Community AND Public Health Nursing

EVIDENCE FOR PRACTICE

4TH EDITION

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Preface

"If you want to go quickly, go alone. If you want to go far, go together."
African Proverb

"The idea that some lives matter less is the root of all that is wrong in the world."
Paul Farmer

"No matter what people tell you, words and ideas can change the world."
Robin Williams

We have experienced and continue to experience extraordinary changes in health and healthcare in this new century, with emerging challenges that call upon the most creative, analytical, and innovative skills and strategies available. Although much of the world has the resources to address health equity and eliminate the differences in healthcare and health outcomes that exist between various population groups across the globe, accomplishing this is a long-term and complicated task. In fact, even adequate resources do not always yield the outcomes for which we hope. Improvement in the social structure and environmental context within which people live and a redistribution of resources so that all people have access to the basic necessities of life require an unprecedented global consciousness and political commitment.

Ultimately, reducing health disparities and promoting health equity occur within the local community where people reside. Nurses are by far the largest group of healthcare providers worldwide and, as such, have the ability and responsibility to be change agents and leaders in implementing transformation and innovation in their communities. They can be the primary participants in the development of health policy that specifically addresses the unique needs of their communities. Through implementation and evaluation of culturally appropriate, community-based programs, nurses can use their expertise to remedy the conditions that contribute to health inequities.

In the United States, public health has resurged as a national priority. Through *Healthy People 2030*, national goals have been set to promote a healthy population and address the issue of health disparities. The process of implementing the *Healthy People 2030* objectives rests with regional and local practitioners, with nurses having a direct responsibility in the implementation process. The nurse practicing in the community has a central role in providing direct care for the ill, promoting and maintaining the health of populations, and working collaboratively with multisector stakeholders to achieve health equity. Today, there are unparalleled challenges to the public/community health nurse's problem-solving skills in carrying out this mission at the individual, community, and systems levels. We do not need to look much further than the COVID-19 pandemic to understand the contribution of nurses who are the vertebrae of the healthcare system and of public health. Public health nurses are well positioned to lead and contribute to the transformation needed in healthcare.

Whether caring for the individual or populations within the community, it is essential that nurses incorporate evidence from multiple sources in the analysis and solution of public health issues. *Community and Public Health Nursing: Evidence for Practice* focuses on evidence-based practice, presenting multiple formats designed to develop the abstract critical thinking skills and complex reasoning abilities necessary for nurses becoming generalists in community and public health nursing. The unique blend of both the nursing process and the epidemiologic process provides a framework for gathering evidence about health problems, analyzing the information, generating diagnoses or hypotheses, planning for resolution, implementing plans of action, and evaluating the results.

To every complex question there is a simple answer ... and it is wrong. **H. L. Mencken (writer and wit, 1880–1956)**

CONTENT ORGANIZATION

It is the intention of *Community and Public Health Nursing: Evidence for Practice* to present the core content of community and public health nursing in a succinct, logically organized, but comprehensive manner. The evidence for practice focus not only includes chapters on epidemiology, biostatistics, and research but also integrates these topics throughout the text. Concrete examples assist students in interpreting and applying statistical data. This edition includes an enhanced emphasis on healthcare reform, population health, the social determinants of health (SDOH), inequities, and

achieving health equity. Relevant information and recommendations from healthcare reform, *Healthy People 2030*, *The Future of Nursing 2020–2030: Charting a Path to Achieve Health Equity*, the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), the COVID-19 pandemic, and nursing and public health organizations are integrated throughout the text chapters. The structure and functions of public health and public health nursing are described in detail, with a focus on community assessment and change. All major public health problems and challenges, including communicable diseases and emerging infections, emergency and disaster preparedness, environmental health and climate change, behavioral health, and violence, are addressed in dedicated chapters. The needs of underserved populations are analyzed throughout the text. Attention is given to specialized practice settings including global health, home healthcare, environmental health, community engagement, occupational health, and palliative care.

Challenges to critical thinking are presented in multiple places throughout each chapter. Case studies are integrated into the content of each chapter and contain critical thinking questions imbedded in the case study content. Also, a series of critical thinking questions can be found at the end of each chapter. (Please see the description of features below.) Considering the onus presented by Mark Twain: "Be careful about reading health books. You may die of a misprint," every attempt has been made to present correct, meaningful, and current evidence for practice.

Part One presents the context within which the public health nurse practices. Healthcare system reform is introduced with its emphasis on population health, better integration of the clinical services and public health sectors, and the need for system-wide transformation. Principles of public health and population health are presented, and the interconnectedness of the SDOH, health inequities, and health equity is described. Exploring the roots of public health nursing leads to an analysis of the current role and functions of public health nurses with recent revisions in the American Nurses Association (ANA) *Scope and Standards of Public Health Nursing Practice*, the Quad Council's Core Competencies for Public Health Nursing, and the Public Health Intervention Wheel highlighted, and major challenges for public health nursing discussed.

A more in-depth discussion of the complex structure, function, and outcomes of public health and healthcare systems follows. National and international perspectives regarding philosophical and political attitudes, social structures, economics, resources, financing mechanisms, and historical contexts are presented. Theoretical foundations and practical applications of nurses' roles in health policy development and implementation, advocacy, and politics are discussed. The World Health Organization's commitment to improving the public's health globally follows, with an emphasis on the global burden of disease, poverty, and the Sustainable Development Goals. With the burden of disease (actual and emerging) growing disproportionately in the world, largely because of climate, public policy, socioeconomic conditions, age, and an imbalance in distribution of risk factors and resources, the countries burdened by disease often have the least capacity to institute change. Part One concludes with examination of the indicators of health, health and human rights, factors that affect health globally, and nurses' role in improving global health.

Part Two provides the frameworks and tools necessary to engage in evidence-based practice focused on the population's health. Concepts of health literacy, health promotion, disease prevention, and risk reduction are explored, and a variety of conceptual frameworks are presented with a focus on both the epidemiologic and ecologic models. Epidemiology is presented as the science of prevention, and nurses are shown how epidemiologic principles are applied in practice, including the use of rates and other statistics as community health indicators. Specific research designs are also explored, including the application of epidemiologic research to practice settings.

Part Three is designed to develop the skills necessary to implement nursing practice effectively in community settings. Because healthcare is in a unique state of transformation, planning for community change is paramount. The health planning process is described, with specific attention given to the social and environmental determinants of change. Lewin's change theory, force-field analysis, and the effective use of leverage points identified in the force-field analysis demonstrate the change process in action.

Changes directed at decreasing health disparities must be culturally sensitive, person-centered, and community-oriented. A chapter on cultural awareness and respect fosters the development of culturally humble practitioners, who understand the influence that culture has on all aspects of health and healthcare delivery and approach the individual, family, or community as the cultural informant in the process of health assessment and intervention. Frameworks of community assessment are presented and various approaches are explored. Management of care and the case management process follow. The role and scope of home care nursing practice and the provision of services are presented along with the challenges inherent with interdisciplinary roles, advances in telehealth, and other home care services.

Although content on family assessment can be found in other texts, it is an integral component of community and public health practice. Therefore, theoretical perspectives of family and contemporary family configurations and life cycles are explored. Family Systems Nursing and the Calgary Family Assessment and Intervention Model are provided as guides to implementing family nursing practice in the community. Evidence-based maternal–child health home visiting programs and prominent issues related to family caregiving are also highlighted.

Part Four presents the common challenges in community and public health nursing. The chapter addressing the risk of infectious and communicable diseases explores outbreak investigation with analysis of data experience provided by the

case studies. Public health surveillance, the risk of common foodborne and waterborne illnesses, and sexually transmitted illnesses are followed by a discussion of factors that influence the emergence/reemergence of infectious diseases, examples of recent outbreaks, and means of prevention and control.

The challenge presented by violence in the community includes an emphasis on intimate partner violence, gun violence, abuse of special populations, and human trafficking and the roles that public health nurses can assume in addressing these public health problems. Because of the cultural variations in substance use disorder, multifaceted approaches to the problem are discussed with the recommendation that evidence-based prevention and treatment protocols for substance use disorder are incorporated by community health nurses in all practice settings. Meeting the healthcare needs of vulnerable and underserved populations is another challenge. Health inequities and priorities for people who live in rural areas; are lesbian, gay, bisexual, transgender, queer/questioning or other (LGBTQ+); are racial–ethnic minorities, are veterans, or live in correctional institutions are reviewed.

The issues of access to quality care, chronic disease management, interaction with health personnel, and health promotion in hard-to-reach populations among these populations are also presented.

The environmental chapter demonstrates how to assess contaminants in the community by creation of an exposure pathway. The health effects of the exposure pathway can then be ascertained. Individual assessment of contaminant exposures, interventions, and evaluations is also explored, ending with a focus on maintaining healthy communities and addressing climate change and environmental injustices. The final chapter in Part Four presents the issue of community preparedness. The types of disasters along with classification of agents are described, disaster management outlined, and the public health response explained. The role and responsibility of nurses in disasters and characteristics of the field response complete the content.

