as telemedicine present an insight into the ever-changing world of health care.
- Critical Thinking questions have been added to the end of each chapter to give students an opportunity to further investigate the content and topics taught within the chapter.
- Activities give students the opportunity to use active learning and work in small groups to practice skills featured in the chapter from preparing a classroom debate and conducting research to lively competitions as students solve real-world problems and synthesize key terms.
- hosa future health professionals The HOSA Connection highlights HOSA competitive events that correspond with chapter content. This textbook is listed as the recommended resource for nine competitions including Health Science Events, Knowledge Tests, Health Professions Events, Emergency Preparedness Events and HOSA Bowl.

EXTENSIVE TEACHING AND LEARNING PACKAGE

DHO Health Science, ninth edition, has a complete and specially designed supplement package to enhance student learning and workplace preparation. It is also designed to assist instructors in planning and implementing their instructional programs for the most efficient use of time and resources. The package contains the following instructor and student support materials.

DHO Health Science, Ninth Edition, Instructor's Manual

The online *Instructor's Manual* provides easy-to-find answers to questions found in the *Student Workbook*. New to this edition are answers to the end-of-chapter review questions found in the textbook.

DHO Health Science, Ninth Edition, Student Workbook

ISBN-13: 9780357646434

This workbook, updated to reflect the *DHO Health Science* ninth edition text, contains perforated, performance-based assignment and evaluation sheets. The assignment sheets help students review what they have learned. The evaluation sheets provide criteria or standards for judging student performance for each procedure in the text.

Instructor Companion Website to Accompany *DHO Health Science*, Ninth Edition

Everything you need for your course in one place! This collection of product-specific lecture and class tools is available online via the instructor resource center. You will be able to access and download materials such as PowerPoint® presentations, lesson plans, solution files, Precision Exams Correlations, and more.

Components include:

- Teacher's Resource Kit offers a complete guide to implementing a *DHO Health Science* course. The kit explains how to apply content to applied academics and the *National Health Care Foundation Standards*.
- *Cognero®, Customizable Test Bank Generator* is a flexible, online system that allows you to import, edit, and manipulate content from the text's test bank or elsewhere, including your own favorite test questions; create multiple test versions in an instant; and deliver tests from your Learning Management System, your classroom, or wherever you want.
- Teacher support slides created in PowerPoint® supporting the text for use in classroom lectures
- Online Instructor's Manual in PDF format
- Multimedia animations narrating difficult-to-visualize anatomical and physiological processes, including "The Anatomy of a Cell," "The Process of Hearing," "Blood Flow Through the Heart," and much more
- A comprehensive guide maps the textbook content to the *National Consortium for Health Science Education's National Healthcare Foundation Standards and Accountability Criteria*

Download your resources at companion-sites.cengage.com.

Don't have an account? Request access from your Sales Consultant, ngl.cengage.com/repfinder.

Visit us at ngl.cengage.com/cte.

MindTap to accompany *DHO Health Science*, Ninth Edition MINDTAP

ISBN-13: 9780357646458

MindTap for *DHO Health Science*, ninth edition is the online learning solution for career and technical education courses that helps teachers engage and transform today's students into critical thinkers. Through paths of dynamic assignments and applications that you can personalize, real-time course analytics, and an interactive eBook, MindTap helps teachers organize and engage students. Every MindTap course includes data analytics with engagement tracking as well as student tools, such as flashcards, practice quizzes, auto-graded homework, and tests.

Whether you teach this course in the classroom or in hybrid/e-learning models, MindTap for *DHO Health Science*, ninth edition enhances the course experience with *Learning Lab Simulations* for career exploration, health careers, critical thinking, and foundational skills like infection control, anatomy & physiology, medical terminology, and more. Gain insight into student knowledge and skill competency before you get hands-on in the lab as students work through video-based, real-world scenarios in clinics and make decisions using E.H.R. resources, talking to colleagues, and gain feedback from their clinic administrator.

The *Career Exploration Learning Lab for DHO Health Science* introduces health science students to the variety of health care career paths available to them. Using video simulations that follow a young, seriously injured patient from an accident scene through all aspects of required health care to home care, the student is exposed to 31 primary careers and various additional related careers. From the patient's point of view, the student watches video segments of each primary professional that offer a glimpse of

the health care professional's role in the care of the young patient. Students are introduced to career paths that require various levels of education and training and offer a variety of salary ranges—careers that range from phlebotomist to occupational therapist to psychiatrist. Accompanying career profile screens offer interview videos for each primary career and provide basic information such as duties and responsibilities, career attributes, and educational and certification requirements.

Teachers and students who have adopted MindTap can access their courses at nglsync.cengage.com. Request access from your Sales Consultant, ngl.cengage.com/repfinder.

Additional Student Resources

Audio podcasts of medical terminology and animations are available for download at companion-sites.cengage.com. Search by author last name, book title, or 13-digit ISBN to access these bonus resources available with the textbook. Look for the Free Materials tab.

This edition of *DHO Health Science* is aligned to Precision Exams' *Health Sciences* Career Cluster exams listed below, and with the *National Health Science Assessment* sponsored by NCHSE (National Consortium for Health Educators). Precision Exams' standards are validated by industry, allowing students to earn a certification that connects skills taught in the classroom to a future profession, creating a successful transition from high school to college and/or career. Working together, Precision Exams and National Geographic Learning, a part of Cengage, focus on preparing students for the workforce, with exams and content that are kept up to date and relevant to today's jobs.

PRECISION EXAMS

DHO Health Science correlates to the following Precision Exams:

- Medical Assistant: Medical Office Management;
- Medical Assistant: Clinical and Laboratory Procedures;
- Medical Assistant: Anatomy & Physiology;
- Medical Anatomy: Anatomy & Physiology;
- Dental Assistant: Dental Science I & II;
- Health Science Introduction;
- Medical Terminology; and
- Medical Assistant: Medical Terminology,

To access the corresponding correlation guides, visit the accompanying Online Instructor Companion Website for this title in NGLsync or at companion-sites.cengage.com. For more information on how to administer the *DHO Health Science* exam or to gain access to any of the 180+ Precision Exams, contact your local NGL/Cengage Sales Consultant. You can find your rep at ngl.cengage.com/repfinder.

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.

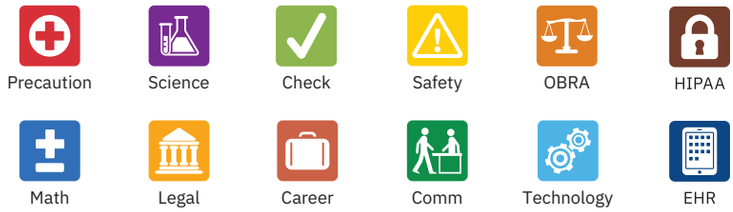
LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Describe at least eight types of private health care facilities.
- Analyze at least three government health services agencies and the services offered by each.
- Describe at least three services offered by voluntary or nonprofit agencies.
- Explain the purpose of organizational structures in health care facilities.

ICONS

Icons are used throughout the text to highlight specific pieces of information. An icon key is presented at the beginning of each part to reinforce the meaning of the icons.



KEY TERMS

Key terms highlight the critical vocabulary words you will need to learn. Pronunciations are also included for the harder-to-pronounce words. These terms are highlighted within the text where they are defined. 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

- Agency for Healthcare Research and Quality (AHRQ)
- assisted living facilities
- Centers for Disease Control and Prevention (CDC)
- clinics
- concierge medicine
- dental offices
- emergency care services
- fee-for-service compensation
- Food and Drug Administration (FDA)
- genetic counseling centers
- health departments
- health insurance plans
- Health Insurance Portability and Accountability Act (HIPAA)
- health maintenance organizations (HMOs)
- home health care
- hospice
- hospitals
- independent living facilities
- industrial health care centers
- laboratories
- long-term care facilities (LTCs or LTCFs)
- managed care
- Medicaid
- medical offices
- Medicare
- Medigap policy
- mental health facilities
- National Institutes of Health (NIH)
- nonprofit agencies
- Occupational Safety and Health Administration (OSHA)

TODAY'S RESEARCH: TOMORROW'S HEALTH CARE AND ISSUES IN HEALTH CARE

Today's Research: Tomorrow's Health Care and *Issues in Health Care* boxes are located in each chapter. 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

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 Taxol, 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.

The National Cancer Institute (NCI) has more than 50,000 samples of plants and 10,000 samples of marine organisms stored in Frederick, Maryland. Every sample is crushed into a powder and made into extracts that can be tested against human cancer cells. More than 110,000 extracts of these samples are available to other scientists who evaluate their effectiveness against conditions such as viral diseases and infections. To date, more than 4,000 extracts have shown promise and are being used in more advanced studies. One compound, Halichondrin B, labeled "yellow slimy" by researchers, is an extract taken from a deep-sea sponge found in New Zealand. 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 by the FDA in 2010 as a treatment for metastatic breast cancer. Bristol-Myers received FDA approval for another drug, Ixabepilone, that is extracted from garden soil bacteria and is also used to treat metastatic breast cancer. Wyeth's drug Rapamune was isolated from soil on Easter Island and approved for preventing kidney rejection after transplants. Another novel drug involves photodynamic activity. A substance called psoralen is obtained from a Nile-dwelling weed called ammi. Psoralen is inactive until it is exposed to light. When it is activated, it attaches to the DNA of cancer cells and kills them. Research led to the approval of a psoralen-like drug that is exposed to certain wavelengths of light and used to treat some forms of lymphoma, a cancer of white blood cells. By creating synthetic versions of the compounds, scientists are preserving natural resources while also benefiting from them.

RELATED HEALTH CAREERS

Related Health Careers appear in Chapter 7, *Anatomy and Physiology*, and in other chapters that contain information related to specific careers. By reviewing the information presented in these boxes, you will relate specific health careers to specific body systems or chapter content.

Related Health Careers

- Activity director
- Assisted living administrator
- Biogerontologists
- Geriatric aide
- Geriatric case manager
- Geriatric counselor

CAREER HIGHLIGHTS

Career Highlights appear in the Special Health Care Skills chapters. By reading and understanding the material presented in these boxes, you will learn the educational requirements of each profession, potential places of employment, and additional tasks you may have to perform that are not specifically discussed within the chapter.

Career Highlights

Dental assistants work under the supervision of doctors called dentists, and they are important members of the dental health care team. Educational requirements vary from state to state, but can include on-the-job training, one- or two-year health science education programs, and/or an associate's degree.

Legal

Certification is available through the Dental Assisting National Board (DANB) after an individual has graduated from a Commission on Dental Accreditation (CODA)–accredited program of dental assisting or has met the requirements established in their state for completing a specific number of hours of work experience in a period of two years of full-time or four years of part-time employment as a dental assistant. The duties of dental assistants vary depending on the size and type of practice, and on the dental practice laws of the state in which they work. Each state has a dental practice act that governs which duties dental assistants can perform under the scope of practice. It is the responsibility of the dental assistant to know and follow the state regulations. In addition to the knowledge and skills presented in this chapter, dental assistants must also learn and master skills such as:

- Presenting a professional appearance and attitude
- Obtaining knowledge regarding health care delivery systems, organizational structure, and teamwork
- Meeting all legal responsibilities
- Communicating effectively
- Being sensitive to and respecting cultural diversity
- Comprehending human anatomy, physiology, and pathophysiology with an emphasis on oral anatomy and physiology
- Observing all safety precautions

FULL-COLOR PHOTOS AND ILLUSTRATIONS

Illustrations are presented in full color and demonstrate important health care concepts, including the inner workings of the body. Use these illustrations for review while studying.

Full-color photos are used throughout the text to illustrate important techniques you will be required to know and demonstrate when working within a health care field.

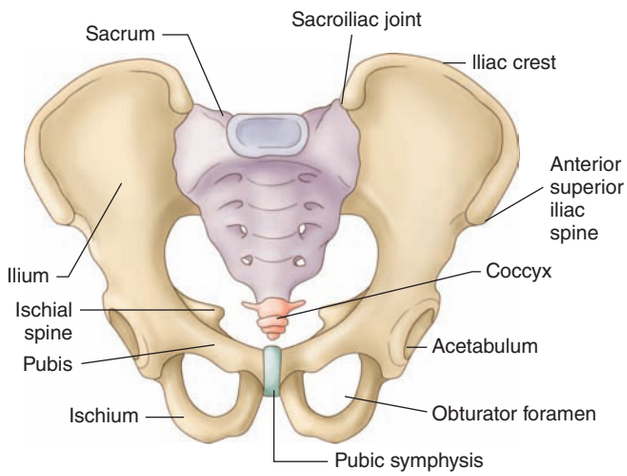


FIGURE 7–22 Anterior view of the pelvic girdle.

FIGURE 20–3 To carry a microscope, place one hand firmly on the arm and the other hand under the base.

PROCEDURE SECTIONS

Procedure sections provide step-by-step instructions on how to perform the procedure outlined in the initial information section at the start of each topic. Practice these procedures until you perform them correctly and proficiently.

Procedure 20:1

Operating the Microscope

Equipment and Supplies

Microscope; lens paper; slide and coverslip; hair, paper, or other small object; drop of water; immersion oil; gloves for a biological specimen

Procedure

1. Assemble equipment.
2. Wash hands. Put on gloves if needed.

   Precaution **CAUTION:** Wear gloves and observe standard precautions while handling any specimen contaminated by blood or body fluids, or while examining pathogenic organisms. If splashing of the specimen is possible, wear a gown, mask or face shield, and eye protection.
3. Use a prepared slide or get a clean slide. Place a human hair, shred of paper, or other small object on the slide. Add a drop of water or normal saline. Cover with a clean coverslip by holding the coverslip at an angle and allowing it to drop on the specimen.

   NOTE: Make sure there are no air bubbles between the slide and coverslip. If air bubbles are present, remove the coverslip and position it again.
4. Use lens paper to clean the eyepiece (ocular viewpiece) and the objectives (**Figure 20–4A**).

   Safety **CAUTION:** Do not use any other material to clean these surfaces. Towels, rags, and tissues can scratch these surfaces.
5. Turn on the illuminating light. Open the iris diaphragm so that the largest hole is located directly under the hole in the stage platform.
6. Turn the revolving nosepiece until the low-power objective clicks into place.
7. Place the slide on the stage. Fasten it with the slide clips (**Figure 20–4B**).

   NOTE: Avoid getting fingerprints or smudges on the slide.
8. Watch the stage and slide. Turn the coarse adjustment so that the objective moves down close to the slide.

   Safety **CAUTION:** Do not look into the eyepiece while moving the objective down. The objective could crack the slide and/or be damaged.
9. Now, look through the eyepiece. Slowly turn the body tube upward until the object comes into focus.
10. Change to the fine adjustment. Turn the knob slowly until the object comes into its sharpest focus (**Figure 20–4C**).
11. Do the following while still using low power:
    a. Move the slide to the right while looking through the eyepiece. In which direction does the image move?
    b. Move the slide to the left. In which direction does the image move?
    c. Open and close the iris diaphragm. How does this affect the image?
12. Without moving the body tube, turn the revolving nosepiece until the high-power objective is in place. Focus with the fine adjustment only.

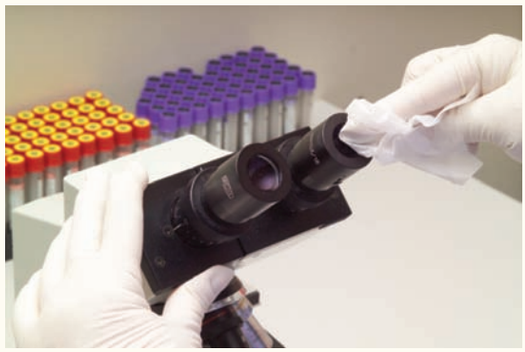


FIGURE 20–4A Use lens paper to clean the eyepiece and objectives.

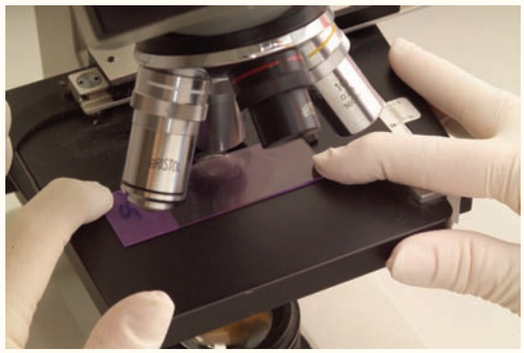


FIGURE 20–4B Place the slide on the stage and fasten it in place with the slide clips.

HOSA CONNECTION

HOSA Connections are included to offer you an insight as to how the content will prepare you for HOSA competitive events.

hosa future health professionals | CONNECTION

Pathophysiology

Purpose: To encourage HOSA members to improve their ability to identify, spell, define and apply the prefixes, suffixes, roots, anatomy and physiology of human diseases impacting the health community.

Description: This event shall be a written test requiring competitors to apply, analyze, synthesize, and evaluate information related to pathophysiology. Competitors will recognize, identify, define, interpret, and apply terms related to human diseases and conditions in a 100-item multiple choice test plus one tiebreaker essay question. Written test will measure knowledge and understanding at the recall, and application.

Details of this competitive event may be found at www.hosa.org/guidelines

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

1. Differentiate between antisepsis, disinfection, and sterilization.
2. List the five (5) essential times for handwashing as identified by the World health Organization (WHO).
3. Name the different types of personal protective equipment (PPE) and state when each type must be worn to meet the requirements of standard precautions.
4. What level of infection control is achieved by an ultrasonic cleaner? Chemicals? An autoclave?

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

1. Josh Merkowski is a pharmacist that has been found guilty of falsifying drug records at the pharmacy. He has also revealed that he is addicted to Vicodin. Investigate industry standards for substance abuse related to health care providers. Based on these facts, write a report predicting Dr. Merkowski's remediation.
2. Analisa Gallegos 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 different 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?
3. After a building explodes, EMS delivers 22 critically injured patients to a hospital emergency room. Which type of leader do you think would be most effective in directing the group of emergency room personnel? Why?

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

1. With a partner, stand back to back. The shorter person should draw a figure. The taller partner will then draw a figure that the shorter partner describes. After 2 minutes, compare original figure with what the taller partner drew. 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.

SUPPLEMENTS AT A GLANCE

Supplement	Where to Find It	What's In It
Online Teacher's Resource Kit	Available on the Instructor Companion Website via NGLsync.cengage.com. if you have purchased a MindTap online course, or at companion-sites.cengage.com.	Classroom Management Activities Lesson Plans Ready-to-Use Tests and Quizzes Classroom Activities Internet Activities Leadership Development Activities Applied Academics Clinical Rotations Resources
Online Instructor's Manual	Available on the Instructor Companion Website via NGLsync.cengage.com. if you have purchased a MindTap online course, or at companion-sites.cengage.com.	Answers to Student Workbook Assignment Sheets Answers to end-of-chapter review questions
Workbook ISBN-13: 9780357646434	Print product	Assignment Sheets for student review Evaluation Sheets for judging student performance for each procedure in the textbook
Instructor Companion Website	Accessed via NGLsync.cengage.com. if you have purchased a MindTap online course, or at companion-sites.cengage.com.	Computerized test banks powered by Cognero® software Slide presentations in PowerPoint® Image Library Animations Standards mapping grid Online Instructor's Manual Online Teacher's Resource Kit
MindTap to Accompany *DHO Health Science* ISBN-13: 9780357646441	Accessed via NGLsync.cengage.com.	Flexible learning path to meet diverse classroom needs and learning styles Chapter-level simulations to apply knowledge and elevate learning Adaptable Table of Contents and customizable Learning Path
Student Online Companion	Additional online student resources; web access via NGLsync.cengage.com with purchase of a MindTap online course.	Audio podcasts of medical terminology Animations of anatomical and physiological processes

*Online Teacher and Student resources require a Cengage Account at NGLsync or for our Companion sites. Don't have an account? Request access from your Sales Consultant, ngl.cengage.com/repfinder.

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PART 1

BASIC HEALTH CARE CONCEPTS AND SKILLS

Welcome to the world of health science education!

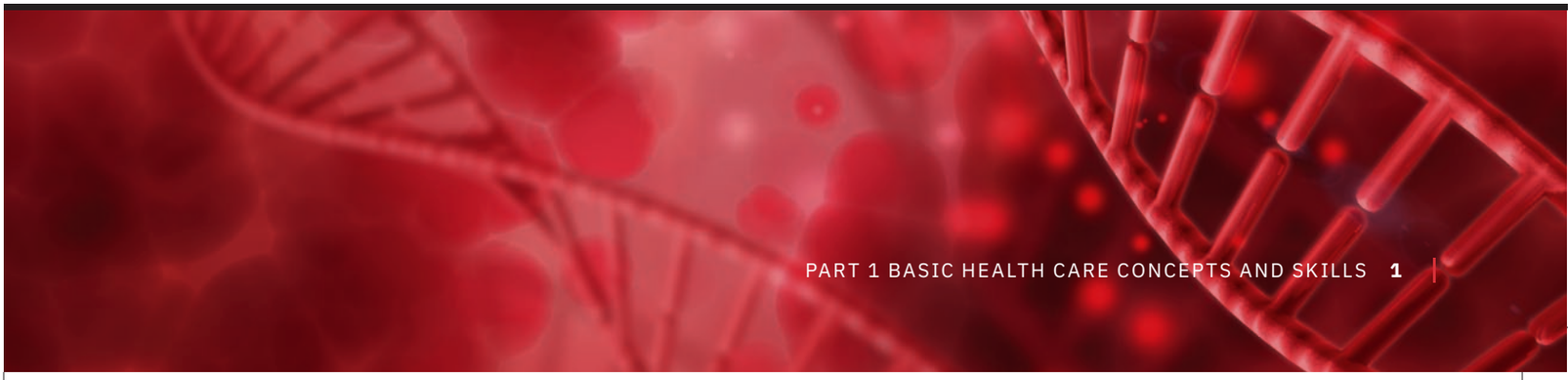
You have chosen a career in a field that offers endless opportunities. If you learn and master the knowledge and skills required, you can find employment in any number of rewarding careers.

What would you do?
Annalisa is a 19-year-old college student who has recently started to experience headaches, fainting, and heart flutters. Her boyfriend, Joe, rushes her to the ER when she faints three times in one day while they are at the park.

What could be wrong?
Annalisa was brought into your freestanding ER because of her fainting and general disorientation. What lab tests would you order? Is a cardiac or neuro workup in order? Should she have some radiology testing?

What is the answer?
Annalisa is experiencing some troubling changes in her health status. After being cleared to go home, the ER doctor recommends that Annalisa's family take her to be further evaluated by her doctor.

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.



CHAPTER

1 HISTORY AND TRENDS OF HEALTH CARE

Case Study Investigation

Mrs. Anita Perez is a 66 year-old Hispanic female that has been battling high blood pressure for 3 years. Mrs. Perez is taking care of her terminally ill mother and is still working full time, resulting in elevated stress levels. She has been on high blood pressure medication for 6 months and has added an anti-anxiety medication this month. Mrs. Perez complains about headaches, an upset stomach and nervousness. She has experienced an 8 pound weight loss over the last 2 months and developed mouth ulcers. She has complained of increasing fatigue and muscle aches as well. Mr. Perez is worried about Anita and is looking for ways to help his wife manage these symptoms. What alternative or complimentary therapies might you recommend to the Perez family? Would any of those therapies conflict with her traditional medications or medical treatments?

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Differentiate between early and current beliefs about the causes of disease and treatment.
- Name at least six historic individuals that impacted medicine and explain how each one helped to improve health care.
- Create a timeline showing what you believe are the most important discoveries in health care and explain why you believe they are important.
- 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.
- Define, pronounce, and spell all key terms.

KEY TERMS

alternative therapies
biotechnology
complementary therapies
cost containment
diagnostic related groups (DRGs)
energy conservation
geriatric care
holistic health care
home health care
integrative (integrated) health care
Omnibus Budget Reconciliation Act (OBRA)
outpatient services
pandemic
telemedicine
wellness

NOTE: *To further emphasize the key terms, they appear in color within the chapter. You will notice beginning in Chapter 3 on page 42 that pronunciations have been provided for the more difficult key terms. The single accent mark, _"_, shows where the main stress is placed when saying the word. The double accent, _"_, shows secondary stress (if present in the word).*

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.

ANCIENT TIMES

Table 1–1 lists many of the historical events of health care in ancient times. In primitive times, the common belief was that disease and illness were caused by evil spirits and demons. Treatment was directed toward eliminating the evil spirits. As civilizations developed, people began to study the human body and make observations about how it functions.

Religion played an important role in health care. It was commonly believed that illness and disease were punishments from the gods. Religious ceremonies were frequently used to eliminate evil spirits and restore health. Exploring the structure of the human body was limited because most religions did not allow dissection, or cutting the body apart. For this reason, animals were frequently dissected to learn about different body parts.

The ancient Egyptians were the first people to keep health records. It is important to remember that many people could not read; therefore, knowledge was limited to an educated few. Most of the records were inscribed on stone and were created by priests, who also acted as physicians.

The ancient Chinese strongly believed in the need to cure the spirit and nourish the entire body. This form of treatment remains important today, when holistic health methods stress treating the entire patient—mind, body, and soul. Chinese herbal medicine, acupuncture, and massage (Tui na) are still commonly used.

Hippocrates (ca. 460–377 BC), called the "Father of Medicine," was one of the most important physicians in ancient Greece (see the Biography box for more information about Hippocrates). The records that he and other physicians created helped establish that disease is caused by natural causes, not by supernatural spirits and demons. The ancient Greeks were also among the first to stress that a good diet and cleanliness help to prevent disease.

Biography Hippocrates

Image courtesy National Library of Medicine

Hippocrates (ca. 460–377 BC) was a Greek physician who is called the "Father of Medicine." He is best known for authoring a code of conduct for physicians, the "Hippocratic Oath." The oath began as swearing to the healing gods to practice medicine following a strict code of ethics. Through the years, the oath has been modernized and no longer involves swearing to the gods. Most schools of medicine still use some form of the oath, and it is a rite of passage to practicing medicine in many countries.

The ancient Greeks thought that illness and disease were caused by the disfavor of the gods or evil spirits. Hippocrates's beliefs led medicine in a more accurate direction. He believed that illness and disease had rational and physical explanations.

Hippocrates stressed the importance of observation, diagnosis, and treatment. He was the first to accurately describe symptoms of pneumonia and epilepsy in children. He encouraged the use of a good diet, fresh air, cleanliness, and exercise to help the body heal itself.

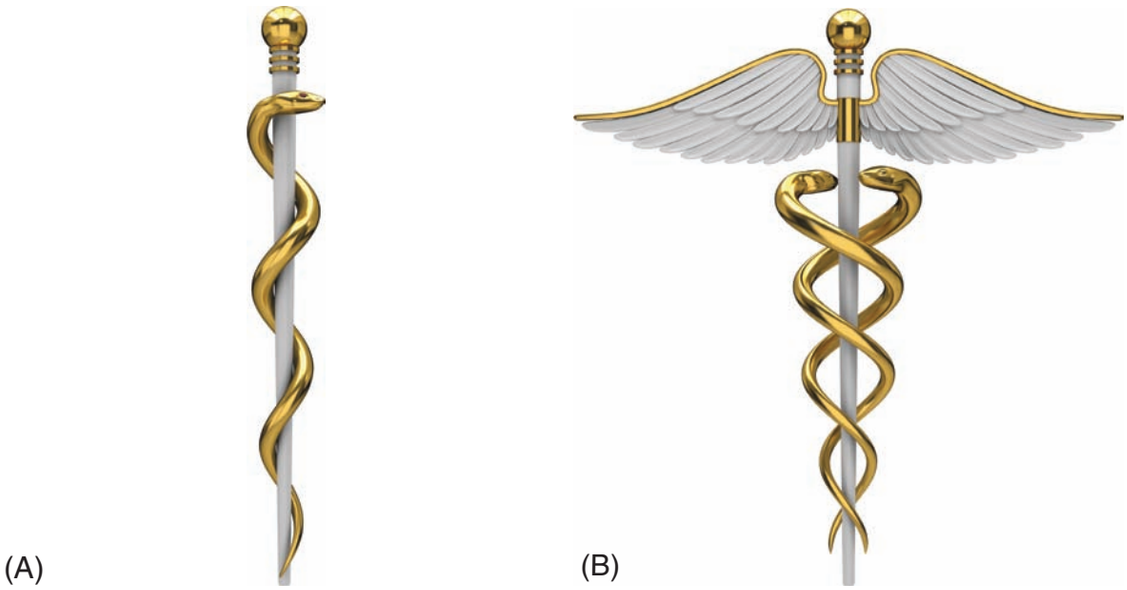
Hippocrates founded a medical school in Cos, Greece, to teach his ideas about medicine. His students were held to a strict ethical code of behavior; this oath is the basis of medical practice today.

The Rod of Asclepius (**Figure 1–1A**), the Greek symbol associated with medicine and healing, originated in ancient Greece. The caduceus symbol (**Figure 1–1B**) is often mistaken as the medical symbol, but it is actually the symbol for commerce. Different variations of both of these symbols are in use today. All contain the staff, but many have wings and either one or two serpents.