Part Five describes five common specialty practices within community and public health nursing. All have frameworks that define practice and reflect the competencies necessary for quality practice in a variety of community settings. Beyond the classroom, the chapters serve as excellent preparation for students who are completing their clinical practicum in one of these practice settings. These include application of the principles of practice to community mental health, school health, faith-oriented communities, palliative care, and occupational health nursing. A revised chapter focuses on community engagement as an innovative practice setting. A model of community engagement and the process of community-based participatory research are presented. Community-based partnerships with faith-based organizations, libraries, and barbershops are highlighted. Exemplars of innovative community engagement with underserved populations including racial–ethnic minorities and those experiencing homelessness and incarceration are analyzed. Nursing implications and ethical considerations in community engagement are discussed.

Features Found in Each Chapter

CHAPTER HIGHLIGHTS

Brief outline of the content and direction of the chapter

OBJECTIVES

Observable changes expected following completion of the chapter

KEY TERMS

Essential concepts and terminology required for comprehension of chapter content

CASE STUDIES

Vignettes presented throughout the content of each chapter, designed to stimulate critical thinking and analytic skills

Evidence for Practice

Examples of objective evidence obtained from research studies that provide direction for practice

Practice Point

Highlighting of essential facts relevant to practice

Student Reflection

Student stories of their own experience and reflections

KEY CONCEPTS

Summary of important concepts presented in the chapter

CRITICAL THINKING QUESTIONS

Problems requiring critical analysis that combine research, context, and judgment

COMMUNITY RESOURCES

List of resources that support the content of selected chapters

I didn't fail the test, I just found 100 ways to do it wrong.
Benjamin Franklin

NEW TO THIS EDITION

Throughout the Book

- Enhanced discussion of health equity promotion and healthcare reform to address local and global health challenges across populations
- Increased detail on the health ramifications of environmental and climate changes—particularly for historically under-resourced communities, families, and individuals
- Emphasis on connecting and engaging with community stakeholders and networks to address public and community health challenges
- Findings and implications from the COVID-19 pandemic woven throughout the text:
  - Specific examination in seven chapters (1, 3, 4, 7, 16, 22, 23) of how COVID-19 has affected existing public health issues such as poverty, childhood obesity, intimate partner violence, public health nursing and healthcare reform, and school health, along with a spotlight on a public health nurse's partnership with a library to advance the health of a population experiencing homelessness
- Integration of critical insights and recommendations from the National Academy of Medicine's *The Future of Nursing 2020-2030: Charting a Path to Achieve Health Equity*
- Vital contributions of current expertise and thoughtful analysis from 16 new expert authors
- Consistent reinforcement of the interrelatedness of population health, public health, public/community health nursing, social determinants of health, and health equity and inequities, with six chapters (1, 3, 4, 16, 22, 23) totally or substantially rewritten to underscore these relationships
- By-topic application of *Healthy People 2030* health and well-being objectives, with *Healthy People 2030* learning activities in selected chapters
- Focused attention to promoting inclusive, nonbiased language and discussion of health issues for specific populations

Updates to Specific Chapters

- Chapter 1: Rewritten to provide a broad foundation in public health nursing, to enhance students' understanding of public health and the public health nurse's role in healthcare reform and transformation, with attention to the Triple Aim and Affordable Care Act; the latest from the ANA's *Public Health Nursing Scope and Standards of Practice*, Quad Council Coalition's Public Health Nursing Competencies, Public Health 3.0, and the Minnesota Health Department's Public Health Intervention Wheel; and the challenges and changes needed to the U.S. public health system that were revealed by COVID-19
- Chapter 3: Rewritten to stimulate students' interest in health policy by identifying the relationship of policy, politics, influence, and advocacy and providing practical advice on how nurses can be involved in the health policy process and politics to improve healthcare and health equity
- Chapter 4: Includes new sections on global impact of COVID-19 and climate change, with three new global exemplars of nurses leading transformative change: Community-Based, Nurse-Led, Group Medical Visits for NCDs in Kenya; An Independent Nurses Clinic for the Homeless in Boston; and A Whole-of-Health Approach to HIV in Eswatini
- Chapter 5: Addresses how to measure community engagement as a key component to health promotion, disease prevention, and risk reduction
- Chapter 11: Features asset-based approaches to assessment, communities as partners, and how GIS (Geographic Information Systems) can assist with understanding trends and patterns of challenges and interventional improvement
- Chapter 12: Includes an update on home care assessments and reimbursement as well as the evolving delivery of care through a medical home care delivery for acute care and telehealth
- Chapter 14: Summarizes the latest findings about respiratory syncytial virus (RSV) and sexually transmitted infections in special populations
- Chapter 15: Details the onset and duration of the COVID-19 pandemic, applying the missed opportunities and lessons learned from other pandemics such as Ebola and Zika
- Chapter 16: Offers an enhanced introduction to violence from a public health perspective and an expanded section focusing on gun violence as a public health crisis
- Chapter 18: Reorganized to focus on communities that are underserved, under-resourced, and/or facing negative consequences of generational poverty and social determinants of health, with a new key focus on health equity and advocacy and specific updates on LGBTQIA+ populations
- Chapter 22: Rewritten using the National Association of School Nurses' model of school nursing interventions, Framework for 21st-Century School Nursing Practice, to provide a detailed description of the structure and function of school nursing
- Chapter 23: *All new* chapter, "Innovative Community Engagement Practice to Advance Population Health" that:
  - provides students with a basic understanding of the community engagement process and community-based participatory research

- introduces innovative community engagement programs to address the needs of specific populations
- explores the role of community-based locations such as faith-based organizations, barber shops, and libraries in health promotion activities

- Chapter 25: Promotes personal protective equipment (PPE) as an intersection of preparedness for occupational needs and safety

A COMPREHENSIVE PACKAGE FOR TEACHING AND LEARNING

Ancillary Package

To further facilitate teaching and learning, a carefully designed ancillary package has been developed to assist faculty and students.

Instructor Resources

Tools to assist you with teaching your course are available upon adoption of this book on thePoint® at http://thepoint.lww.com/DeMarco4e.

- A **Test Generator** features National Council Licensure Exam (NCLEX)-style questions mapped to chapter learning objectives.
- An extensive collection of materials is provided for each book chapter:
  - **PowerPoint Presentations** provide an easy way to integrate the textbook with your students' classroom experience; multiple-choice and true/false questions are included to promote class participation.
  - **Assignments** (and suggested answers) include group, written, clinical, and web assignments to engage students in varied activities and assess their learning.
  - **Case Studies** with related questions (and suggested answers) give students an opportunity to apply their knowledge to a client case similar to one they might encounter in practice.
  - **Lesson Plans** aid you in outlining a lecture for each chapter, mapping learning objectives directly to the most relevant chapter content and features.
- Sample **Syllabi** are provided for 7-week and 15-week courses
- A **Quality and Safety Education for Nurses (QSEN) Competency Map** identifies content and special features in the book related to competencies identified by the QSEN Institute.
- An **American Association of Colleges of Nursing (AACN) Essentials Competency Map** identifies book content related to the AACN Essentials.
- An **Image Bank** lets you use the photographs and illustrations from this textbook in your course materials.
- An **eBook** serves as a handy resource.
- Access to all **Student Resources** is provided so that you can understand the student experience and use these resources in your course as well.

Student Resources

Students can access these free learning resources at https://thepoint.lww.com/DeMarco4e using the codes printed in the front of their textbooks.

- **Journal Articles** offer access to current research relevant to each chapter and are available in Wolters Kluwer journals to familiarize students with nursing literature.

A COMPREHENSIVE, DIGITAL, INTEGRATED COURSE SOLUTION: LIPPINCOTT® COURSEPOINT+

Lippincott® CoursePoint+ is an integrated, digital curriculum solution for nursing education that provides a completely interactive experience geared to help students understand, retain, and apply their course knowledge and be prepared for practice. The time-tested, easy-to-use, and trusted solution includes engaging learning tools, evidence-based practice, case studies, and in-depth reporting to meet students where they are in their learning, combined with the most trusted nursing education content on the market to help prepare students for practice. This easy-to-use digital learning solution of *Lippincott® CoursePoint+*, combined with unmatched support, gives instructors and students everything they need for course and curriculum success!

Lippincott® CoursePoint+ includes the following:

- Leading content provides a variety of learning tools to engage students of all learning styles.
- A personalized learning approach gives students the content and tools they need at the moment they need it, giving them data for more focused remediation and helping to boost their confidence and competence.
- Powerful tools, including varying levels of case studies, interactive learning activities, and adaptive learning powered by PrepU, help students learn the critical thinking and clinical judgment skills to help them become practice-ready nurses.
- Preparation for Practice improves student competence, confidence, and success in transitioning to practice.
  - Lippincott® Clinical Experiences: Community, Public, and Population Health Nursing offers clinical experiences that consistently expose students to diverse settings, situations, and populations in a safe, immersive, and engaging virtual environment, while actively developing their communication and intervention skills.
  - Lippincott® Advisor for Education: With over 8,500 entries covering the latest evidence-based content and drug information, Lippincott® Advisor for Education provides students with the most up-to-date information possible, while giving them valuable experience with the same point-of-care content they will encounter in practice.
- Unparalleled reporting provides in-depth dashboards with several data points to track student progress and help identify strengths and weaknesses.