TABLE 1–1 History of Health Care in Ancient Times

Historical Events of Health Care in Ancient Times	
4000 BC–3000 BC **Primitive Times**	People believed that illness and disease were caused by supernatural spirits and demons Tribal witch doctors treated illness with ceremonies to drive out evil spirits Herbs and plants were used as medicines, and some are still used today Average life span was 20 years
3000 BC–300 BC **Ancient Egyptians**	Earliest people known to maintain accurate health records Called on the gods to heal them when disease occurred Physicians were priests who studied medicine and surgery in temple medical schools Used magic and medicinal plants to treat disease Average life span was 20 to 30 years
1700 BC–220 AD **Ancient Chinese**	Religious prohibitions against dissection resulted in inadequate knowledge of body structure Monitored the pulse to determine the condition of the body Believed in the need to treat the whole body by curing the spirit and nourishing the body Recorded a pharmacopoeia (an official drug directory) of medications based mainly on the use of herbs Used acupuncture to relieve pain and congestion Began the search for medical reasons for illness Average life span was 20 to 30 years
1200 BC–200 BC **Ancient Greeks**	Began modern medical science by observing the human body and effects of disease Hippocrates (460–377 BC), called the Father of Medicine: • Developed an organized method to observe the human body • Recorded signs and symptoms of many diseases • Created a high standard of ethics, the Oath of Hippocrates, used by physicians today Believed illness is a result of natural causes Stressed diet and cleanliness as ways to prevent disease Average life span was 25 to 35 years
753 BC–410 AD **Ancient Romans**	First to organize medical care by providing care for injured soldiers Early hospitals developed when physicians cared for ill people in rooms in their homes Began public health and sanitation systems: • Created aqueducts to carry clean water to the cities • Built sewers to carry waste materials away from the cities • Drained marshes to reduce the incidence of malaria Claudius Galen (129–199? AD), a physician, described the symptoms of inflammation and studied infectious diseases in addition to dissecting animals and determining the functions of muscles, the kidney, and the bladder Average life span was 25 to 35 years

FIGURE 1–1 Symbols of medicine include (A) the Rod or Staff of Asclepius and (B) a caduceus.



(A) (B)

With knowledge obtained from the Greeks, the Romans realized that some diseases were connected to filth, contaminated water, and poor sanitation. They began to develop sanitary systems by building sewers to carry away waste and aqueducts (waterways) to deliver clean water. They drained swamps and marshes to reduce the incidence of malaria. They created laws to keep streets clean and eliminate garbage. The first hospitals were also established in ancient Rome when physicians began caring for injured soldiers or ill people in their homes.

Although many changes occurred in health care during ancient times, treatment was still limited. The average person had poor personal hygiene, drank contaminated water, and had unsanitary living conditions. Diseases such as typhoid, cholera, malaria, dysentery, leprosy, and smallpox infected many individuals. Because the causes of these diseases had not been discovered, the diseases were usually fatal. The average life span was 20 to 35 years. Today, individuals who die at this age are considered to be young people.

THE DARK AGES AND MIDDLE AGES

Table 1–2 lists many of the historical events of health care during the Dark Ages and the Middle Ages. During the Dark Ages, after the fall of the Roman Empire, the study of medicine stopped. Individuals again lived in unsanitary conditions with little or no personal hygiene. Epidemics of smallpox, dysentery, typhus, and the plague were rampant. Monks and priests stressed prayer to treat illness and disease.

The Middle Ages brought a renewed interest in the medical practices of the Romans and Greeks. Monks obtained and translated the writings of the Greek and Roman physicians and recorded the knowledge in handwritten books. Medical universities were created in the 9th century to train physicians how to use this knowledge to treat illness. Later, the Arabs began requiring that physicians pass examinations and obtain licenses.

In the 1300s, a major epidemic of bubonic plague killed almost 75 percent of the population of Europe and Asia. Other diseases such as smallpox, diphtheria, tuberculosis, typhoid, and malaria killed many others. The average life span of 20 to 35 years was often reduced even further by the presence of these diseases. Many infants died shortly after birth. Many children did not live into adulthood. Today, most of these diseases are almost nonexistent because they are prevented by vaccines or treated by medications.

THE RENAISSANCE

Table 1–3 lists many of the historical events of health care that occurred between 1350 and 1650 AD, a period known as the Renaissance. This period is often referred to as the "rebirth of the science of medicine." New information about the human body was discovered as a result of human dissection becoming accepted and allowed. Physicians could now view body organs and see the connections between different systems in the body. Artists, such as Michelangelo and Leonardo da Vinci, were able to draw the body accurately. In addition, the development of the printing press resulted in the publication of medical books that were used by students at medical universities. Knowledge spread more rapidly. Physicians became more educated.

The life span increased to an average age of 30 to 40 years during the Renaissance, but common infections still claimed many lives. At this point in time, the actual causes of disease were still a mystery.

TABLE 1–2 History of Health Care in the Dark Ages and the Middle Ages

Historical Events of Health Care in the Dark Ages and the Middle Ages	
400–800 AD Dark Ages	Emphasis was placed on saving the soul, and the study of medicine was prohibited Prayer and divine intervention were used to treat illness and disease Monks and priests provided custodial care for sick people Average life span was 20 to 30 years
800–1400 AD Middle Ages	Renewed interest in the medical practice of Greeks and Romans Physicians began to obtain knowledge at medical universities in the 9th century A pandemic (worldwide epidemic) of the bubonic plague (black death) killed three-quarters of the population of Europe and Asia Major diseases were smallpox, diphtheria, tuberculosis, typhoid, the plague, and malaria Rhazes (al-Razi), an Arab physician, became known as the Arab Hippocrates: • Based diagnoses on observations of the signs and symptoms of disease • Suggested blood was the cause of many infectious diseases • Began the use of animal gut as suture material Arabs began requiring that physicians pass examinations and obtain licenses Average life span was 20 to 35 years

TABLE 1–3 History of Health Care in the Renaissance

Historical Events of Health Care in the Renaissance	
1350–1650 AD Renaissance	Rebirth of the science of medicine Dissection of the body began to allow a better understanding of anatomy and physiology Artists Michelangelo (1475–1564) and Leonardo da Vinci (1452–1519) used dissection to draw the human body more realistically Development of the printing press allowed knowledge to be more easily spread to others First anatomy book was published by Andreas Vesalius (1514–1564) Michael Servetus (1511–1553): • Described the circulatory system in the lungs • Explained how digestion is a source of heat for the body Roger Bacon (1214?–1292?) researched optics and refraction (bending of light rays) Average life span was 30 to 40 years

THE 16TH, 17TH, AND 18TH CENTURIES

Table 1–4 lists many of the historical events of health care that occurred during the 16th, 17th, and 18th centuries. During this period, physicians gained an increased knowledge of the human body. William Harvey described the circulation of blood. Gabriel Fallopius described the tympanic membrane in the ear and the fallopian tubes in the female reproductive system. Bartolomeo Eustachio identified the tube between the ear and throat. These discoveries allowed other physicians to see how the body functioned.

A major development occurred after Anton van Leeuwenhoek built a microscope that increased magnification ability and produced clear and bright images (see the Biography box for more information about Anton van Leeuwenhoek). This instrument allowed physicians to see organisms that are too small to be seen by the human eye. Even though they were not aware of it at the time, physicians were looking at many of the pathogenic organisms (germs) that cause disease. The microscope continues to be a major diagnostic tool.

This period also saw the start of drug stores, or pharmacies. Apothecaries (early pharmacists) made, prescribed, and sold medications. Many of these medications were made from plants and herbs similar to those used in ancient times. At the end of the 18th century, Edward Jenner developed a vaccine to prevent smallpox, a deadly disease.

During this time, the average life span increased to 40 to 50 years. However, the causes of many diseases were still unknown, and medical care remained limited.

TABLE 1–4 History of Health Care in the 16th, 17th, and 18th Centuries

Historical Events of Health Care in the 16th, 17th, and 18th Centuries	
16th and 17th Centuries	Causes of disease were still not known, and many people still died from infections and puerperal (childbirth) fever Ambroise Paré (1510–1590), a French surgeon, known as the Father of Modern Surgery: • Established the use of ligatures to bind (use of thread or suture to tie off) arteries and stop bleeding • Promoted use of artificial limbs Gabriel Fallopius (1523–1562): • Identified the fallopian tubes in the female reproductive system • Described the tympanic membrane in the ear William Harvey (1578–1657) described the circulation of blood to and from the heart in 1628 Anton van Leeuwenhoek (1632–1723) built a microscope with increased magnification in 1666 First successful blood transfusion was performed on animals in England in 1667 Bartolomeo Eustachio identified the eustachian tube leading from the ear to the throat Apothecaries (early pharmacists) made, prescribed, and sold medications Average life span was 35 to 45 years
18th Century	Gabriel Fahrenheit (1686–1736) created the first mercury thermometer in 1714 John Hunter (1728–1793), an English surgeon: • Established scientific surgical procedures • Introduced tube feeding in 1778 Benjamin Franklin (1706–1790) invented bifocals for eyeglasses Dr. Jesse Bennett performed the first successful Cesarean section operation to deliver an infant in 1794 James Lind prescribed lime juice containing vitamin C to prevent scurvy in 1795 Edward Jenner (1749–1823) developed a vaccination for smallpox in 1796 Average life span was 40 to 50 years

Biography Anton van Leeuwenhoek

Image courtesy of Pfizer, Inc.

Anton van Leeuwenhoek (1632–1723) is one of several individuals who are called the "Father of Microbiology" because of his discovery of bacteria and other microscopic organisms. He was born in Delft, Holland, and worked as a tradesman and apprentice to a textile merchant. He learned to grind lenses and make simple microscopes to use while examining the thread densities of materials.

In 1668, he visited London and saw a copy of Robert Hooke's *Micrographia*, a book depicting Hooke's own observations with the microscope. This stimulated van Leeuwenhoek's interest, and he began to build microscopes that magnified more than 200 times, with clearer and brighter images than were available at the time. Using the improved microscope, van Leeuwenhoek began to observe bees, bugs, water, and other similar substances. He noticed tiny single-celled organisms that he called *animalcules*, now known as microorganisms. When van Leeuwenhoek reported his observations to the Royal Society of London, he was met with skepticism. However, other scientists researched his findings, and eventually his ideas were proved and accepted.

Anton van Leeuwenhoek was the first individual to record microscopic observations on muscle fibers, blood vessels, and spermatozoa. He laid the foundations of plant anatomy and animal reproduction. He developed a method for grinding powerful lenses and made more than 400 different types of microscopes. Anton van Leeuwenhoek's discoveries are the basis for microbiology today.

THE 19TH CENTURY

Table 1–5 lists many of the historical events of health care that occurred during the 19th century, a period also known as the Industrial Revolution. Major progress in medical science occurred because of the development of machines and the wide availability of books.

Early in the century, René Laënnec invented the stethoscope (see the Biography box for more information about René Laënnec). This invention allowed physicians to listen to internal body sounds, which increased their knowledge of the human body.

Formal training for nurses began during this century. After training at a program in Germany, Florence Nightingale established sanitary nursing care units for injured soldiers during the Crimean War. She is known as the founder of modern nursing (see the Biography box for more information about Florence Nightingale).

TABLE 1–5 History of Health Care in the 19th Century

Historical Events of Health Care in the 19th Century	
19th Century	Royal College of Surgeons (medical school) founded in London in 1800
	French barbers acted as surgeons by extracting teeth, using leeches for treatment, and giving enemas
	René Laënnec (1781–1826) invented the stethoscope in 1816
	In 1818, James Blundell performed the first successful blood transfusion on humans
	Dr. Philippe Pinel (1755–1826) began humane treatment for mental illness
	Cholera pandemic in 1832
	Theodor Fliedner started one of the first training programs for nurses in Germany in 1836, which provided Florence Nightingale with her formal training
	In the 1840s, Ignaz Semmelweis (1818–1865) encouraged physicians to wash their hands with lime after performing autopsies and before delivering babies to prevent puerperal (childbirth) fever
	Dr. William Morton (1819–1868), an American dentist, began using ether as an anesthetic in 1846
	American Medical Association was formed in Philadelphia in 1847
	Elizabeth Blackwell (1821–1910) became the first female physician in the United States in 1849; she started the first Women's Medical College in New York in 1868

(continues)

TABLE 1–5 History of Health Care in the 19th Century *(continued)*

Historical Events of Health Care in the 19th Century	
	Florence Nightingale (1820–1910), the founder of modern nursing: • Established efficient and sanitary nursing units during Crimean War in 1854 • Began the professional education of nurses Dorothea Dix (1802–1887) was appointed Superintendent of Female Nurses of the Army in 1861 International Red Cross was founded in 1863 Joseph Lister (1827–1912) started using disinfectants and antiseptics during surgery to prevent infection in 1865 Elizabeth Garrett Anderson (1836–1917) became the first female physician in Britain in 1870 and the first woman member of the British Medical Association in 1873 Paul Ehrlich (1854–1915), a German bacteriologist, developed methods to detect and differentiate between various diseases, developed the foundation for modern theories of immunity, and used chemicals to eliminate microorganisms Clara Barton (1821–1912) founded the American Red Cross in 1881 Robert Koch (1843–1910), another individual who is also called the "Father of Microbiology," developed the culture plate method to identify pathogens and in 1882 isolated the bacteria that causes tuberculosis Louis Pasteur (1822–1895) contributed many discoveries to the practice of medicine, including: • Proving that microorganisms cause disease • Pasteurizing milk to kill bacteria • Creating a vaccine for rabies in 1885 Gregory Mendel (1822–1884) established the principles of heredity and dominant/recessive patterns Wilhelm Roentgen (1845–1923) discovered roentgenograms (X-rays) in 1895 Bayer introduced aspirin in powdered form in 1899 Average life span was 40 to 60 years

Biography René Laënnec

Image courtesy of Pfizer, Inc.

René-Théophile-Hyacinthe Laënnec (1781–1826) was a French physician who is frequently called the "Father of Pulmonary Diseases." In 1816, he invented the stethoscope, which began as a piece of rolled paper and evolved into a wooden tube that physicians inserted into their ears.

Laënnec used his stethoscope to listen to the various sounds made by the heart and lungs. For years, he studied chest sounds and correlated them with diseases found on autopsy. In 1819, he published a book on his findings, *De l'auscultation mediate*, also known as *On Mediate Auscultation*. Laënnec's use of auscultation (listening to internal body sounds) and percussion (tapping body parts to listen to sounds) formed the basis of the diagnostic techniques used in medicine today.

Laënnec studied and diagnosed many medical conditions such as bronchiectasis, melanoma, cirrhosis, and tuberculosis. Cirrhosis of the liver is still called *Laënnec's cirrhosis* because Laënnec was the first physician to recognize this condition as a disease entity. Laënnec also conducted extensive studies on tuberculosis, but unfortunately he was not aware of the contagiousness of the disease, and he contracted tuberculosis himself. He died of tuberculosis at the age of 45, leaving a legacy of knowledge that is still used by physicians today.

Infection control was another major development. Physicians began to associate the tiny microorganisms seen under the microscope with diseases. Methods to stop the spread of these organisms were developed by Theodor Fliedner, Joseph Lister, and Louis Pasteur (see the Biography box for more information about Louis Pasteur).

Women became active participants in medical care in the 19th century. Elizabeth Blackwell was the first female physician in the United States. Dorothea Dix was appointed superintendent of female nurses in the U.S. Army. Clara Barton founded the American Red Cross (see the Biography box for more information about Clara Barton).

Biography Florence Nightingale

Image courtesy National Library of Medicine

Florence Nightingale (1820–1910) is known as the founder of modern nursing. In 1854, Nightingale led 38 nurses to serve in the Crimean War. During the war, the medical services of the British army were horrifying and inadequate. Hundreds of soldiers died because of poor hygiene and unsanitary conditions. Nightingale fought for the reform of the military hospitals and for improved medical care.

Nightingale encouraged efficiency and cleanliness in the hospitals. Her efforts decreased the patient death rate by two-thirds. She used statistics to prove that the number of deaths decreased with improved sanitary conditions. Because of her statistics, sanitation reforms occurred and medical practice improved.

One of Nightingale's greatest accomplishments was starting the Nightingale Training School for nurses at St. Thomas' Hospital in London. Nurses attending her school received a year's training, which included lectures and practical ward work. Trained nurses were then sent to work in British hospitals and abroad. These trained nurses also established other nursing schools using Nightingale's model. Nightingale published more than 200 books, pamphlets, and reports. Her writings on hospital organization had a lasting effect in England and throughout the world. Many of her principles are still used in health care today.

Biography Louis Pasteur

Image courtesy of Pfizer, Inc.

Louis Pasteur (1822–1895) was a French chemist and biologist. He is also called the "Father of Microbiological Sciences and Immunology" because of his work with the microorganisms that cause disease. Pasteur developed the germ theory and discovered the processes of pasteurization, vaccination, and fermentation. His germ theory proved that microorganisms cause most infectious diseases. In addition, he proved that heat can be used to destroy harmful germs in perishable food, a process now known as *pasteurization*. Pasteur also discovered that weaker microorganisms could be used to immunize against more dangerous forms of a microorganism. He developed vaccines against anthrax, chicken cholera, rabies, and swine erysipelas. Through his studies of fermentation, he proved that each disease is caused by a specific microscopic organism.

Pasteur's principles for sanitation helped control the spread of disease and provided ideas about how to prevent disease. These discoveries reformed the fields of surgery and obstetrics. Pasteur is responsible for saving the lives of millions of people through vaccination and pasteurization. His accomplishments are the foundation of bacteriology, immunology, microbiology, molecular biology, and virology in today's health care.

The average life span during this period increased to 40 to 65 years. Treatment for disease was more specific after the causes for diseases were identified. Many vaccines and medications were developed.

Biography Clara Barton

Image courtesy of National Archives, photo no. 111-B-4246 [Brady Collection]

Clara Barton (1821–1912) was the founder of the American Red Cross. During the American Civil War, she volunteered to provide aid to wounded soldiers. She appealed to the public to provide supplies and, after collecting the supplies, personally delivered them to soldiers of both the North and the South.

In 1869, Barton went to Geneva, Switzerland, to rest and improve her health. During her visit, she learned about the Treaty of Geneva, which provided relief for sick and wounded soldiers. A dozen nations had signed the treaty, but the United States had refused. She also learned about the International Red Cross, which provided disaster relief during peacetime and war.

When Barton returned to the United States, she campaigned for the Treaty of Geneva until it was ratified. In 1881, the American Red Cross was formed, and Barton served as its first president. She represented the American Red Cross by traveling all over the United States and the world to assist victims of natural disasters and war.

THE 20TH CENTURY

Table 1–6 lists many of the historical events of health care that occurred during the 20th century. This period showed the most rapid growth in advancements in health care. Physicians were able to use new machines such as X-rays to view the body. Medicines—including insulin for diabetes, antibiotics to fight infections, and vaccines to prevent diseases—were developed. The causes for many diseases were identified. Physicians were now able to treat the cause of a disease to cure the patient.

Biography Francis Crick and James Watson

Image courtesy of the Salk Institute

Francis Crick and **James Watson** shared the Nobel Prize with Maurice Wilkins in 1962 for discovering the structure of deoxyribonucleic acid (DNA). Crick was a biophysicist and chemist; Watson studied zoology; Wilkins was a physicist and molecular biologist. Crick and Watson studied at the University of Cambridge, while Wilkins did his studies at King's College. They all shared a desire to solve the mystery of the structure of DNA.

Crick and Watson built a three-dimensional model of the molecules of DNA to assist them in discovering its structure. In 1953, they discovered that the structure of DNA is a double helix, similar to a gently twisted ladder. It consists of pairs of bases: adenine and thymine, and guanine and cytosine. The order in which these bases appear on the double helix determines the identity of the organism. That is, DNA carries life's hereditary information. Wilkins studied DNA using X-ray diffraction. His X-ray crystallographic technique allowed him to be the first to obtain an X-ray image of DNA. This image supported the Crick and Watson model of DNA.

Crick and Watson's model of the DNA double helix provided motivation for research in molecular genetics and biochemistry. Their work showed that understanding how a structure is arranged is critical to understanding how it functions. Crick and Watson's discovery is the foundation for most of the genetic research that is being conducted today.

A major development in understanding the human body occurred in the 1950s when Francis Crick and James Watson described the structure of DNA and how it carries genetic information (See the Biography box for

TABLE 1–6 History of Health Care in the 20th Century

Historical Events of Health Care in the 20th Century	
20th Century	Carl Landsteiner classified the ABO blood groups in 1901 Female Army Nurse Corps was established as a permanent organization in 1901 Marie Curie (1867–1934) isolated radium in 1910 Sigmund Freud's (1856–1939) studies formed the basis for psychology and psychiatry Influenza (Spanish flu) pandemic killed more than 40 million people in 1918 Frederick Banting and Charles Best discovered and used insulin to treat diabetes in 1922 Health insurance plans and social reforms were developed in the 1920s Sir Alexander Fleming (1881–1955) discovered penicillin in 1928 Buddy, a German shepherd, became the first guide dog for the blind in 1928 The Ransdell Act reorganized the Laboratory of Hygiene into the National Institutes of Health (NIH) in 1930 Dr. Robert Smith (Dr. Bob) and William Wilson founded Alcoholics Anonymous in 1935 Gerhard Domagk (1895–1964) developed sulfa drugs to fight infections Dr. George Papanicolaou developed the Pap test to detect cervical cancer in women in 1941 The first kidney dialysis machine was developed in 1944 Jonas Salk (1914–1995) developed the polio vaccine using dead polio virus in 1952 In 1953, Francis Crick and James Watson described the structure of DNA and how it carries genetic information The first heart–lung machine was used for open-heart surgery in 1953 Joseph Murray performed the first successful kidney transplant in humans in 1954 Albert Sabin (1906–1993) developed an oral live-virus polio vaccine in the mid-1950s Birth control pills were approved by the U.S. Food and Drug Administration (FDA) in 1960 An arm severed at the shoulder was successfully reattached to the body in 1962 The Medicare and Medicaid 1965 Amendment to the Social Security Act marked the entry of the federal government into the health care arena as a major purchaser of health services Christian Barnard performed the first successful heart transplant in 1967 The first hospice was founded in England in 1967 The U.S. Congress created the Occupational Safety and Health Administration (OSHA) in 1970 The Health Maintenance Organization Act of 1973 established standards for HMOs and provided an alternative to private health insurance Physicians used amniocentesis to diagnose inherited diseases before birth in 1975 Computerized axial tomography (CAT) scan was developed in 1975 In 1975, the New Jersey Supreme Court ruled that the parents of Karen Ann Quinlan, a comatose woman, had the power to remove her life support systems The first "test tube" baby, Louise Brown, was born in England in 1978 Acquired immune deficiency syndrome (AIDS) was identified as a disease in 1981 In 1982, Dr. William DeVries implanted the first artificial heart, the Jarvik-7, in a patient Cyclosporine, a drug to suppress the immune system after organ transplants, was approved in 1983 In 1984, the human immunodeficiency virus (HIV), which causes AIDS, was identified The Omnibus Budget Reconciliation Act (OBRA) of 1987 established regulations for the education and certification of nursing assistants The Clinical Laboratory Improvement Act (CLIA) was passed in 1988 to establish standards and regulations for performing laboratory tests The first gene therapy to treat disease occurred in 1990 President George H.W. Bush signed the Americans with Disabilities Act in 1990 The Patient Self-Determination Act was passed in 1990 to require health care providers to inform patients of their rights in regard to making decisions about their medical care and to provide information and assistance in preparing advance directives OSHA's Bloodborne Pathogens Standards became effective in 1991 A vaccine for hepatitis A became available in 1994 A vaccine for chicken pox (varicella) was approved in 1995 President Clinton signed the Health Insurance Portability and Accountability Act (HIPAA) of 1996 to protect patient privacy and to make it easier to obtain and keep health insurance Identification of genes that caused diseases increased rapidly in the 1990s Oregon enacted the Death with Dignity Act in 1997 to allow terminally ill individuals to end their lives A sheep was cloned in 1997 An international team of scientists sequenced the first human chromosome in 1999 Average life span was 60 to 80 years

more information about Francis Crick and James Watson. See also **Figure 1–2**.). Their studies began the search for gene therapies to cure inherited diseases. This research continues today.

Health care plans that help pay the costs of care also started in the 20th century. At the same time, standards were created to make sure that every individual had access to quality health care. This remains a major concern of health care in the United States today.

The first open-heart surgery, which took place in the 1950s, has progressed to the heart transplants that occur today. Surgical techniques have provided cures for what were once fatal conditions. Also, infection control has helped decrease surgical infections that previously killed many patients.

The contribution of computer technology to medical science has helped medicine progress faster in the 20th century than in all previous periods combined. Today, computers and technology are used in every aspect of health care. Their use will increase even more in the 21st century.

All of these developments have helped increase the average life span to 60 to 80 years. In fact, it is not unusual for people to live to be 100. With current pioneers such as Ben Carson (see the Biography box for more information about Ben Carson), as well as many other medical scientists and physicians, there is no limit to what future health care will bring.

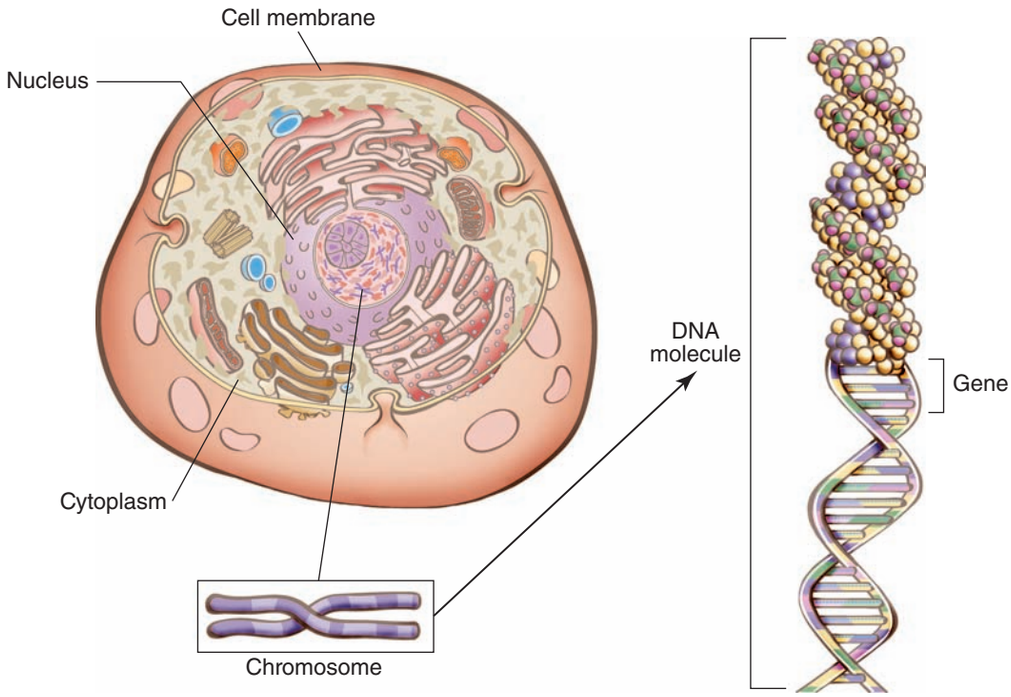
THE 21ST CENTURY

The potential for major advances in health care in the 21st century is unlimited. Early in this century, the completion of the Human Genome Project by the U.S. Department of Energy and the National Institutes of Health (NIH) provided the basis for much of the current research on genetics. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) technology has built on that information, and this new technology allows advanced genetic editing. Research with embryonic stem cells and the development of cloned cells could lead to treatments that will cure many diseases.

Some major threats to health care exist in this century. Bioterrorism, the use of microorganisms or biologic agents as weapons to infect humans, is a real and present threat. New viruses, such as the H1N1, or swine flu virus, and the COVID-19 or coronavirus, can mutate and cause disease in humans. Pandemics, or worldwide epidemics, could occur quickly in our global society because people can travel easily from one country to another.

Organizations such as the World Health Organization (WHO), an international agency sponsored by the United Nations, are constantly monitoring health problems throughout the world and taking steps to prevent pandemics. Health care has become a global concern and countries are working together to promote good health in all individuals. Technology is allowing

FIGURE 1–2 The discovery of the structure of DNA and how it carries genetic (inherited) information was the beginning of research on how to cure inherited diseases by gene therapy.



Biography Benjamin Carson, MD

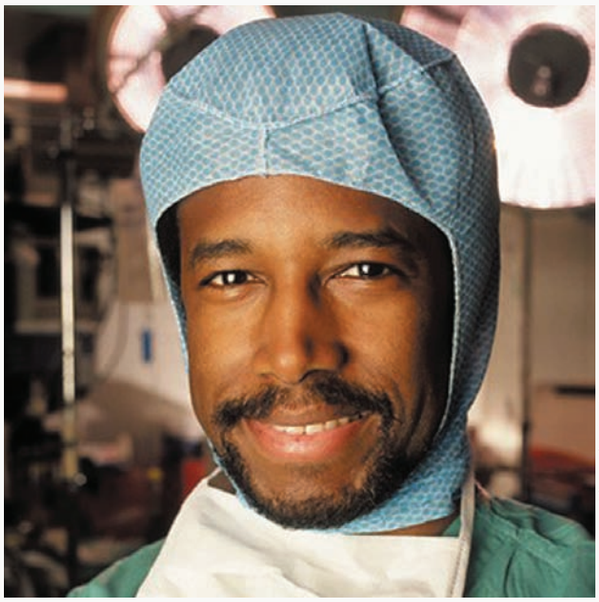


Image courtesy of Carson Scholars Fund

Benjamin Carson, MD, has become famous for his landmark surgeries to separate conjoined twins. Dr. Carson is one of the most skilled and accomplished neurosurgeons today.