- Unmatched support includes training coaches, product trainers, and nursing education consultants to help educators and students implement CoursePoint with ease.

BUILDING CLINICAL JUDGMENT SKILLS

Nursing students are required to obtain nursing knowledge and apply foundational nursing processes to practice effective clinical judgment. Being able to apply clinical judgment in practice is critical for patient safety and optimizing outcomes. The content provided in this text includes features such as Case Studies; Evidence for Practice, Practice Point, and Student Reflection boxes; and Critical Thinking Questions that strengthen students' clinical judgment skills by giving them opportunities to apply knowledge and practice critical thinking. Additionally, accompanying products CoursePoint and Lippincott NCLEX-RN PassPoint provide an adaptive experience that allows students to build confidence by answering questions like those found on the Next Generation NCLEX (NGN) examination.

INCLUSIVE LANGUAGE

A note about the language used in this book: Wolters Kluwer recognizes that people have a diverse range of identities, and we are committed to using inclusive and nonbiased language in our content. In line with the principles of nursing, we strive not to define people by their diagnoses, but to recognize their personhood first and foremost, using as much as possible the language diverse groups use to define themselves, and including only information that is relevant to nursing care.

We strive to better address the unique perspectives, complex challenges, and lived experiences of diverse populations traditionally underrepresented in health literature. When describing or referencing populations discussed in research studies, we will adhere to the identities presented in those studies to maintain fidelity to the evidence presented by the study investigators. We follow best practices of language set forth by the *Publication Manual of the American Psychological Association*, 7th edition but acknowledge that language evolves rapidly, and we will update the language used in future editions of this book as necessary.

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Judith Healey-Walsh

A Special Thanks in Memoriam to Dr. Gail A. Harkness, DPH, FAAN

The first and second editions of this textbook were led by the efforts of Dr. Gail Harkness. Gail was a mentor and friend. Although she is no longer with us to help support, guide, and enliven this newest edition, we wanted to continue to remember her and produce this edition in her honor and in recognition of her passion for and many contributions to public health nursing.

Gail was such an intelligent, warm, and wise public health expert who was most passionate about population health and epidemiology, particularly infectious diseases past, present, and evolving. She was a prolific writer and teacher. When I met her, she reached out to me, asking if I could help her with her vision of a community health and public health textbook for nursing students that was affordable and succinct and did not just "rattle on" with facts but situated public health ideas in the context of evidence, student stories, and current disease prevention and health promotion innovations. She brought to my mentorship opportunity her global experiences from the UK (University of Leeds) to Japan (Osaka), as well as her own local work on a town Board of Health in Massachusetts. Gail loved public health research and the evidence it yielded to inform policy decisions toward all our health. She was a graduate of the University of Rochester (undergraduate and graduate programs) in Nursing and received her Doctorate in Public Health from the University of Illinois, School of Public Health in Epidemiology and Biometry (the application of statistical analysis to biologic data).

More than being an epidemiologist, she loved the opportunity as an academician to teach nursing students at all levels to be as passionate about public health as she was. She was a professor emerita at the University of Connecticut. We know her family, friends, and colleagues miss Gail very much, but her energy and spirit will always be in this textbook.

Rosanna F. DeMarco

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Chapter 6

Epidemiology: The Science of Prevention

Oluwatomisin Olayinka and Patrice Nicholas

There are in fact two things, science and opinion; the former begets knowledge, the latter, ignorance.
Hippocrates

Science is organized common sense, where many a beautiful theory was killed by an ugly fact.
Thomas Huxley

Get your facts first, then you can distort them as you please.
Mark Twain

CHAPTER HIGHLIGHTS

- Defining epidemiology
- Development of epidemiology as a science
- Epidemiologic conceptual frameworks
- Applying epidemiologic principles in practice
- Assessment of health needs and assets
- Using assessment data for planning and implementing interventions
- Promoting healthy lifestyles
- Preventing and controlling outbreaks
- Contributing to a safe and healthy environment
- Evaluating the effectiveness of health services

OBJECTIVES

- Trace the origins of epidemiology.
- Comprehend the basic principles and scope of epidemiology.
- Contrast three epidemiologic conceptual models.
- Apply principles of epidemiology to *Healthy People 2030*.
- Relate the problem-solving process to both the epidemiologic process and the nursing process.
- Apply epidemiologic principles to the practice of public health nursing.

KEY TERMS

Epidemic: An outbreak that occurs when there is an increased incidence of a disease beyond that which is normally found in the population.

Epidemiologic triad: Model based on the belief that health status is determined by the interaction of the characteristics of the host, agent, and environment.

Epidemiology: Study of the distribution and determinants of states of health and illness in human populations; used both as a research methodology to study states of health and illness and as a body of knowledge that results from the study of a specific state of health or illness.

Natural history: Course of a disease or condition from the onset to resolution.

Outbreak: Epidemic usually limited to a localized increase in the incidence of the illness.

Rate: Primary measurement used to describe either the occurrence or the existence of a specific state of health or illness.

KEY TERMS *(continued)*

Risk: Probability or likelihood that a disease or illness will occur in a group of people who presently do not have the problem.

Risk factor: Characteristics or events that have been shown to increase the probability that a specific disease or illness will develop.

Web of causation: Epidemiologic model that strongly emphasizes the concept of multiple causation while de-emphasizing the role of agents in explaining illness.

Wheel of causation: Epidemiologic model that de-emphasizes the agent as the sole cause of disease while emphasizing the interplay of physical, biologic, and social environments.

CASE STUDY

References to the case study are found throughout this chapter (look for the case study icon). Readers should keep the case study in mind as they read the chapter.

Childhood obesity is a major public health problem that is linked to the development of chronic conditions such as diabetes, asthma, hypertension, cardiovascular disease, anxiety, and depression. Nutrition and physical activity serve as risk factors in the development of obesity. The social determinants of health (SDOH) influence the opportunities an individual has to achieve healthy nutrition and participate safely in physical activity. For example, a family's socioeconomic status influences the neighborhood in which they live. Shayna is a public health nurse in a large racially, ethnically, and socioeconomically diverse, urban city, which includes a large proportion of Black and Hispanic families with school-age youth (children and adolescents). Several schools in the city serve students from racially/ethnically diverse and socioeconomically challenged neighborhoods. School nurses who test body mass index (BMI) measures have reported an alarming increase in BMI measures in the CDC range indicating overweight and obesity. She is leading a partnership between the public health department and the school system. From the partnership, a task force has been formed to address the rising prevalence of obesity among youth in the schools by identifying needed changes in the school environment and curriculum that promote healthy eating and physical activity. *Healthy People 2030* (*HP 2030*) has identified "Reducing the proportion of children and adolescents with obesity" as a Leading Health Indicator, meaning that it is a high-priority objective. *HP 2030* uses epidemiologic data to develop their health indicators and objectives. *HP 2030* has identified several objectives related to youth (children and adolescents) obesity, targeting nutrition and physical activity, and the task force is exploring these objectives as foundational goals for the program. These objectives include:

- Reduce the consumption of added sugar by people two and over
- Increase the proportion of schools that do not sell less-healthy foods and drinks
- Increase the proportion of children/adolescents who play sports
- Increase the proportion of children and adolescents who do enough aerobic physical activity
- Increase the proportion of adolescents that walk or bike to get places
- Increase the proportion of adolescents who participate in daily school physical education classes
- Increase the proportion of schools that require students to take at least two health education courses in grades 6 to 12.

HP 2030 advocates for policy, school curriculum, and environmental changes that support healthy nutrition and physical activity. Go to the *HP 2030* website and explore the above objectives. Which of the objectives have data? What are the targets and how are the data trending? Explore the sources of the data. Using what you have learned, develop four broad goals that can guide the potential changes needed (focusing on nutrition and physical activity).

Like other types of modern science, epidemiology arose from building blocks constructed by ancient civilizations. Humans have experienced disease for as long as they have existed, and in early history, attempts that people made to understand the onset of disease and to prevent its occurrence were crude. People perceived health as something holy, and healers looked to the spiritual world to protect health and prolong life. People often considered disease and disability as a great curse and a divine punishment, and they believed that amulets, totems, charms, and rituals prevented all sorts of evils. However, early cave dwellers experimented with medicinal plants and became adept at treating some illnesses. These discoveries were primarily a direct result of trial-and-error observations, enhanced by doses of curiosity, common sense, and chance.

For thousands of years, the practice of healing slowly developed as humans observed that more and more herbal remedies and therapeutic treatments had beneficial results.

Some cultures, such as in Egypt, had an extensive repertoire of treatments. More than 700 remedies existed for ailments resulting from crocodile bites to infections following childbirth. Practitioners at that time reduced dislocations, aligned and immobilized fractures, and applied hot and cold treatments to reduce inflammation. People recognized and understood differences in individual constitutions and observed that many diseases were contagious in nature. Interestingly, they conceptualized the influence of the environment on the occurrence of disease. However, priests and religious healers kept most of this knowledge secret.