In 1987, he was the primary surgeon of a 70-member surgical team that separated conjoined twins born in West Germany. The 7-month-old boys were joined at the back of the head, sharing the major cerebral blood drainage system. After the operation, both boys were able to survive independently. This was the first surgery to separate occipital craniopagus twins, meaning they were joined at the head near the occipital bone. In 1997, Dr. Carson was the lead surgeon in South Africa in another successful operation to separate 11-month-old boys who were vertical craniopagus twins, meaning they were joined at the top of the head looking in opposite directions.

Dr. Carson continues to perform landmark surgeries and conduct research for new techniques and procedures. He has refined hemispherectomy, a revolutionary surgical procedure performed on the brain to stop seizures that are difficult to treat or cure. He also works with craniofacial (head or facial disfigurement) reconstructive surgery. Dr. Carson has developed an important craniofacial program that combines neurosurgery and plastic surgery for children with congenital (at birth) deformities. He is also known for his work in pediatric neuro-oncology (brain tumors).

Dr. Carson is the author of three best-selling books: *Gifted Hands*, the story of his life; *Think Big*, a story inspiring others to use their intelligence; and *The Big Picture*, a closeup look at the life of a professional surgeon. Dr. Carson is also cofounder and president of the Carson Scholars Fund, which was established to recognize young people for superior academic performance and humanitarian achievement.

In 2017, the U.S. Senate confirmed Dr. Carson to become the U.S. Secretary of Housing and Urban Development.

scientists to remotely monitor patient health status. Robots assist and enhance surgery all across the globe. 3-D printers are revolutionizing the cost and availability of implants and joints to match individual measurements precisely. Nanotechnology is pushing medical devices to become smaller and more efficient. Implanted insulin pumps can now measure glucose levels and respond seamlessly.

Table 1–7 lists some of the events of health care that have occurred so far in the 21st century and some possible advances that might occur soon. The potential for the future of health care has unlimited possibilities.

checkpoint

1. Who was responsible for keeping health records?
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 any health care provider. Medical professionals are lifelong learners.

COST CONTAINMENT

Cost containment, a term heard frequently in health care circles, means trying to control the rising cost of health care and achieve the maximum

TABLE 1–7 History of Health Care in the 21st Century

Historical Events of Health Care in the 21st Century	
21st Century	Adult stem cells were used in the treatment of disease early in the 2000s The FDA approved Da Vinci, the first robotic surgical system, which allows for smaller surgical incisions, less pain, and faster recovery in 2000 President George W. Bush approved federal funding for research using only existing lines of embryonic stem cells in 2001 The first totally implantable artificial heart was placed in a patient in Louisville, Kentucky, in 2001 In 2002, smallpox vaccinations were given to military personnel and first responders to limit the effects of a potential bioterrorist attack The Netherlands became the first country in the world to legalize euthanasia in 2002 The Human Genome Project to identify all of the approximately 20,000 to 25,000 genes in human DNA was completed in 2003 The Standards for Privacy of Individually Identifiable Health Information, required under the Health Insurance Portability and Accountability Act (HIPAA) of 1996, went into effect in 2003 The virus that causes severe acute respiratory syndrome (SARS) was identified in 2003 as a new coronavirus, never before seen in humans National Institutes of Health (NIH) researchers discovered that primary teeth can be a source of stem cells in 2003 In 2005, the first face transplant was performed in France on a woman whose lower face was destroyed by a dog attack Stem cell researchers at the University of Minnesota coaxed embryonic stem cells to produce cancer-killing cells in 2005 The National Cancer Institute (NCI) and the National Human Genome Research Institute started a project in 2006 to map genes associated with cancer so mutations that occur with specific cancers can be identified Researchers proposed a new method to generate embryonic stem cells from a blastocyst without destroying embryos in 2006 Gardasil, a vaccine to prevent cervical cancer, was approved by the FDA in 2006 Zostavax, a vaccine to prevent herpes zoster (shingles), was approved by the FDA in 2006 The CDC issued Transmission-Based Precautions for preventing the spread of infectious diseases in 2007 The FDA approved the first molecular test to detect metastatic breast cancer in 2007 Scarless surgery using the body's own openings was first performed in 2008 In 2008, a genetic screen for cancer was developed, allowing physicians to determine who would best respond to Herceptin, a breast cancer drug In 2009, the funding ban on stem cell research was lifted, leading to advancements that used adult skin stem cells to create the first stem cell mice and to regenerate fully functioning teeth in rodents A new set of three genes linked to Alzheimer's disease was discovered in 2009 By November of 2009, 71% of the U.S. population was banned from smoking in bars, restaurants, and the workplace WHO declared a pandemic of the H1N1 virus, commonly called swine flu, in 2009 In 2010, Dr. Craig Venter, co-mapper of the human genome, synthesized an entire genome of a bacterium that was then able to reproduce In 2010, the first artificial ovary was created, a major advancement in infertility research The Patient Protection and Affordable Care Act was signed into law in March 2010 An experimental vaccine for glioblastoma, a deadly brain tumor, was developed in 2011 In 2011, the FDA approved an implant that is inserted in the brain through blood vessels—without brain surgery—to treat brain aneurysms In 2013, the FDA approved a bionic eye to treat retinitis pigmentosa, a leading cause of blindness Sofosbuvir, the first oral pill to treat hepatitis C, was approved by the FDA in 2013 In 2013, the FDA approved Neuropace, a responsive neurostimulator that is surgically implanted into the brain, as a treatment for intractable epilepsy A woman in Sweden with a transplanted uterus gave birth to a baby boy in 2014 A major epidemic of Ebola occurred in West African countries in 2014 In September 2014, the CDC declared the first case of Ebola in the United States and issued transmission-based guidelines for the Ebola virus disease (EVD) In 2014, surgeons in the Netherlands used a 3-D printer to create a custom-made skull that was used in a complete skull transplant Shringrex, a more effective vaccine to prevent herpes zoster (shingles), was approved by the FDA in 2017 In 2019, an outbreak of coronavirus spurred the World Health Organization (WHO) to declare a pandemic Average life span is 75 to 85 years
Potential for the 21st Century	Cures for AIDS, cancer, and heart disease are found Genetic manipulation to prevent inherited diseases is a common practice Development of methods to slow the aging process or stop aging are created Nerves in the brain and spinal cord are regenerated to eliminate paralysis Transplants of every organ in the body, including the brain, are possible Antibiotics are developed that do not allow pathogens to develop resistance Enhanced biology using prosthetics Average life span is increased to 90 to 100 years and beyond

benefit for every dollar spent. Some reasons for high health care costs include:

- **Technological advances**: Highly technical procedures such as heart, lung, liver, or kidney transplants can cost hundreds of thousands of dollars. Even so, many of these procedures are performed daily throughout the United States. Artificial hearts are another new technology being used. Computers and technology that can examine internal body parts are valuable diagnostic tools, but these devices can cost millions of dollars. Advanced technology does allow people to survive illnesses that used to be fatal, but these individuals may require expensive and lifelong care.
- **The aging population**: Older individuals use more pharmaceutical products (medications), have more chronic diseases, and often need more frequent health care services.

Lawsuits force health care providers to obtain expensive malpractice insurance, order diagnostic tests even though they might not be necessary, and make every effort to avoid lawsuits. Because these expenses must be paid, a major concern is that health care costs could rise to levels that could prohibit providing services to all individuals. Health services can have a detrimental effect on the economy. Health care is a growing expense for businesses and individuals. Health care is a driver of U.S. debt at the federal level. National health spending—which includes government spending, the private sector, and individual spending—has risen by trillions from 1960 to the present and continues to rise. It is projected to be 19.9 percent in 2025, as opposed to 17.9 percent in 2016. The average health insurance premium has risen 19 percent over the past 5 years. Thus, all aspects of health care focus on cost containment. Although there is no absolute answer to how to control health costs, most agencies that deliver health care are trying to provide quality care at the lowest possible price. Some methods of cost containment include:

- **Diagnostic related groups (DRGs)**: This is one way Congress is trying to control costs for government insurance plans such as Medicare and Medicaid. Under this plan, patients with certain diagnoses who are admitted to hospitals are classified in one payment group. A limit is placed on the cost of care, and the agency providing care receives this set amount. This encourages the agency to make every effort to provide care within the expense limit allowed.
- **Replace fee-for-service compensation with value-based compensation or bundled payments**: Fee-for-service compensation pays health care providers for each service rendered, so there is little incentive to consider the cost or necessity of services provided. Replacing this payment type with value-based or bundled payments, in which providers are paid a certain amount for each diagnosis or disease, makes health care providers consider the necessity of various services or treatments.
- **Combination of services**: This is done to eliminate duplication of services. Clinics, laboratories shared by different agencies, health maintenance organizations (HMOs), preferred provider organizations (PPOs), and other similar agencies all represent attempts to control the rising cost of health care. When health care agencies join together or share specific services, care can be provided to a larger number of people at a decreased cost per person. For example, a large medical laboratory with expensive computerized equipment performing thousands of tests per day can provide quality service at a much lower price than smaller laboratories with less expensive equipment capable of performing only a limited number of tests per day.
- **Outpatient services**: Patients who use these services receive care without being admitted to hospitals or other care facilities. Hospital care is expensive. Reducing the length of hospital stays or decreasing the need for hospital admissions lowers the cost of health care. For example, patients who had open-heart surgery used to spend several weeks in a hospital. Today, the average length of stay is 4 to 7 days. Less expensive home care or transfer to a skilled-care facility can be used for individuals who require additional assistance.
- **Mass or bulk purchasing**: This means buying equipment and supplies in larger quantities at reduced prices. This can be done by combining the purchases of different departments in a single agency or by combining the purchases of several different agencies. A major health care system purchasing medical supplies for hundreds or thousands of health care agencies can obtain much lower prices than an individual agency. Computerized inventory can be used to determine when supplies are needed and to prevent overstocking and waste.
- **Early intervention and preventive services**: Providing care before acute or chronic disease occurs is crucial. Preventing illness is always more cost-effective than treating illness. Methods used to prevent illness include 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. Studies have shown that individuals with limited access to health services and restricted finances use expensive emergency rooms and acute care facilities much more frequently.

- **Environmental Protection**: A major expense is the correct disposal of the toxic waste that health care produces. All hazardous medical waste must be collected by a licensed medical waste collector/hauler.
  - **Categories of waste**: There are three categories of hazardous medical waste that must be treated differently than general waste. *Infectious Medical Waste* can transmit infection and includes bloody bandages, sharps, body parts, and lab cultures. *Radioactive Medical Waste* contains radioactive material such as nuclear medicine for cancer treatment and diagnostic test material. *Hazardous Medical Waste* is dangerous but not necessarily infectious such as chemotherapy agents and unused sharps.
  - **Management of waste**: Ways to improve management of these potential environmental hazards include building systems for long-term improvements, reducing volume, autoclave or steam on-site, providing easy-to-use waste disposal, proper air venting, and protecting water from facility containments.
- **Energy conservation**: This means monitoring the use of energy to control costs and conserve resources. Some of the major expenses for every health care industry/agency are electricity, water, and/or gas. Most large health care facilities perform energy audits to determine how resources are being used and to calculate ways to conserve energy. Methods that can be used for energy conservation include designing new energy-efficient facilities, maintaining heating/cooling systems, using insulation and thermopane windows to prevent hot/cool air loss, repairing plumbing fixtures immediately to stop water loss, replacing energy-consuming lightbulbs with energy-efficient bulbs, installing infrared sensors to turn water faucets on and off, and using alternative forms of energy such as solar power. Recycling is also a form of energy conservation, and most health care facilities recycle many different materials.

The preceding are just a few examples of cost containment. Many other methods will undoubtedly be applied in the years ahead. It is important to note that the quality of health care should not be lowered simply to control costs. The Agency for Healthcare Research and Quality (AHRQ) researches the quality of health care services to make health care safer; more accessible, equitable, and affordable; and of higher quality. 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 a rapidly growing field. 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 involved. Nursing care, physical and occupational therapy, respiratory therapy, social services, nutritional and food services, and other types of care can be provided in the home environment.

GERIATRIC CARE

Career

Geriatric care, or care for the elderly, is another field that will continue to experience rapid growth in the future (**Figure 1–3**). This is caused in part by the large number of individuals who are experiencing 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. Also, the "baby boom" generation—the large number of people born after World War II—is now reaching the geriatric age. Projections from the U.S. Census Bureau indicate that the rate of population growth during the next 50 years will be slower for all age groups, but the number of people in older age groups will continue to grow more than twice as rapidly as the total population. Many different facilities will be involved in providing care and resources for this age group. Adult day care centers, retirement communities, assisted/independent living facilities, long-term care facilities, and other organizations will all see increased demand for their services.

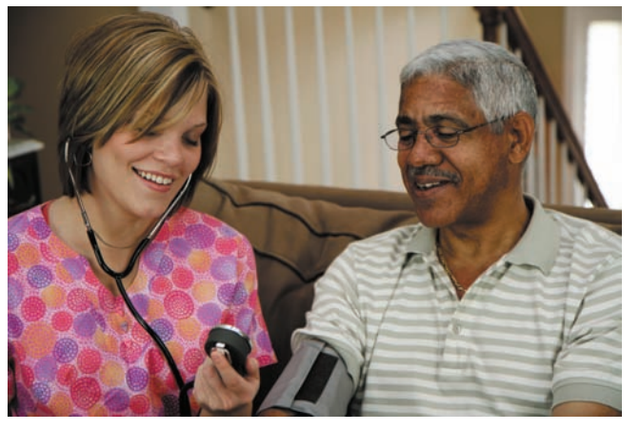


FIGURE 1–3 Home health care and geriatric care are fields that will continue to experience rapid growth.

OBRA

OBRA, the **Omnibus Budget Reconciliation Act** of 1987, has led to the development of many regulations regarding long-term care and home health care. This act requires states to establish training and competency evaluation programs for nursing and geriatric assistants. Each assistant working in a long-term care facility or home health care is now required under federal law to complete a state-approved training program and pass a written and competency examination to obtain certification. OBRA also requires continuing education, periodic evaluation of performance, and retraining and testing if a nursing assistant does not work in a health care facility for more than 2 years. Each state then maintains a registry of qualified individuals.

The minimum skills required are specified in the National Nurse Aide Assessment Program (NNAAP), the largest nurse aide certification examination in the United States, developed by the National Council of State Boards of Nursing (NCSBN). Programs that prepare nursing and geriatric assistants use NNAAP as a guideline to ensure that the minimum requirements of OBRA are met. OBRA also requires compliance with patients'/residents' rights and forces states to establish guidelines to ensure that such rights are observed and enforced.

TELEMEDICINE

Telemedicine involves the use of video, audio, and computer systems to provide medical and/or health care services. New technology now allows interactive services between health care providers even though they may be in different locations. For example, emergency medical technicians (EMTs) at the scene of an accident or illness can use technology to transmit medical data such as an electrocardiogram to an emergency department physician. The physician can then monitor the data and direct the care of the patient. This fills an especially critical need when personal exposure and limited travel is a factor, as seen in the COVID-19 pandemic. Telemedicine allows medical professionals to diagnose and treat patients without unnecessary exposure to disease for either provider or patient. Practitioners can also disseminate information and take care of noncritical patients in a home setting. That type of treatment helps eliminate pressure on hospital systems and resources that are already stressed.

EHR

Electronic health records (EHRs), also called electronic medical records (EMRs), facilitate rapid transmission of patient information. When physician offices, hospitals, and other health care providers have access, a doctor or authorized individual 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 are already allowing individuals with chronic illnesses or disabilities to receive care in the comfort of their own homes. This decreases the need for trips to medical care facilities. Patients can test their own blood sugar levels, oxygen levels, blood pressure measurements, and other vital signs as well 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 "face-to-face" through phone apps, 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.

WELLNESS

Career

Wellness—or the state of being in optimum health with a balanced relationship between physical, mental, and social health—is another major trend in health care. 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 1–4**). 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 1–4 Individuals are recognizing the importance of exercise and healthy living habits. © iStock.com/Catherine Yeulet

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 alcohol, tobacco, caffeine, drugs, environmental contaminants, and risky sexual behavior
- **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 using values, ethics, and morals to find meaning, direction, and purpose in life; often includes believing in a higher authority and observing religious practices

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 whole body, mind, and spirit. Each patient is recognized as a unique person with different needs. Holistic health care uses many methods of diagnosis and treatment in addition to traditional Western medical practice. Treatment is directed toward protection and restoration. It is based on the body's natural healing powers, the various ways different tissues and systems in the body influence each other, and the effect of the external environment. It is essential to remember that the patient is responsible for choosing his or her own care. Health care workers must respect the patient's choices and provide care that promotes the well-being of the whole person.

COMPLEMENTARY AND ALTERNATIVE METHODS OF HEALTH CARE

The most common health care system in the United States is the biomedical or "Western" system. It is based on evaluating the physical signs and symptoms of a patient, determining the cause of disease, and treating the cause. A major trend, however, is an increase in the use of complementary and alternative (CAM) health care therapies. **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.

Many health care facilities now offer **integrative (integrated) health care**, which uses both mainstream medical treatments and CAM therapies to treat patients. For example, chronic pain is treated with both medications and CAM therapies that encourage stress reduction and relaxation. Integrative health care is based on the principle that individuals have the ability to bring greater wellness and healing into their own lives and that the mind affects the healing process. In addition, integrative care recognizes that each person is unique and may require different medical treatments and a variety of CAM therapies. For this reason, an integrative treatment plan must be individualized to meet the patient's own special needs and circumstances.

The interest in holistic health care has increased the use of CAM therapies. Common threads in these therapies are that they consider the whole individual and recognize that the health of each part has an effect on the person's total health status; that each person has a life force or special type of energy that can be used in the healing process; and that skilled practitioners, rituals, and specialized practices are a part of the therapy. Many of these therapies are based on cultural values and beliefs. A few examples of CAM practitioners include the following:

- **Ayurvedic practitioners**: use an ancient philosophy, ayurveda, which was developed in India, to determine a person's predominant *dosha* (body type) and prescribe diet, herbal treatment, exercise, yoga, massage, minerals, and living practices to restore and maintain harmony in the body.
- **Chinese medicine practitioners**: use an ancient holistic-based healing practice based on the belief that a life energy (Chi) flows through every living person in an invisible system of meridians (pathways), linking the organs together and connecting them to the external environment or universe; they use acupuncture (**Figure 1–5**), acupressure, tai chi, and herbal remedies to maintain the proper flow of energy and promote health.
- **Chiropractors**: believe that the brain sends vital energy to all body parts through nerves in the spinal cord, and, when there is a misalignment of the vertebrae (bones), pressure is placed on spinal nerves that results in disease and pain; they use spinal manipulation, massage, and exercise to adjust the position of the vertebrae and restore the flow of energy.

- **Homeopaths**: believe in the ability of the body to heal itself through the actions of the immune system; they use minute diluted doses of drugs made from plant, animal, and mineral substances to cause symptoms similar to the disease and activate the immune system.
- **Hypnotists**: help an individual obtain a trancelike state with the belief that the person will be receptive to verbal suggestions and make a desired behavior change.
- **Naturopaths**: use only natural therapies such as fasting, special diets, lifestyle changes, and supportive approaches to promote healing; they avoid the use of surgery or medicinal agents to treat disease.

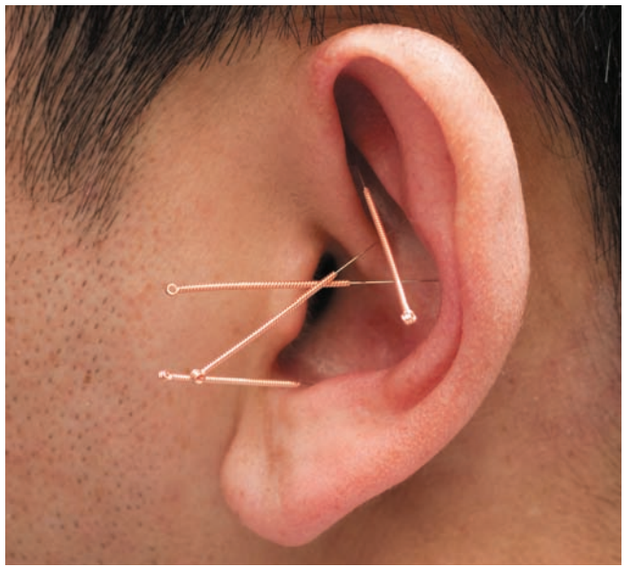


FIGURE 1–5 Acupuncture therapists insert very thin needles into specific points along the meridians (pathways) in the body to stimulate and balance the flow of energy. © iStock.com/Eliza Snow

Many different therapies are used in CAM medicine. Some of these therapies are discussed in **Table 1–8**. Most of the therapies are noninvasive and holistic. In many instances, they are less expensive than other traditional treatments: An excellent example is pet therapy (**Figure 1–6**). Many insurance programs now cover a wide variety of CAM therapies.

Legal

Because of the increased use of CAM therapies, the federal government established the National Center for Complementary and Alternative Medicine (NCCAM) at the National Institutes of Health in 1992. Its purpose is to research the various therapies and determine standards of quality care. In addition, many states have passed laws to govern the use of various therapies. Some states have established standards for some therapies, forbidden the use of others, labeled specific therapies experimental, and require a

FIGURE 1–6 Pet therapy helps individuals overcome physical limitations, socialize, increase self-esteem, and lower stress levels and blood pressure. © iofoto/Shutterstock.com

TABLE 1–8 Complementary and Alternative Therapies

Therapy	Basic Description
Acupressure (*Shiatsu*)	Pressure is applied with fingers, palms, thumbs, or elbows to specific pressure points of the body to stimulate and regulate the flow of energy; based on the belief that Chi (life energy) flows through meridians (pathways) in the body, and illness and pain occur when the flow is blocked; used to treat muscular–joint pain, depression, digestive problems, and respiratory disorders; *Shiatsu* is the Japanese form of acupressure
Acupuncture	Ancient Chinese therapy that involves the insertion of very thin needles into specific points along the meridians (pathways) in the body to stimulate and balance the flow of energy; at times, heat (moxibustion) or electrical stimulation is applied to the needles; based on the belief that Chi (life energy) flows through the meridians, and illness and pain occur when the flow is blocked; used to relieve pain (especially headache and back pain), reduce stress-related illnesses, and treat drug dependency and obesity
Antioxidants (Free Radicals)	Nutritional therapy that encourages the use of substances called *antioxidants* to prevent or inhibit oxidation (a chemical process in which a substance is joined to oxygen) and neutralize free radicals (molecules that can damage body cells by altering the genetic code); examples of antioxidants are vitamins A, C, and E, and selenium; antioxidants may prevent heart disease, cataracts, and some types of cancer
Aromatherapy	Therapeutic use of selected fragrances (concentrated essences or essential oils that have been extracted from roots, bark, plants, and/or flowers) to alter mood and restore the body, mind, and spirit; fragrances may be diluted in oils for massages or placed in warm water or candles for inhalation; used to relieve tense muscles and tension headaches or backaches, lower blood pressure, and create a stimulating, uplifting, relaxing, or soothing effect
Biofeedback	Relaxation therapy that uses monitoring devices to provide a patient with information about his/her reaction to stress by showing the effect of stress on heart rate, respirations, blood pressure, muscle tension, and skin temperature; patient is then taught relaxation methods to gain voluntary control over these physical responses; used to treat hypertension (high blood pressure), migraine headaches, and stress-related illnesses, and to enhance relaxation

(continues)

TABLE 1–8 Complementary and Alternative Therapies *(continued)*

Therapy	Basic Description
Healing Touch (*Reiki*)	Ancient Japanese/Tibetan healing art based on the idea that disease causes an imbalance in the body's energy field; begins with centering (inward focus of total serenity) before gentle hand pressure is applied to the body's chakras (energy centers) to harness and balance the life energy force, help clear blockages, and stimulate healing; at times, hands are positioned slightly above the energy centers; used to promote relaxation, reduce pain, and promote wound healing
Herbal or Botanical Medicine	Herbal medicine treatments that have been used in almost all cultures since primitive times; based on the belief that herbs and plant extracts from roots, stems, seeds, flowers, and leaves contain compounds that alter blood chemistry, remove impurities, strengthen the immune system, and protect against disease
Homeopathy	Treatment based on using very minute, dilute doses of drugs made from natural substances to produce symptoms of the disease being treated; based on the belief that these substances stimulate the immune system to remove toxins and heal the body; very controversial form of treatment
Hydrotherapy	Type of treatment that uses water in any form, internally and externally, for healing purposes; common external examples include water aerobics and exercises, massage in or under water, soaking in hot springs or tubs, and steam vapors; a common internal example is a diet that encourages drinking large amounts of water to help cleanse the body and stimulate the digestive tract
Hypnotherapy (Hypnosis)	Technique used to induce a trancelike state so a person is more receptive to suggestion; enhances a person's ability to form images; used to encourage desired behavior changes such as losing weight, stopping smoking, reducing stress, and relieving pain
Imagery	Technique of using the imagination and as many senses as possible to visualize a pleasant and soothing image; used to decrease tension, anxiety, and adverse effects of chemotherapy
Ionization Therapy	Special machines called *air ionizers* are used to produce negatively charged air particles or ions; used to treat common respiratory disorders
Macrobiotic Diet	Macrobiotic (meaning "long life") is a nutrition therapy based on the Taoist concept of the balance between yin (cold, death, and darkness) and yang (heat, life, and light) and the belief that different foods represent yin (sweet foods) and yang (meat and eggs); the diet encourages balanced foods such as brown rice, whole grains, nuts, vegetables, fruits, and fish; discourages overindulgence in yin or yang foods; emphasizes that processed and treated foods, red meat, sugar, dairy products, eggs, and caffeine should be avoided; similar to the American Dietary Association's low-fat, low-cholesterol, and high-fiber diet
Meditation	Therapy that teaches breathing and muscle relaxation techniques to quiet the mind by focusing attention on obtaining a sense of oneness within oneself; used to reduce stress and pain, slow heart rate, lower blood pressure, and stimulate relaxation
Pet Therapy	Therapy that uses pets, such as dogs, cats, and birds, to enhance health and stimulate an interest in life; helps individuals overcome physical limitations, decrease depression, increase self-esteem, socialize, and lower stress levels and blood pressure
Phytochemicals	Nutritional therapy that recommends foods containing phytochemicals (nonnutritive plant chemicals that store nutrients and provide aroma and color in plants) with the belief that the chemicals help prevent disease; phytochemicals are found mainly in a wide variety of fruits and vegetables, so these are recommended for daily consumption; used to prevent heart disease, stroke, cancer, and cataracts
Play Therapy	Therapy that uses toys to allow children to learn about situations, share experiences, and express their emotions; important aspect of psychotherapy for children with limited language ability
Positive Thought	Therapy that involves developing self-awareness, self-esteem, and love for oneself to allow the body to heal itself and eliminate disease; based on the belief that disease is a negative process that can be reversed by an individual's mental processes
Reflexology	Ancient healing art based on the concept that the body is divided into ten equal zones that run from the head to the toes; illness or disease of a body part causes deposits of calcium or acids in the corresponding part of the foot; therapy involves applying pressure on specific points on the foot so energy movement is directed toward the affected body part; used to promote healing and relaxation, reduce stress, improve circulation, and treat asthma, sinus infections, irritable bowel syndrome, kidney stones, and constipation
Spiritual Therapies	Therapies based on the belief that a state of wholeness or health depends not only on physical health but also the spiritual aspects of an individual; uses prayer, meditation, self-evaluation, and spiritual guidance to allow an individual to use the powers within to increase the sense of well-being and promote healing
Tai Chi	Therapies based on the ancient theory that health is harmony with nature and the universe and a balanced state of yin (cold) and yang (heat); uses a series of sequential, slow, graceful, and precise body movements combined with breathing techniques to improve energy flow (Chi) within the body; improves stamina, balance, and coordination and leads to a sense of well-being; used to treat digestive disorders, stress, depression, and arthritis
Therapeutic (Swedish) Massage	Treatment that uses kneading, gliding, friction, tapping, and vibration motions of the hands to increase circulation of the blood and lymph, relieve musculoskeletal stiffness, pain, and spasm, increase range of motion, and induce relaxation
Therapeutic Touch	Therapy based on an ancient healing practice with the belief that illness is an imbalance in an individual's energy field; the practitioner assesses alterations or changes in a patient's energy fields, places his/her hands on or slightly above the patient's body, and balances the energy flow to stimulate self-healing; used to encourage relaxation, stimulate wound healing, increase the energy level, and decrease anxiety
Yoga	Hindu discipline that uses concentration, specific positions, and ancient ritual movements to maintain the balance and flow of life energy; encourages the use of both the body and mind to achieve a state of perfect spiritual insight and tranquility; used to increase spiritual enlightenment and well-being, develop an awareness of the body to improve coordination, relieve stress and anxiety, and increase muscle tone

license or certain educational requirements before a practitioner can administer a particular therapy. It is essential for health care providers to learn their states' legal requirements regarding the different CAM therapies. Health care providers must also remember that patients have the right to choose their own type of care. Thus, a nonjudgmental attitude is essential.

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. Throughout history, influenza pandemics have killed large numbers of people. For example, the 1918 Spanish flu pandemic killed approximately 2.6 percent of individuals who contracted it, or more than 40 million people. Researchers recently identified the virus that caused this epidemic as an avian (bird) flu virus, or H5N1, that was transmitted directly to humans. The *H5N1* viruses present today devastate bird flocks but the spread from one person to another has been reported only rarely. In 2009 a new virus, H1N1, was discovered. The respiratory infection caused by this virus is commonly called the swine flu. Swine flu is an influenza in pigs, and it can occasionally be transmitted to humans. H1N1 spreads quickly and easily between humans when infected people cough or sneeze and others breathe in the virus or come in contact with a contaminated surface. H1N1 spread to almost all parts of the world, and the WHO declared it to be a global pandemic in 2009.