Hippocrates of Cos (460 to 370 BC), considered the father of modern medicine, was the first person to record these secrets in writing. In a textbook of medicine that was used for centuries, he recorded the belief that external factors in the environment were a cause of illness in humans. He wrote of the effects of seasons, winds, and water, as well as the characteristics of the ground. He encouraged healers to observe what are known today as lifestyle patterns by assessing what individuals ate and drank, and how they exercised (Hippocrates, 1938). Hippocrates also wrote *On Air, Waters and Places*, a book that provided details on the relationship between humans and the environment. Experts now consider this book as a milestone in the development of the science of epidemiology, illustrating the connection between human life and the environment. However, people overlooked this concept for centuries, and it was not seriously considered again until investigators in the late 19th century developed the science of bacteriology.

People today still search for reasons for their illnesses, and many still perceive illness as a punishment for sins. However, the wealth of scientific knowledge developed within the last 160 years has permitted the understanding of the complexities of the human body and the effects of internal and external stressors. This knowledge has provided the means for preventing and modifying illness and providing treatments for people with disabilities. Much of this knowledge has been gained through the extension of the observations of the past to the rigorous study of specific illnesses or disabilities in large groups of people.

> All truths are easy to understand once they are discovered—the point is to discover them. **Galileo Galilei**

DEFINING EPIDEMIOLOGY

Early attempts to understand illness and disease focused on studying the experiences of individual people. Today, clinicians consider these case reports or case studies. Studying individual experiences is invaluable for forming ideas, or hypotheses, about possible causes of specific diseases. However, studying individual people may not provide accurate information about the characteristics of the disease being investigated, because individual experiences with a disease may vary. Also, examining the experiences of individual persons does not provide evidence of causality (see Chapter 8). To gather more accurate information about disease, studying groups of people is essential.

An example is the relationship between smoking and lung cancer that experts statistically determined in the 20th century. Without studying the experiences of groups of people, they may never have identified this relationship. Some people who smoke never develop lung cancer, and some people who do not smoke do develop lung cancer. However, in the 1950s epidemiologists Doll and Hill demonstrated the relationship between lung cancer and smoking by comparing a group of people with lung cancer to a group of people without lung cancer. They discovered that the people with lung cancer had smoked significantly more cigarettes than those without lung cancer (Doll & Hill, 1950). Further epidemiologic research studies provided more evidence of a causal link between smoking cigarettes and lung cancer.

Unfortunately, after 50 years, smoking is still a cause of significant illness and death throughout the world. In the United States alone, in 2019, 14.0% of all adults were identified as smokers, as defined by smoking every day. This indicates an estimated 34.1 million adults in the United States currently smoke cigarettes (Cornelius et al., 2020).

Epidemiology as the science of prevention emerged from the rigorous study of disease and illness in groups of people. **Epidemiology** is defined as the study of the distribution and determinants of states of health and illness in human populations, which include health, disease, morbidity, injuries, disability, and mortality. The goals of epidemiology are to prevent or limit the consequences of illness and disability in humans, as well as to maximize their state of health (Harkness, 1995). The word *epidemiology* is derived from the word **epidemic** in the Greek language: *epi*—upon, *demo*—people, and *logos*—thought. In epidemiology, the community replaces the individual client as the primary focus of concern (Mausner & Kramer, 1985).

The science of epidemiology has been traditionally associated with infectious disease. Many of the techniques used in epidemiologic investigations were developed when cholera was killing much of the population of Europe. Therefore, early epidemiologic attempts to control and prevent infectious disease involved altering the characteristics of the agent, the host, and the environment (see Chapter 14).

The scope of epidemiology has expanded and shifted substantially. Primarily as a result of improved public health practices in the early 20th century, life expectancy in the United States, the United Kingdom, and European countries, as well as in other high- and middle-income countries, rose. With it, a change in the patterns of disease occurred. No longer are infectious diseases the leading causes of death; the morbidity and mortality from noninfectious diseases and chronic degenerative conditions have increased (Table 6.1). Advancing technology in the 20th century made everyday life increasingly complex. There were unparalleled changes in diagnostic practices and therapeutic methods, resulting in expanded strategies for the prevention and control of disease. A focus on maintenance of wellness evolved.

TABLE 6.1 Comparison of the Leading Causes of Death in the United States, 1900 and 2020

1900[a]	2020[b]
Pneumonia (all forms) and influenza	Heart disease
Tuberculosis (all forms)	Cancer
Diarrhea, enteritis, and ulceration of the intestines	COVID-19
Diseases of the heart	Accidents (unintentional injuries)
Intracranial lesions of vascular form	Stroke (cerebrovascular diseases)
Nephritis (all forms)	Chronic lower respiratory disease
All accidents	Alzheimer disease
Cancer and malignant tumors	Diabetes mellitus
Senility	Influenza and pneumonia
Diphtheria	Nephritis, nephritic syndrome, and nephrosis

[a]1900–1940 tables ranked in National Office of Vital Statistics, December 1947, as cited in Centers for Disease Control and Prevention. *Leading Causes of Death, 1900-1998.* https://www.cdc.gov/nchs/data/dvs/lead1900_98.pdf
[b]Centers for Disease Control and Prevention. *National Center for Health Statistics, 2020.* https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm

Investigators now use epidemiologic techniques to study all aspects of health, including factors that keep people well. Chronic disease, psychosocial problems, occupational injuries, environmental effects, and the planning and evaluation of health services are but a few of the disciplines that have been enhanced by using principles of epidemiology. Today, epidemiology is both a *research methodology* used to study states of health and illness and a *body of knowledge* that results from the study of a specific state of health or illness. When using epidemiology as a research methodology, the calculation of **rates** is the primary measurement used to describe either the occurrence or the existence of a specific state of health or illness (see Chapter 7).

DEVELOPMENT OF EPIDEMIOLOGY AS A SCIENCE

The study of illness in groups of people developed gradually. Several key figures throughout history experimented with analyzing data, making observations and comparisons, and hypothesizing causes of illness and death, thus developing the early scientific methods of epidemiology.

John Graunt and the Bills of Mortality

One of the first people to study patterns of disease in populations was a London haberdasher, John Graunt. In 1662, he analyzed the weekly reports of births and deaths in London; his analyses were the precursor of modern vital statistics. Graunt found that more male infants were born than female infants and that more male adults died than female adults. He also observed that infant mortality was high, and he noted that seasonal variations occurred in deaths.

Through his analysis of the Bills of Mortality, Graunt developed a better understanding of diseases and conditions that led to death. He published his observations and findings in *Natural and Political Observations Made Upon the Bills of Mortality.* Graunt added an essential step in the development of epidemiology as a science. He developed a new logic of statistical inference, demonstrating that examining routinely collected data from groups of people would yield clues to human illness. His publication can be found online.

Two centuries passed before William Farr expanded Graunt's work. In the meantime, James Lind instituted the precursor of the clinical trial when he compared responses to dietary treatments for scurvy, and Percivall Pott observed cancer of the scrotum in English chimney sweeps, hypothesizing that soot was the cause. Edward Jenner performed the first successful vaccination against smallpox with the liquid from a cowpox pustule, resulting in the vaccination of more than 100,000 people in England within 3 years. These accomplishments in the 18th century linked specific diseases with the characteristics of groups of people and documented the effects of various treatments. Table 6.2 summarizes the milestones in the evolution of epidemiology from 460 BC through the 20th century.

William Farr, Registrar General

In 1839, William Farr was appointed to the new Office of the Registrar General for England and Wales. Farr set up a system for the consistent collection of the numbers and causes of deaths. With these data, he was able to compare the death rates of workers in various occupations, the differences in mortality according to sex, and the effect of imprisonment on mortality. He also discovered an inverse relationship: Deaths from cholera decreased with an increase in elevation above sea level (Farr, 1852).

Farr and his predecessors contributed significantly to the understanding of the distribution of illness and death. As one of the first epidemiologists, he recognized (1) the value of a precise definition of both the illness and the population at risk for the illness; (2) the importance of using appropriate comparison groups; and (3) that factors such as age, health status, and environmental exposure can confound statistical results.