In 2014, a widespread epidemic of Ebola virus disease (EVD) occurred in West African countries, primarily in Guinea, Liberia, and Sierra Leone. Conservative estimates from WHO show that more than 23,000 people were infected and more than 70 percent of these people died from the disease. Ebola is a filovirus that was first discovered in 1976. It spreads to humans after close contact with the blood or body fluids of animals such as fruit bats, monkeys, chimpanzees, and gorillas who are infected with the disease. The disease starts by causing flu-like symptoms. As the disease becomes more severe, external and internal hemorrhaging occurs, and major organs such as the heart, kidney, and liver fail, causing death.

In September 2014, the first case of Ebola in the United States occurred when an infected person traveled from Liberia to Texas. Even with intensive treatment, the individual died from the disease. Two nurses who provided care for the patient were diagnosed with Ebola. Both nurses survived, but fear developed that a pandemic would occur. Many other cases developed in health care personnel who provided care in West Africa. Some were transported to their home countries for treatment and care. As a result, Ebola cases were present not only in the United States but also in other countries—including Spain, Britain, France, Germany, Norway, Switzerland, Italy, and the Netherlands. To prevent a pandemic, WHO began coordinating the construction and staffing of treatment centers in the highly infected areas and providing education about the disease. In the United States, the Centers for Disease Control and Prevention issued very strict transmission-based guidelines that must be followed when providing care to infected individuals.

The major concern is that flu viruses can mutate quickly and may create a new, even more lethal virus. In addition to H5N1, H1N1, and Ebola, WHO is concerned about many other viruses. Examples include the hantavirus spread by rodents, severe acute respiratory syndrome (SARS), monkeypox, and the Marburg virus, which is a filovirus similar to Ebola. In 2018, for the first time in history, the United States had flu outbreaks in 49 states at the same time.

In 2019, COVID-19, or coronavirus, spread from China to the rest of the world. WHO declared an international public health emergency and eventually a pandemic. China quarantined 15 cities, and international travel with China was restricted. The United States declared a national emergency. The rapid global spread of this disease caused further international travel restrictions, and cities issued "shelter in place" orders that closed schools and nonessential businesses and restricted how many people could gather. States had phased reopenings. When out in public, the recommended physical distance between people was 6 feet apart, and this was called social distancing. The use of masks by the general population was encouraged, especially indoors. Personal protective equipment like N95 masks, face shields, and gowns for health care providers were sometimes in short supply. Hospitals filled and a shortage of ventilators was a concern and occurred in some parts of the world.

As the number of coronavirus cases and deaths increased, major research was directed toward finding effective methods of treatment and developing a vaccine.

Many governments are creating pandemic influenza plans to protect their populations. 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 can now choose to take their vaccine by not just an injection but also intranasal, oral, or 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.

Of growing concern are the drug-resistant bacteria, or superbugs. Infections such as MRSA (methicillin-resistant Staphylococcus aureus), VRE (vancomycin-resistant Enterococcus), CRA (carbapenem-resistant Enterobacteriaceae), and MRAB (multidrug-resistant Acinetobacter baumannii) are believed to be caused by decades of unnecessary antibiotic use. This overuse caused genetic mutations in bacteria that made them resistant to commonly used antibiotics.

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 or, as defined by the UN Convention on Biological Diversity, "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use." Engineers have made equipment smaller and more implantable. 3-D printing has provided cost-effective and individualized choices. Some recent examples are sleep apnea implants and combination glucose monitor and insulin pumps. Even though biotechnology has been used for thousands of years in agriculture, food production, energy, medicine, and other fields, it has expanded to include new and diverse sciences. Some of these include genomics, pharmacogenomics, proteomics, 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. It analyzes the structure and function of genes, what they express, how they are regulated, how they interact with the environment, and ways they mutate or change. Research is directed at basing treatments on an individual's genetic makeup and identifying inherited genetic conditions. In 2019, scientists, using Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), were able to pinpoint defective or malfunctioning genes and provide advanced gene editing to treat disease.

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, ovarian, colorectal, gastric, lung, leukemia, lymphoma, and melanoma and for diseases such as osteoporosis and AIDS. In addition, prenatal screening tests can be performed for diseases such as cystic fibrosis, sickle cell anemia, and Tay-Sachs. As research continues, many more genetic tests will become available to diagnose disease.

Pharmacogenomics is defined by the National Human Genome Research Institute as using a person's genetic makeup to choose the drugs and drug doses that are likely to work best for that individual. It is based on recognizing that individuals respond differently to medications according to their genetic makeup. The hope is to provide *personalized medicine* in which medications and dosages are optimized for each individual. Personalized medicine can lead to more accurate and effective treatments for many cancers and other diseases. The targeted drugs would decrease adverse reactions or side effects, provide accurate dosages based on how the individual's body metabolizes the drug, and treat the diseased area while limiting damage to nearby healthy cells.

Proteomics studies the structure and function of proteins. Proteins are substances in the protoplasm of cells that cause biochemical reactions, act as messengers, influence growth and development of tissues, transport oxygen in the blood, defend the body against disease, regulate cell reproduction, and perform many other vital functions. Research is directed toward mapping a proteome, or the entire set of proteins produced or modified by an organism, similar to the way genomics maps the human genome. When researchers identify defective proteins that cause specific diseases, new drugs can be developed that correct a defective protein or replace a missing one. Other research on finding biomarkers that identify unique patterns of protein to diagnose diseases, such as the prostate specific antigen (PSA) test used for prostate cancer, will lead to better diagnostic tests.

Stem cell research studies stem cells, or cells that are capable of becoming any of the specialized cells in the body such as skin, muscle, or nerve cells. The two main types include embryonic stem cells from a developing fetus and somatic or adult stem cells. Stem cells can be used to replace defective cells and treat diseases such as cancer, diabetes, and heart disease. Research is directed toward determining how the stem cells can be delivered to a specialized organ/cell and continue with specific function.

Nanotechnology uses a wide range of techniques to manipulate atoms and molecules to create new materials and devices. *Nanomedicine* is the use of nanotechnology

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

The Food and Drug Administration Regulating Maggots and Leeches as Medical Devices?

Throughout the history of health care, maggots and leeches have been used to treat infection and encourage blood flow. Maggots clean festering, gangrenous wounds that fail to heal. They eat the dead tissue and discharges to clean the wound and promote the growth of new tissue. Leeches drain excess blood from tissue and encourage new circulation.

Microsurgeons—physicians who specialize in reattaching fingers, hands, and other body appendages—have come to rely on the assistance of leeches. When microsurgeons reattach or transplant a body part, they can usually connect arteries that bring blood to the appendage. They find it more difficult to attach veins, which carry blood away from the appendage, because veins are smaller and more fragile. Without a good venous supply, blood tends to collect in the new attachment, clot, and in some cases, kill the tissue. To allow time for the body to create its own veins to the new appendage, physicians apply leeches. The leeches naturally inject the area with a chemical that includes an anticoagulant (a substance that prevents clotting), an anesthetic, an antibiotic, and a vasodilator (a substance that dilates or enlarges blood vessels). This chemical encourages the blood to flow quickly. The leeches drain this blood to reduce pressure and allow veins to form.

Now, researchers are evaluating the use of maggots to treat burns and skin cancer. Surgeons are determining if maggots can decrease the risk of infection after surgery, especially as so many infectious agents are antibiotic resistant. German scientists are evaluating the use of leech therapy to lessen pain and decrease the inflammation associated with osteoarthritis and other inflammatory diseases. Many other alternative uses of this biotherapy (including using living animals to aid in diagnosis or treatment) are possible in the future.

Even though many individuals are squeamish about the use of maggots and leeches, they have proved to be an effective method of treatment for chronic infections and microsurgery. The FDA has classified maggots and leeches as medical devices and regulates how maggots and leeches are grown, transported, sold, and disposed of after use. This regulation provides a safe source for this unique method of treatment and encourages future research on the use of maggots and leeches as methods of treatment.

for medical applications. A nanometer (nm) is a very small structure, 1 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. This decreases the side effects of drugs and damage to other body cells. *Tissue engineering* is attempting to use nanotechnology to build structures that repair or reproduce damaged tissue. This has the potential to replace organ transplants or artificial implants. *Neuro-electronic* research is directed at using nanodevices to link computers to the nervous system to treat paralysis and nerve damage. Research has also led to the development of diagnostic devices, contrast agents for imaging, energy-based treatments using heat and radiation, and biosensors that measure very minute amounts of substances in biological fluids. The potential for this science is almost unlimited.

Cloning describes a number of different lab processes that can be used to produce genetically identical copies of a biological entity. Researchers have cloned tissues, genes, and cells. They have also cloned a sheep. Human cloning is still fiction. It is much more difficult to clone primates than other mammals. In 2004, Woo-Suk Hwang of Seoul National University in South Korea published a paper in the journal *Science* claiming to have cloned a human embryo. Independent scientists could not verify these results, and in January 2006, Hwang's paper was retracted.

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 mention that biotechnology research has also created bioethical concerns. For example, should a human being be cloned using biotechnology? Solving bioethical issues is a major concern as science advances.

checkpoint

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

PRACTICE: Go to the workbook and complete the assignment sheet for Chapter 1, History and Trends of Health Care.

Case Study Investigation Conclusion

What specific alternative treatments might help Mrs. Perez with her symptoms? Would anything in the treatment interfere with or block the effectiveness of her regular medications?

CHAPTER 1 SUMMARY

- Even in ancient times, people thought disease was caused by supernatural spirits, and 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 (CAM) of health care, pandemic preparation, and biotechnologies are some current changes and trends in health care. An awareness of of such changes and trends is important for any health care provider.

REVIEW QUESTIONS

1. Name the person responsible for each of the following events in the history of health care. Briefly state how their accomplishments contributed to the current state of health care.
   - **a.** The ancient Greek who is known as the Father of Medicine
   - **b.** An artist who drew the human body during the Renaissance
   - **c.** The individual who built a microscope that led to the discovery of microorganisms
   - **d.** The individual who discovered roentgenograms (X-rays)
   - **e.** The person who discovered penicillin
   - **f.** The 19th-century individual that encouraged washing hands in lime before delivering babies
   - **g.** The person that started using disinfectants and antiseptics during surgery
2. List six (6) specific ways to control the rising cost of health care.
3. You are employed in a medical office with four physicians. Identify and sketch or construct a model of four (4) specific ways to conserve energy and protect the health care environment in the office.
4. Review all the CAM therapies shown in Table 1–8. Identify two (2) therapies that you believe would be beneficial and explain why you think the therapies might be effective.
5. What is a pandemic? List four (4) pandemics and the cause of each.
6. 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?

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 medias and research identify four (4) main ways your government agency team can help prevent the spread of disease in your country during a pandemic.

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.

CHAPTER

2 HEALTH CARE SYSTEMS

Case Study Investigation

A homeless man, John, arrives at a county shelter and is found to be a drug addict and in need of medical care. John does have a primary care provider, Dr. Brinthall, and he is sent there for medical care. Dr. Brinthall refers John to a drug treatment clinic for his addiction under a county program. The addiction center must report treatment information back to the county for program reimbursement and back to the shelter to verify that John is in treatment. Someone claiming to be a relation of John requests information from the shelter on all the health services John has received. The staff at the homeless shelter is working to connect the homeless man with his relative. At the end of the chapter, you will be asked to identify two private facilities where John was treated, one government agency that would be involved, and how HIPAA laws would impact the amount of information the facilities and the relative would be able to obtain about John's condition.

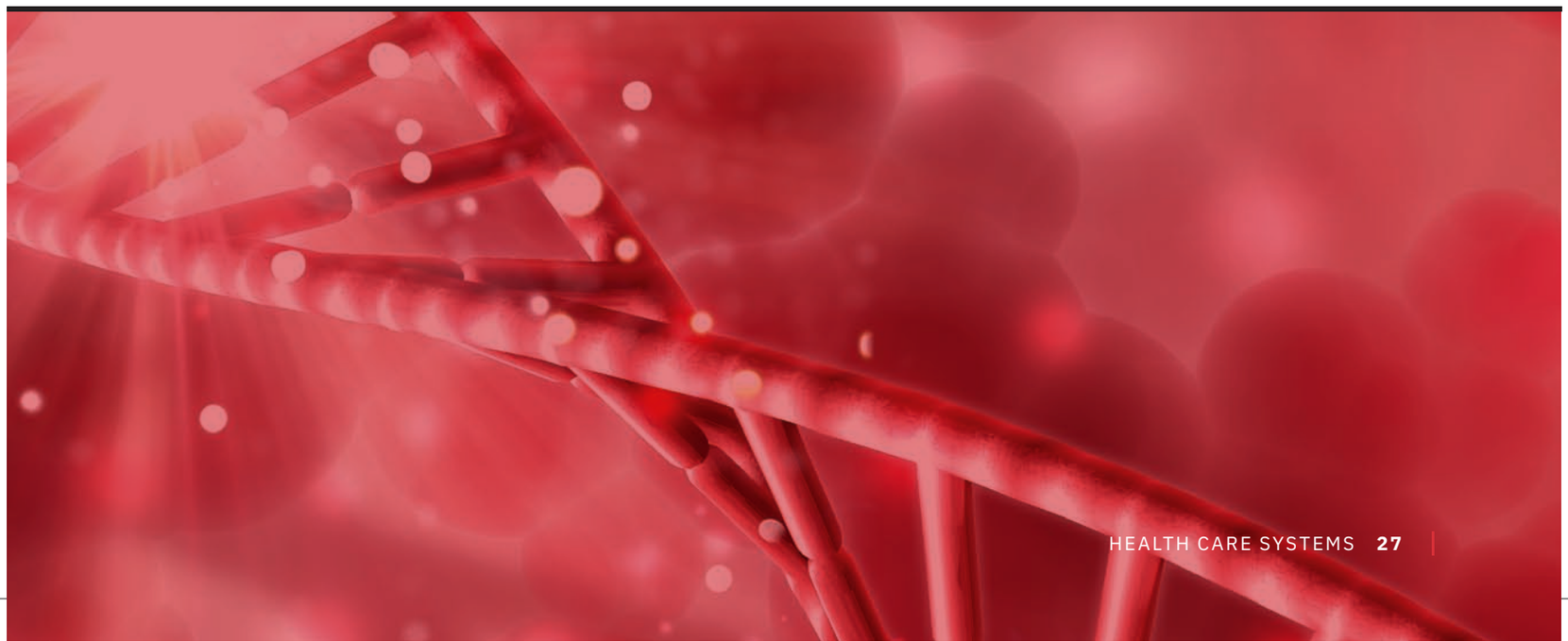
LEARNING OBJECTIVES

After completing this chapter, you should be able to:

- Describe at least eight types of private health care facilities.
- Analyze at least three government health services agencies and the services offered by each.
- Describe at least three services offered by voluntary or nonprofit agencies.
- Explain the purpose of organizational structures in health care facilities.
- Compare the basic principles of at least four different health insurance plans.
- Define, pronounce, and spell all key terms.

KEY TERMS

Agency for Healthcare Research and Quality (AHRQ)
assisted living facilities
Centers for Disease Control and Prevention (CDC)
clinics
concierge medicine
dental offices
emergency care services
fee-for-service compensation
Food and Drug Administration (FDA)
genetic counseling centers
health departments
health insurance plans
Health Insurance Portability and Accountability Act (HIPAA)
health maintenance organizations (HMOs)
home health care
hospice
hospitals
independent living facilities
industrial health care centers
laboratories
long-term care facilities (LTCs or LTCFs)
managed care
Medicaid
medical offices
Medicare
Medigap policy
mental health facilities
National Institutes of Health (NIH)
nonprofit agencies
Occupational Safety and Health Administration (OSHA)
Office of the National Coordinator for Health Information Technology (ONC)
optical centers
organizational structure
Patient Protection and Affordable Care Act (PPACA)
pharmaceutical services
preferred provider organization (PPO)
rehabilitation facilities
school health services
technology
The Joint Commission
TRICARE
U.S. Department of Health and Human Services (USDHHS)
value-based compensation
Veteran's Administration
voluntary agencies
workers' compensation
World Health Organization (WHO)



2:1 PRIVATE HEALTH CARE FACILITIES

Today, health care systems include the many agencies, facilities, and personnel involved in the delivery of health care. According to U.S. government statistics, health care is one of the largest and fastest-growing industries in the United States. This industry employs more than 17 million workers in more than 200 different health care careers. It attracts people with a wide range of educational backgrounds because it offers multiple career options. By the year 2026, health care employment is expected to increase by 11.6 million jobs to more than 28.1 million workers. Health care spending in the United States is projected to increase from more than $3.8 trillion in 2020 or 17.8 percent of the GDP to 19.9 percent of the GDP in 2025.

Many different health care facilities provide services that are a part of the industry called *health care* (**Figure 2–1**). Most private health care facilities require a fee for services. In some cases, grants and contributions provide some financial support for these facilities. 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 Different health care facilities. Top image, © iStock.com/Steve Shepard; middle Image, © iStock.com/Catherine Yeulet; and bottom image, © iStock.com/Paul Hill

HOSPITALS

Hospitals are one of the major types of health care facilities. They vary in size and types of services provided. Some hospitals are small and serve the basic needs of a community; 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), religious, nonprofit or voluntary, and government, depending on the sources of income received by the hospital.

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

- **General hospitals**: treat a wide range of conditions and age groups; 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, 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 hospitals**: operated by federal, state, and local government agencies; include the many facilities located throughout the world that provide care for government service personnel and their dependents; examples are Veterans Administration hospitals (which provide care for veterans), state psychiatric hospitals, and state rehabilitation centers
- **University or college medical centers**: provide hospital services as well as research and education; can be funded by private and/or governmental sources

In many instances, the classifications and types of hospitals can overlap. For example, a hospital in a major city can be a for-profit hospital but still receive government funding. A hospital can also be a general hospital but offer specialty services such as oncology and pediatrics.

LONG-TERM CARE FACILITIES

Long-term care facilities (LTCs or LTCFs) 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.

There are many different types of long-term care facilities. Some of the more common ones include:

- **Residential care facilities (nursing homes or geriatric homes)**: designed to provide basic physical and emotional care for individuals who can no longer care for themselves; help individuals with activities of daily living (ADLs), provide a safe and secure environment, and promote opportunities for social interactions
- **Extended care facilities or skilled care facilities**: designed to provide skilled nursing care and rehabilitative care to prepare patients* or residents for return to home environments or other long-term care facilities; some have *subacute units* designed to provide services to patients who need rehabilitation to recover from a major illness or surgery, treatment for cancer, or treatments such as kidney dialysis or heart monitoring
- **Independent living facilities** and **assisted living facilities**: allow individuals who can care for themselves to rent or purchase an apartment in the facility; provide services such as meals, housekeeping, laundry, transportation, social events, and basic medical care (such as assisting with medications)

Most assisted or independent living facilities are associated with nursing homes, extended care facilities, and/or skilled care facilities. This arrangement allows an individual to move readily from one level of care to the next when health needs change. Many long-term care facilities also offer special services such as the delivery of meals to the homes of older adults, the chronically ill, or people with disabilities. Some facilities offer senior citizen or adult day care centers, which provide social activities and other services for older people. The need for long-term care facilities has increased dramatically because of the large increase in the number of older people. Many health care career opportunities are available in these facilities, and there is a shortage of nurses and other trained personnel.

*In some health care facilities, patients are referred to as *clients*. For the purposes of this text, *patient* will be used.

MEDICAL OFFICES

Medical offices vary from offices that are privately owned by one physician to large complexes that operate as corporations and employ many physicians and other health care professionals. Medical services obtained in these facilities can include diagnosis (determining the nature of an illness), treatment, examination, basic laboratory testing, minor surgery, and other similar care. Some physicians treat a wide variety of illnesses and age groups, but others specialize in and handle only certain age groups or conditions. Examples of specialties include pediatrics (infants and children), cardiology (diseases and disorders of the heart), obstetrics (care during pregnancy), and pulmonology (respiratory diseases).

CONCIERGE MEDICINE

Concierge medicine, or *retainer medicine*, is a type of personalized health care. In exchange for an annual or monthly fee, an enhanced level of care is provided by a primary care physician. The physician is able to care for fewer patients while having more availability. The rates and services vary among providers.

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 (straighten teeth).

CLINICS OR SATELLITE CENTERS

Clinics, also called *satellite clinics* or *ambulatory centers*, are health care facilities 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:

- **Surgical clinics or surgicenters**: perform minor surgical procedures and some cosmetic surgeries; frequently called "one-day" surgical centers because patients are sent home immediately after they recover from their operations
- **Urgent, walk-in, or emergency care clinics**: provide first aid or emergency care to acutely ill or injured patients
- **Rehabilitation clinics**: offer physical, occupational, speech, and other similar therapies
- **Substance abuse clinics**: provide rehabilitation for drug and alcohol abuse
- **Specialty clinics**: provide care for specific diseases; examples include diabetic clinics, kidney dialysis centers, and oncology (cancer) clinics
- **Outpatient or ambulatory clinics**: usually operated by hospitals or large medical groups; provide care for outpatients (patients who are not admitted to the hospital)
- **Health department clinics**: may offer clinics for pediatric health care, treatment of sexually transmitted diseases, treatment of respiratory disease, immunizations, and other special services
- **Medical center clinics**: usually located in colleges or universities; offer clinics for various health conditions; offer care and treatment and provide learning experiences for medical students

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.

EMERGENCY CARE SERVICES

Emergency care services provide special care for victims of 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 can 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.

HOME HEALTH CARE

Home health care agencies are designed to provide care in a patient's home (**Figure 2–2**). Older adults and people with disabilities frequently use the services of these agencies. Examples of such services include nursing care, personal care, therapy (physical, occupational, speech, respiratory), and homemaking (food preparation, cleaning, and other household tasks). Health departments, hospitals, private agencies, government agencies, and nonprofit or volunteer groups can offer home care services.

HOSPICE

Hospice agencies provide care for people who are terminally ill and who usually have life expectancies of 6 months or less. Care can be provided in a person's home or in a hospice facility. Hospice offers palliative care, or care that provides support and comfort and is directed toward allowing the person to die with dignity. Psychological, social, spiritual, and financial counseling are provided for both the patient and the family. Hospice also provides support to the family following a patient's death.

MENTAL HEALTH FACILITIES

Mental health facilities treat patients who have mental disorders and diseases. Examples of these facilities include guidance and counseling centers, psychiatric clinics and hospitals, chemical abuse treatment centers (dealing with alcohol and drug abuse), and physical abuse treatment centers (dealing with child abuse, spousal abuse, and geriatric [elder] abuse).

FIGURE 2–2 Many types of health care can be provided in a patient's home.

GENETIC COUNSELING CENTERS

Genetic counseling centers can be independent facilities or can be located in another facility such as a hospital, clinic, or physician's office. Genetic counselors work with couples or individuals who are pregnant or considering a pregnancy. They perform prenatal (before birth) screening tests, check for genetic abnormalities and birth defects, explain the results of the tests, identify medical options when a birth defect is present, and help the individuals cope with the psychological issues caused by a genetic disorder. Examples of genetic disorders include Down syndrome and cystic fibrosis. Counselors frequently consult with couples before a pregnancy if the pregnancy occurs in the late childbearing years, there is a family history of genetic disease, or it involves a specific race or nationality with a high risk for genetic disease.

REHABILITATION FACILITIES

Rehabilitation facilities are located in hospitals, clinics, and/or private centers. They provide care to help patients who have physical or mental disabilities obtain the maximum self-care and function. Services may include physical, occupational, recreational, speech, and hearing therapy.

HEALTH MAINTENANCE ORGANIZATIONS

Health maintenance organizations (HMOs) are both health care delivery systems and a type of health insurance. They provide total health care services that are primarily directed toward preventive health care for a fee that is usually fixed and prepaid. Services include examinations, basic medical services, health education, and hospitalization or rehabilitation services, as needed. Some HMOs are operated by large industries or corporations; others are operated by private agencies. They often use the services of other health care facilities including medical and dental offices, hospitals, rehabilitative centers, home health care agencies, clinics, and laboratories.

INDUSTRIAL HEALTH CARE CENTERS

Industrial health care centers or *occupational health clinics* are found in large companies or industries. Such centers provide health care for employees of the industry or business by performing basic examinations, teaching accident prevention and safety, and providing emergency care. Major resort industries, such as Disney, may also provide emergency health care to visitors.

SCHOOL HEALTH SERVICES

School health services are found in schools and colleges. These services provide emergency care for victims of accidents and sudden illness; perform tests to check for health conditions such as speech, vision, and hearing problems; promote health education; and maintain a safe and sanitary school environment. Many school health services also provide counseling.

PHARMACEUTICAL SERVICES

Pharmaceutical services, also called pharmacies, chemists, or drug stores, link health science with chemical science. A pharmacist prepares and dispenses medications and provides expertise on drug therapy. Pharmacists also ensure patient safety through education. Pharmaceutical services can be found in many settings—including hospitals, community stores, clinics, nursing homes, and even online. In addition to prescription drugs, many pharmaceutical services also offer over-the-counter drugs (for conditions such as pain, colds, and allergies), vitamins, and herbal remedies.

checkpoint

1. Describe eight (8) types of private health care facilities.

2:2 GOVERNMENT HEALTH AGENCIES

In addition to the government health care facilities mentioned previously, other health services are offered at the international, national, state, and local levels. Government services are tax supported. State and local health departments serve critical roles in promoting the health of residents in their jurisdictions. Examples of government agencies include:

- **World Health Organization (WHO)**: an international agency sponsored by the United Nations; compiles statistics and information on disease, publishes health information, and investigates and addresses serious health problems throughout the world; the main objective of the WHO, per its constitution, "is the attainment by all people of the highest possible level of health care"; Internet address: *www.who.int*
- **U.S. Department of Health and Human Services (USDHHS)**: a national agency that deals with the health problems in the United States; its goal is to protect the health of all Americans, especially those people who are in need; provides more grant money than any other federal agency; Internet address: *www.hhs.gov*

- **National Institutes of Health (NIH)**: a division of the USDHHS; involved in researching disease and conducting scientific studies; Internet address: *www.nih.gov*
- **Centers for Disease Control and Prevention (CDC)**: another division of the USDHHS; concerned with the causes, spread, and control of diseases in populations (**Figure 2–3**); Internet address: *www.cdc.gov*
- **Food and Drug Administration (FDA)**: a federal agency responsible for regulating food and drug products sold to the public; also protects the public by regulating things such as medical devices, cosmetics, and cell phones; Internet address: *www.fda.gov*
- **Agency for Healthcare Research and Quality (AHRQ)**: a federal agency established to improve the quality, safety, efficiency, and effectiveness of health care for Americans; Internet address: *www.ahrq.gov*
- **Occupational Safety and Health Administration (OSHA)**: establishes and enforces standards that protect workers from job-related injuries and illnesses; issues standards on things such as limits on chemical and radiation exposure and use of personal protective equipment; Internet address: *www.osha.gov*
- **Office of the National Coordinator for Health Information Technology (ONC)**: leads national efforts to build a private and secure nationwide health information exchange; its goal is to improve health care by allowing health information to be exchanged quickly among providers. Internet address: *www.healthit.gov*
- **Public Health Systems/Health departments**: provide health services as directed by the U.S. Department of Health and Human Services (USDHHS); the public health system in the United States is a complex network of people and organizations in both public and private sectors that collaborate in various ways at national, state and local levels to promote and protect public health. When facing global pandemics or health threats, these agencies can recommend mandates like "shelter in place" and self-quarantine requirements to protect the public. They also provide specific services needed by the state or local community; examples of services include testing and immunization for disease control, inspections for environmental health and sanitation, collection of statistics and records related to health, health education, clinics for health care and prevention, and other services needed in a community; local health care services provide information on home care, recreation activities, meal and food assistance programs, transport, and other resources that will support people's well-being; Internet address: *www.hhs.gov*; use the search box to locate the web address of a specific state or local health department
- **Veteran's Administration**: a federal agency that provides health care for veterans and their families; also is America's largest integrated health care system, providing care at hospitals, medical centers and outpatient sites serving 9 million enrolled veterans each year; Internet address: *https://www.va.gov*

FIGURE 2–3 The Centers for Disease Control and Prevention (CDC) deals with the causes, spread, and control of diseases in populations.
CDC/James Gathany

checkpoint

1. Name three (3) ways that national government agencies provide services to the health care community.
2. Name three (3) ways that the health department provides services for both state and local health care.

2:3 VOLUNTARY OR NONPROFIT AGENCIES

Voluntary agencies, frequently called **nonprofit agencies**, are supported by donations, membership fees, fundraisers, and federal or state grants. They provide health services at the national, state, and local levels.

The Joint Commission is a nonprofit, U.S.-based organization that was created to ensure that patients receive the safest, highest quality care in any health care setting. Meeting the standards of The Joint Commission is recognized as a symbol of quality. In many states, a Joint Commission accreditation is required to receive Medicaid reimbursement. Its Internet address is *www.jointcommission.org*.

Other examples of nonprofit agencies include the American Cancer Society, American Heart Association, American Respiratory Disease Association, American Diabetes Association, National Mental Health Association, Alzheimer's Association, National Kidney Foundation,