TABLE 6.2 Selected Milestones in the Evolution of Epidemiology

Time	Person	Accomplishment or Event
460–377 BC	Hippocrates of Cos	First to record the relationship of the external environment to the health of individuals. Considered the first epidemiologist.
ca. 81 AD	Aretaeus, the Cappadocian	Described pulmonary tuberculosis in detail.
129	Claudius Galen	Described the four humors and introduced many drugs derived from plants. First to describe smallpox.
500	Susruta	Brahmin physician who associated malaria with the mosquito.
850	Rhazes	Arab physician who wrote *al-Hawi*, papers that incorporated all known medical, anatomical, and pharmacologic knowledge of the time. Differentiated smallpox from measles.
1347		Italian 40-day ban on travel and trade was established to control bubonic plague. Quarantine comes from the Italian word *quarentina*, meaning 40 days.
1589	Thomas Moffet	First description of living organisms causing disease: lice, fleas, and scabies mites.
1662	John Graunt	London haberdasher who analyzed weekly reports of births and deaths. Found infant mortality was high and deaths varied according to seasons.
1683	Anton van Leeuwenhoek	Used a microscope to observe and describe "animalcules" from pond water and human saliva.
1701	Nicolas Andry	French surgeon who proposed that infection by germs was a cause of disease.
1747	James Lind	Observed and compared responses to dietary treatments for scurvy—the first evidence of a clinical trial. Recommended preventative techniques for typhus.
1760	Daniel Bernoulli	Demonstrated that smallpox conferred lifelong immunity through the use of the first life table techniques.
1775	Percivall Pott	Observed that many English chimney sweeps developed cancer of the scrotum; hypothesized that exposure to soot was the cause.
1779	Johann Peter Frank	German who wrote *A System of a Complete Medical Policy*, the first book about public health.
1798	Edward Jenner	Discovered the first vaccination against smallpox with cowpox pustule liquid. Within 3 years, 100,000 people in England were vaccinated.
1800	William Cruikshank	Scottish surgeon who used chlorine to purify water.
1836	Pierre-Charles-Alexandre Louis	Conducted observational studies demonstrating the ineffectiveness of bloodletting. Emphasized statistics.
1840–1860s	William Farr	First Registrar General in England. Considered father of modern statistics. Developed mortality surveillance systems and addressed basic epidemiologic concepts. Pioneered public health reforms.
1846	Peter Ludvig Panum	Danish physician who described the epidemiology of measles and the mechanism for spread of disease.
1847	Ignaz Semmelweis	Hungarian obstetrician who demonstrated that mortality from puerperal fever could be dramatically reduced if doctors washed their hands.
ca. 1850	Jean Baptiste Emile Vidal	French dermatologist responsible for the introduction of an efficient sewage system in Paris.
ca. 1854	John Snow	Performed epidemiologic research on transmission of cholera using natural experiments, mapping, and rates. Removed London's Broad Street drinking water pump handle to stop the spread of cholera.

(*continued*)

TABLE 6.2 Selected Milestones in the Evolution of Epidemiology (*continued*)

Time	Person	Accomplishment or Event
1854	Florence Nightingale	Initiated sanitary reforms in the Crimean War and demonstrated that preventable or contagious diseases were the primary cause of mortality. Later used statistics to improve public health in England. Considered the founder of the nursing profession.
ca. 1860	John Parkin	English surgeon who used charcoal filters to purify water in an attempt to prevent the spread of cholera.
1860–1880s	Louis Pasteur	Developed pasteurization. Suggested that living organisms called "germs" caused infectious diseases.
1864		Contagious Diseases Act passed in England to combat the spread of venereal disease.
1865–1880s	Robert Koch	German who discovered the causal agents for anthrax, cholera, and tuberculosis. Developed criteria for identifying cause. Won Nobel Prize for bacteriology in 1905.
1866	Joseph Lister	Developed a carbolic acid spray for surgical disinfections.
1921		Johns Hopkins University established the first academic program in epidemiology.
1927	Wade Hampton Frost	Developed cohort analysis of mortality data and developed life tables. Credited for moving epidemiology from a descriptive to an analytical discipline.
1930		National Institutes of Health established in the United States.
1946		U.S. Communicable Disease Center was established. Now Centers for Disease Control and Prevention (CDC).
1948		Framingham cohort study of cardiovascular disease initiated.
1950s	Richard Doll and A. Bradford Hill	English researchers who conducted the landmark studies on the relationship between smoking and lung cancer.
Second half of the 20th century		Chronic degenerative diseases replaced infectious diseases as leading causes of death worldwide.

Sources: Lee, H. S. J. (2002). *Dates in infectious diseases: A chronological record of progress in infectious diseases over the last millennium*. Parthenon Publishing Group; Timmreck, T. C. (2002). *An introduction to epidemiology*. Jones and Bartlett; and Lilienfeld, D. E., & Stolley, P. D. (1994). *Foundations of epidemiology*. Oxford University Press.

John Snow and the Broad Street Pump

Perhaps the best-known epidemiologist of the 19th century was John Snow, a contemporary of William Farr. He was a British physician who used population data and his own observations to investigate the epidemic of cholera that occurred from 1848 through 1854. He observed that deaths from cholera were particularly high in the parts of London supplied by two water companies, the Lambeth Company and the Southward and Vauxhall Company.

Sewage heavily polluted a section of the Thames River, and interwoven water mains piped untreated water into the homes of two thirds of London's residents. Houses on the same street received water from different companies. Sometime between 1849 and 1854, the Lambeth Company changed its water source to a less contaminated location upstream. During a particularly bad cholera outbreak from 1853 to 1854, Snow demonstrated through calculation of death rates from cholera that the disease decreased in those areas supplied by the Lambeth Company but remained the same in those areas supplied by the Southward and Vauxhall Company (Table 6.3).

The most severe outbreak during this time was in the area of Broad Street, Golden Square, where people obtained their water from a local pump. More than 500 people died from cholera within 10 days. Believing that the water delivered by the pump was responsible for the cases of cholera, Snow removed the handle, and the number of cases immediately declined. However, there also were a number of other factors that contributed to this event, for example, an exodus of the population to other locations. Nonetheless, Snow is credited for "staying the epidemic," and a pump now has been erected in his honor on the corner of Broad Street in Soho.

During his investigations, Snow mapped the areas where cholera occurred, developed rates as an objective measure to

TABLE 6.3 Death Rates From Cholera by Water Company, London, 1853–1854

Water Company	Population, 1851	Cholera Deaths	Deaths/100,000
Southwark and Vauxhall	167,654	192	114
Both companies	301,149	182	60
Lambeth	14,632	0	0

Source: Snow, J. (1855). *On the mode of communication of cholera*. John Churchill. http://www.ph.ucla.edu/epi/snow/snowbook.html

compare populations, made use of the natural experiment provided by the unusual pattern of water mains, and found evidence for the cause of cholera. These were outstanding accomplishments in an era that preceded bacteriology. He published his findings in *On the Mode of Communication of Cholera* (Snow, 1855). The entire document is available online.

Florence Nightingale, Nurse and Epidemiologist

Florence Nightingale, the daughter of a wealthy Englishman, was also a contemporary of William Farr and John Snow. She devoted her life to the prevention of needless illness and death. She used compelling statistics to bring about healthcare reforms, both during the Crimean War and later in her English homeland. She is also credited with founding the profession of nursing.

Prior to leading a group of nurses to aid the British soldiers in the Crimean War, Nightingale was superintendent of a London hospital. There she supervised nurses, the operation of the physical plant, and the purity of the medicines. In 1854, she and a group of carefully chosen nurses and servants joined the troops in Scutari, in the Crimea. Nightingale was appalled by the conditions of the hospital barracks. Rats and fleas infested buildings, facilities were overcrowded, linen was filthy, essential supplies were missing, and an open sewer ran underneath the barracks. The soldiers suffered not only from wounds but also from dysentery, malnutrition, frostbite, cholera, typhus, and scurvy. The mortality rate for the soldiers was 42.7% (Cohen, 1984).

Using carefully gathered data that were unique at the time, Nightingale documented the results of her sanitary reforms, which included strict handwashing, consistent cleaning and disinfecting the hospital environment, and providing clean bandages. The polar area diagram she designed (Fig. 6.1) illustrates the needless deaths in the military hospitals during the Crimean War. Deaths peaked in January 1855. During that month, 83 soldiers died from wounds, but 2,700 died from infectious diseases. By the end of the war, the death rate of British soldiers in the Crimea was less than that of the troops at home (Cohen, 1984).

With the help of William Farr, Nightingale continued documenting events after the war that were associated with poor sanitary conditions. She compared mortality in civilians with that in soldiers and found that in peacetime, the soldiers in England had a mortality rate nearly twice that of civilian males. Nightingale asked for and received a formal investigation of military healthcare, and eventually, the government implemented her sanitary reforms. She studied the health of soldiers in India, the mortality in British hospitals, and the mortality following surgery. Throughout her career, she experimented with graphs and diagrams that everyone

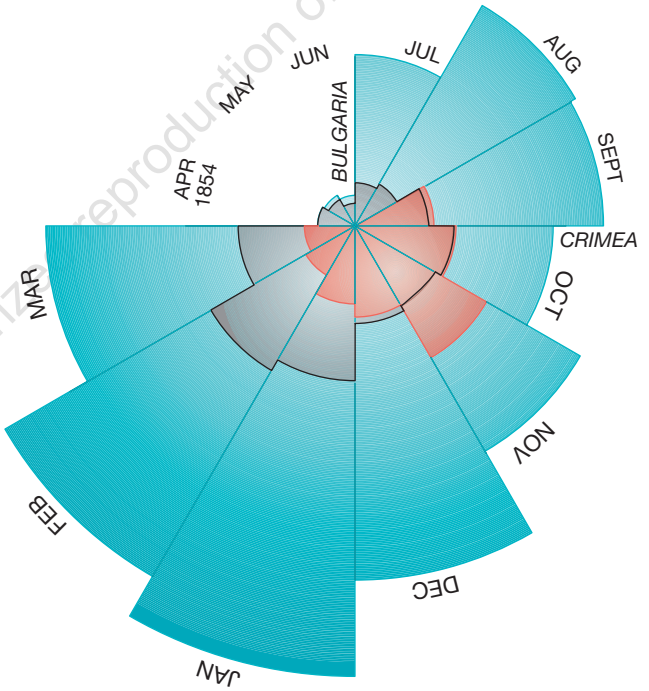

FIGURE 6.1 Florence Nightingale's polar area diagram illustrating the extent of needless deaths in British military hospitals during the Crimean War, April 1854 to March 1855. The *blue wedges* measured from the center of the circle represent area for area the deaths from preventable zymotic diseases, the *red wedges* measured from the center the deaths from wounds, and the *black wedges* measured from the center the deaths from all other causes. The *black lines* across the *red triangles* in September and November 1854 mark the boundaries of the deaths from all other causes during those months. In October 1854, the *black area* coincides with the *red*. The entire areas may be compared by following the *blue*, the *red*, and the *black lines* enclosing them. (From Aiken, L. [1988]. *Assuring the delivery of quality patient care. State of the Science Invitational Conference, Nursing resources and the delivery of patient care* [NIH Publication No. 89–3008, pp. 3–10]. U.S. Department of Health and Human Services, Public Health Service; Cohen, I. B. [1984]. Florence Nightingale. *Scientific American*, *250*[3], 129. https://doi.org/10.1038/scientificamerican0384-128)

could understand and tried to introduce statistics into higher education. As a pioneering epidemiologist, Nightingale effectively demonstrated that statistics provide an organized way of learning from experience.

EPIDEMIOLOGIC MODELS

Several epidemiologic models exist to help illustrate the relationships among key factors affecting health and illness. These models are all based on the interactions among the host, agent, and environment, to varying degrees and level of impact, and provide a basis for planning interventions.

Epidemiologic Triad

The **epidemiologic triad** is the classic model based on the belief that health status is determined by the interaction of the characteristics of the host, agent, and environment, not by any single factor. The host is the client whose health status is the concern, whether it is a person, a family, a group of high-risk people, or the community as a whole. Agents are an element or force that under proper conditions can initiate or perpetuate a health problem. Environment refers to the context within which the agent and host interact (Fig. 6.2).

Host factors, sometimes called intrinsic factors, include both variable (modifiable) and absolute (nonmodifiable) factors. Age, race, and genetic makeup are examples of absolute, or nonmodifiable, factors. Lifestyle, exercise level, nutrition, health knowledge, and motivation for achieving optimal wellness are examples of host factors that are variable, or modifiable.

Agents can be classified into five groups. Agents may be *physical*, such as heat and trauma; *chemical*, such as pollutants, medications, and drugs; *nutritional*, such as the absence or excess of water, vitamins, fats, proteins, and carbohydrates; *psychosocial*, such as stress, social isolation, and social support; and *biologic*, such as bacteria, viruses, arthropods, toxins, and conditions that interfere with the normal function of the body.

Environmental factors are frequently divided into three categories: biologic, physical, and social. The biologic environment is composed of plants, animals, and the toxins they produce; this includes pathogenic microorganisms, vectors

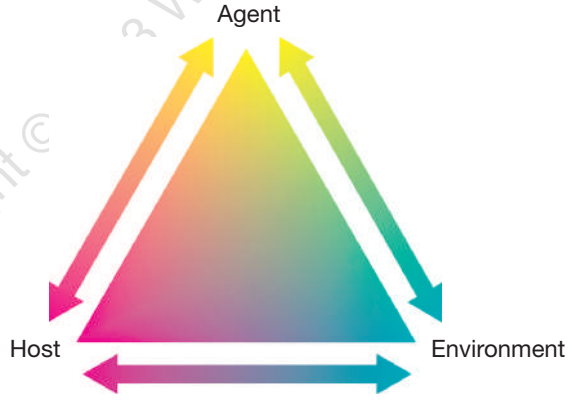

FIGURE 6.2 The epidemiologic triad.

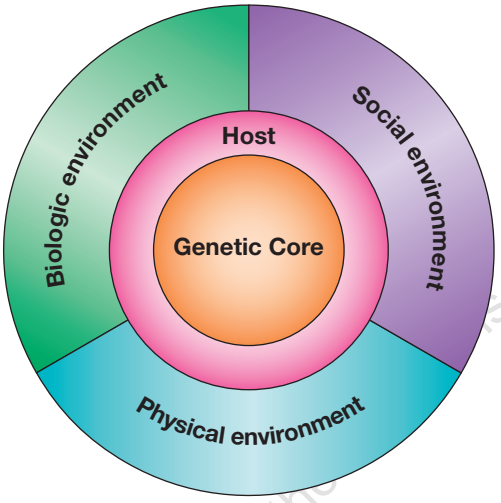

FIGURE 6.3 The wheel of causation.

that carry the infectious agents, and the reservoirs where infectious agents are normally found. The physical environment includes light, heat, air, atmospheric pressure, radiation, geologic factors, and the structures in the environment. The social environment includes culture, technology, educational opportunities, political systems, demographic characteristics, sociologic factors, and economic and legal systems.

The Wheel of Causation

Many diseases, illnesses, and conditions have multiple or no discernible agents, or the agent may be a part of the environment. An alternate model is conceptualized as a wheel, with a circle as the genetic core of the host, surrounded by a larger, segmented wheel representing the biologic, physical, and social environments (Fig. 6.3). The **wheel of causation** de-emphasizes the agent as the sole cause of disease, whereas it emphasizes the interplay of physical, biologic, and social environments. Interaction between the host and environment, with or without an identifiable agent, remains the major determinant of health status in all epidemiologic models.

The Web of Causation

The **web of causation** is an epidemiologic model that strongly emphasizes the concept of multiple causation while de-emphasizing the role of agents in explaining illness. At the time of development, there was a need to create a model that would help describe the multiple complex and interrelated factors underlying chronic illnesses.

In the web of causation, it is necessary to identify all possible antecedent factors that could influence the development or prevention of a particular health condition. Each factor is perceived as a link in multiple interrelated chains. By making the pathways explicit in a web of causation, a diagram deepens understanding and provides a framework for statistical analysis. It also serves as a valuable practical guide. Direct and indirect factors can be identified that can be changed or modified to improve health. Not only does it

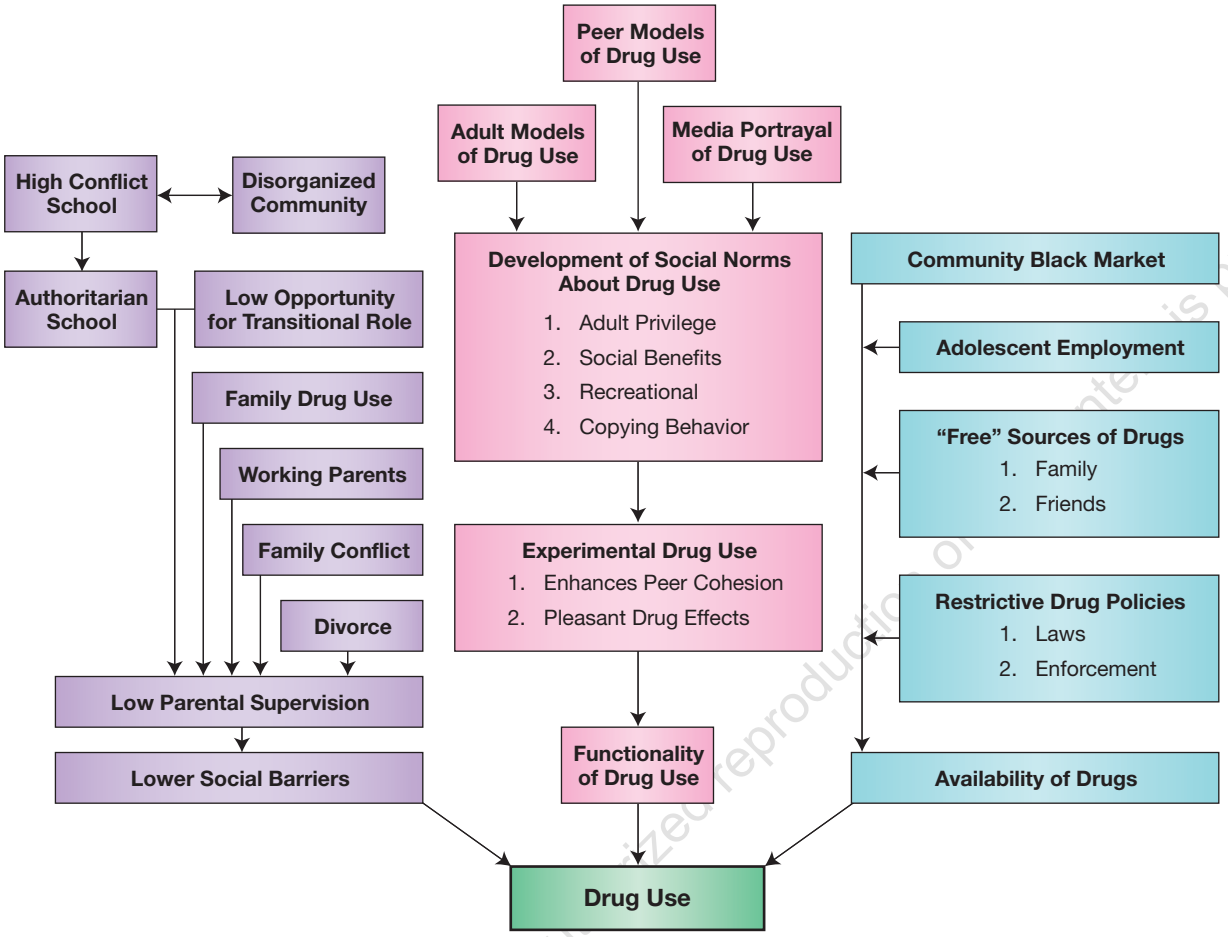

FIGURE 6.4 The web of causation for drug use. (Used with permission from Duncan, D. F., & Petrosa, R. [1999]. Social and community factors associated with drug use and abuse among adolescents. In T. P. Gullotta, G. R. Adams, & R. Montemayor [Eds.], *Substance misuse in adolescence* [pp. 56–91]. Sage Publications.)

provide multiple entry points for intervention, but it also has the capacity to demonstrate the interrelationship of different factors. These can include both unpredicted and possibly undesirable side effects.

Public health professionals use web of causation models to design methods that interrupt the chain of events that lead to adverse states of health. Figure 6.4 exemplifies a classic web of causation that identifies multiple ways to reduce health problems, in this case, drug use and misuse in adolescents.

CASE STUDY

Shayna and two school nurses are planning a presentation to help school administration and involved teachers to understand how serious a health issue obesity is among school-age youth and to begin discussions of needed changes in the school environment and curriculum. Design a web of causation for obesity among youth that the nurses can use to graphically describe the causative pathways to obesity.

Natural History of Disease

Leavell and Clark developed a conceptual model for the **natural history** of any disease affecting humans (Leavell & Clark, 1965). The natural history of disease refers to the course of a disease or condition from onset to resolution. It includes (1) pathologic onset stage, (2) the pre-symptomatic stage, and (3) the manifestation of clinical disease (Leavell & Clark, 1965).

Leavell and Clark's groundbreaking model integrated the pathogenesis of an illness with primary, secondary, and tertiary prevention measures (Fig. 6.5). The initial interactions between the agent, host, and environment occur during the prepathogenesis period. Primary prevention measures specific to the disease can be implemented at this stage to prevent its onset in a population of healthy people. The period of pathogenesis begins when there are biologic, psychological, or other responses within the host. Secondary prevention measures focus on early diagnosis and prompt treatment. This can limit resulting disabilities when implemented during the early stages of the disease. Tertiary prevention follows with rehabilitation measures that enable the individual to function at maximum capability. This model, used widely in practice, is discussed in more detail in Chapter 5 (see Fig. 5.2).

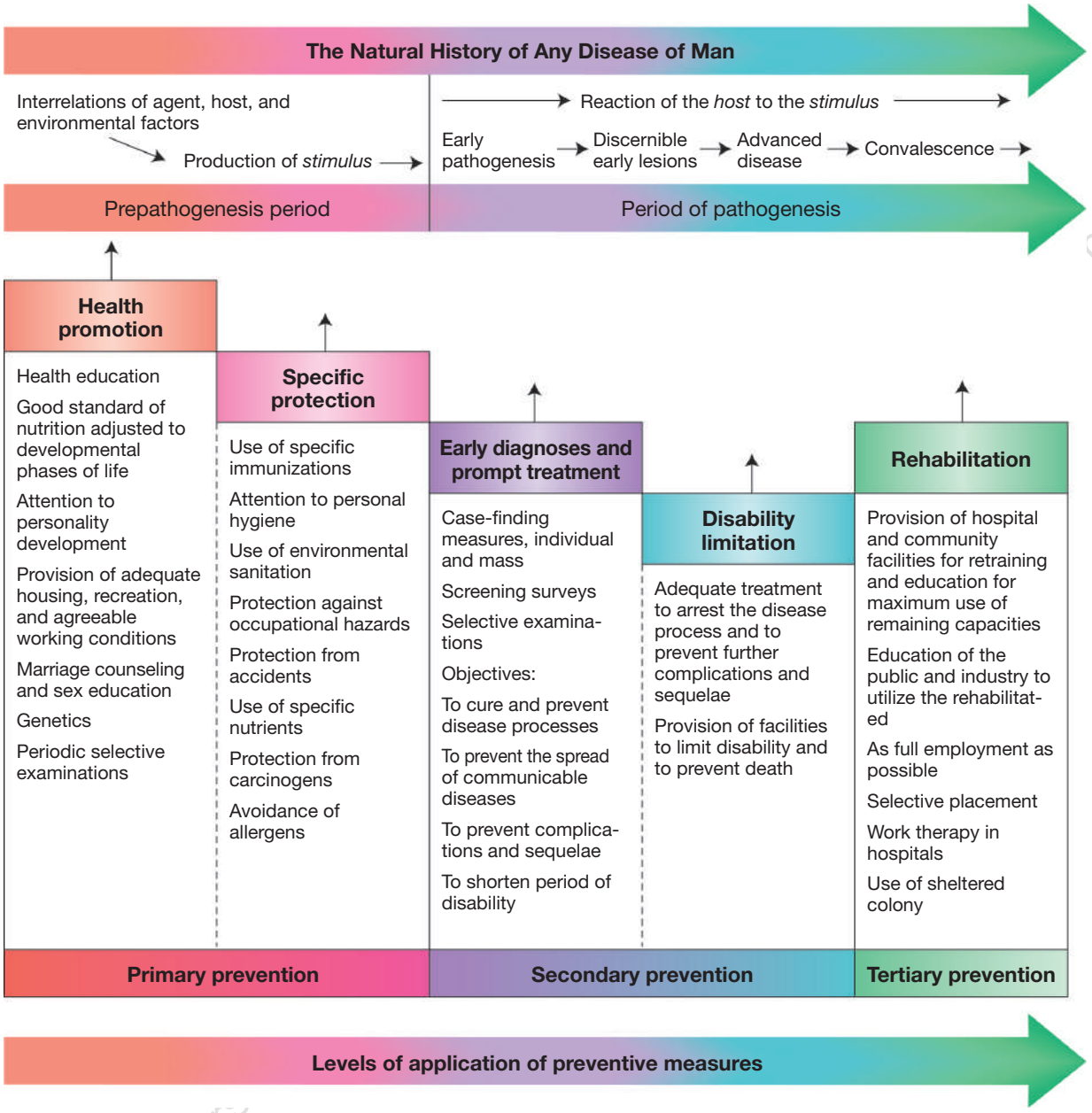

FIGURE 6.5 Leavell and Clark's natural history of any disease affecting humans. (From Leavell, H. R., & Clark, E. G. [1979]. *Preventive medicine for the doctor in his community: An epidemiological approach*. Krieger Publishing Company.)

Every human being is the author of his own health or disease.
Buddha

APPLYING EPIDEMIOLOGIC PRINCIPLES IN PRACTICE

The epidemiologic process and the nursing process are both derived from the problem-solving process that provides a framework for gathering data about health problems, analyzing the information, generating diagnoses or hypotheses, planning for resolution, implementing plans of action, and evaluating results (Table 6.4). The focus of the nursing process is on caring for the client within their family, whereas the focus of the epidemiologic process is on caring for the population of the community as a whole. Whether caring for the individual or the members of a community, nurses need access to data, abstract critical thinking skills, and complex reasoning abilities.

Assessment of Health Needs and Assets

Community and public health nurses assess both health needs and health assets for individual people within their environment and for the population within the community as a whole. Both the individual and the community are considered clients.

TABLE 6.4 Similarities Between the Nursing Process and the Epidemiologic Process

Nursing Process, Client Based	Epidemiologic Process, Population Based
Assessment	
An individual client database is established. Data are interpreted.	Data are gathered from reliable sources. Nature, extent, and scope of problem are defined. Problem is described by person, place, and time.
Diagnosis	
Healthcare needs and assets are identified. Goals and objectives for care are established.	Tentative hypothesis is formulated. Data are analyzed to test the hypothesis.
Planning	
Processes for achieving goals are selected.	Plans are made for control and prevention of the condition or event.
Implementation	
Actions initiated to achieve goals	Actions are initiated to implement the plan.
Evaluation	
Extent of goal achievement is determined.	Actions are evaluated and report is prepared. Further research is conducted if necessary.

Individual Assessment

Providing personal healthcare services to individual persons is a cornerstone of nursing practice. Community health and public health nurses often provide direct health services, including preventative services, to high-risk, displaced, and vulnerable populations. The nurse is usually the first person to systematically observe the individual person, in the home, clinic, parish, or healthcare facility. The public health nurse takes a nursing history, performs a physical assessment, and makes both objective and subjective observations about the condition of the person. The nurse establishes where the person is in relation to the full spectrum of health and identifies the person's assets as well as needs. Assets include strengths and resources of the client such as general state of health, prior use of healthcare services, health behaviors, lifestyle, motivation, and other factors. This information establishes the database about the client. The planning process and the interventions that are subsequently implemented are based on this assessment. Also, the database becomes a baseline for measuring the outcomes of care.

Nurses use the information that epidemiologic research has established when performing most client assessments, although they may not be aware that they are doing so. For example, a common process is to assess individuals for risk factors that have been associated with a disease or illness through epidemiologic research. **Risk** refers to the probability or likelihood that a disease or illness will occur in a group of people who presently do not have the problem. **Risk factors** are those characteristics or events that have been shown to increase the probability that a specific disease or illness will develop. Some risk factors are modifiable, and others such as age are not. For example, epidemiologic research has established that certain risk factors, such as a sedentary lifestyle, obesity, increased cholesterol, hypertension, and smoking, are associated with cardiovascular disease. These risk factors are now a part of the epidemiologic body of knowledge, or the epidemiology, of heart disease. As a result, several health appraisal approaches are now commonly used to profile client risk.

CASE STUDY

Considering the causative factors (risk factors) that were identified in the web of causation, and the *HP 2030* objectives, prioritize the top four risks and describe changes that could be instituted in the school environment and/or the school curriculum.

Practice Point

You have to ask the right questions to gather the information (data) you need.

CASE STUDY

The school administration has asked for more evidence that obesity is a problem in the middle and high schools and more information about the students' nutrition and physical activity. What physical data should the school nurses collect? Shayna suggests that the school nurses should develop a survey that obtains more information about the types of food, drinks, and snacks that the students consume both in and outside of school and the types and frequency of physical activity they participate in, on their way to, at, and after school. What questions should be included to obtain

the data needed to better understand the nutritional and physical activity status of the students? How should the physical and survey data be presented to convince the school administration to act on this public health problem?

Epidemiologic research has also established the natural history of most illnesses. Through the individual assessment process, the nurse can begin to determine the stage of the illness in question. Cues identified at the initial assessment may indicate whether primary, secondary, or tertiary prevention interventions would be most appropriate.

Evidence for Practice

Falls and fall injury significantly contribute to functional decline, morbidity, and mortality among older adults. Annually, more than one in four older adults in the United States report a fall and one in 10 report a fall injury. With continued increase in the aging population, a 55% increase in the older adult population is estimated to occur from 2014 to 2030. Bergen and associates (2019) analyzed national data from the 2016 U.S. Behavioral Risk Factor Surveillance System (BRFSS) to identify the demographics of falls and fall risk factors among older adults. Conducted annually in all 50 states and U.S. territories, the BRFSS is a random-digit-dialed telephone survey open to noninstitutionalized U.S. citizens. The analysis for this study was limited to adults 65 years of age or older living in one of the 50 states or the District of Columbia who responded to the two questions about falls (n = 148,257). The questions included in 2016 were:

1. **"In the past 12 months, how many times have you fallen?"**
2. **If the response indicated one or more times, they were asked to respond to, "How many of these falls caused an injury? By an injury, we mean the fall caused you to limit your regular activities for at least a day or to go see a doctor" (Bergen et al., 2019, p. 581).**

Analysis of the demographic data revealed that almost 30% of older adults had experienced one or more falls. Women (31.6%) reported a significantly higher percentage of falls than men (27.1%). Falls increased significantly with advancing age, with an almost 10% increase between those aged 65 to 74 years (28.2%) and those 85 years and older (37%), American Indians/Alaskan Natives (34.7%) and multirace/other races (35.2%) reported the highest percentage of falls. Those who were married experienced a lower percentage of falls (26.9%) compared to those who were divorced (32.7%), widowed (33.2%), or never married (31.3%). The highest percentage of falls was reported by individuals who were a member of an unmarried couple (34.6%). Thirty-two percent of rural older adults reported one or more falls, significantly higher than the 29% reported by urban older adults.

The factors identified as most strongly associated with increased risk of falls were depression, difficulty doing errands alone, and difficulty dressing or bathing. The factors identified as most strongly associated with increased risk of fall injury were depression, difficulty dressing or bathing, and being a member of an unmarried couple. The researchers categorized risk factors as modifiable or unmodifiable: Demographics were categorized as unmodifiable, geography as difficult to modify, and health and functional conditions as modifiable. Unmodifiable risks helped identify groups at higher risk who should be further studied to identify group-specific modifiable fall risks that could be targeted with interventions.

Given varied risk factors, the researchers recommend a comprehensive approach to fall risk reduction (such as the CDC's Stopping Elderly Accidents, Deaths and Injuries [STEADI] approach) with focused screening and assessment to reveal modifiable risk factors that can be addressed with customized, evidence-based interventions.

Community Assessment

Conceptualizing the community as a client is often difficult for the individual-oriented nurse. Assessing the health needs and assets of a community involves creating a comprehensive community profile or database. The individual nurse may be solely responsible for the assessment, but usually they contribute to the assessment as a member of a team. Epidemiologic statistical methods, such as calculation of rates, are used in this process (see Chapter 7).

Epidemiologists gather available demographic data that provide information about the age and sex distribution, socioeconomic characteristics, and cultural and ethnic distributions of the community. Epidemiologists access vital statistics, including applicable epidemiologic morbidity and mortality rates. Additional data can be obtained from community members or community groups. Information about the accessibility and availability of healthcare services, such as health manpower, may or may not be community assets. To obtain information about health beliefs, norms, values, goals, perceived needs, and health practices, healthcare workers may use focus groups, interviews or observation, or surveys. Nurses may participate in field-testing new tools for data collection.

After epidemiologists collect the data, they analyze and synthesize the information and generate a list of community health needs and assets. Identifying patterns of disease, illness, and injuries detects trends that form the rationale for program development. Critical thinking skills are essential for the appropriate analysis of this information. Finally, it is necessary to set goals and objectives to address high-priority problems.

A detailed discussion of community assessment is found in Chapter 11.

Practice Point

A thorough and accurate client database, whether that of individuals, groups, or the community, provides the evidence and rationale for your interventions.

Student Reflection

Although my nursing program focused a lot on research findings, particularly in writing assignments, I did not fully understand the impact that statistics can make in nursing until I had my community practicum in a local women's health center. When I arrived there, the staff was talking about a violent episode that had occurred the previous week. Everyone seemed to think that there was more violence in the community than there should be, and that we needed to know more about it.

My preceptor was a program developer, and the women at the center asked her if they needed a violence prevention program. One of my first assignments was to find out just how much and what types of violence had occurred in the last year. The first thing my preceptor suggested was to go online and look at websites for various states and towns. I was amazed at how much information was available. For example, I found out that the rates of homicide, assault, and rape in our town were greater than the average for both the state and the nation. I learned that most violence occurs between people who know each other, and that violence can be related to substance use disorder. I presented my information to the staff, and they all decided to have my preceptor contact other community agencies and the local college to form a coalition to address violence. I attended the first meeting, and people tossed around lots of ideas. They decided to look into a 24/7 free telephone line to give people support in a crisis, increase housing for women experiencing domestic violence, and consider a number of initiatives for youth in the town.

This experience taught me several things.

- Lots of information is available about health problems in a community.
- New ideas require presentation of supportive data.
- Involving other interested stakeholders and communities can enhance plans to reduce health problems.
- One person's efforts can really make a difference.

Using Assessment Data for Planning and Implementing Interventions

The individual or community client database, much of which has been gathered using epidemiologic methods, provides the rationale for planning and implementing interventions. It is possible to use the epidemiologic body of knowledge that describes the natural progression of specific diseases or illnesses to target ways to break the problem cycle once it has been identified. An intervention plan outlines the goals, objectives, and strategies for achieving the interventions and provides completion dates for their accomplishment. The type of health problem, the readiness of the individual or community to address the problem, the availability of health services, the nurse's role, the characteristics of social change, and other related factors influence successful implementation.

CASE STUDY

The findings from the analysis of the physical assessments and survey data convince the school administration and health teachers that the school supports an obesogenic environment, meaning that the food, snacks, drinks, and lack of structured physical activity in the school promote unhealthy behaviors that can lead to the development of obesity. What changes can be made in the vending machines in the school and the types of refreshments sold at school events? What healthy foods should be included in the school lunches? How can physical activity be structured into the school day and afterschool programs? Develop four objectives that will guide needed changes in the school environment.

Promoting Healthy Lifestyles

Every phase of public health nursing involves the provision of health education whenever the opportunity arises. Lifestyle patterns are modifiable, and nurses can help make the public aware of the benefits of preventative health through use of the media and meeting with individuals and community groups.

Following the landmark epidemiologic studies of smoking and lung cancer in the 1950s, the general public gradually recognized that personal behaviors such as smoking were risk factors for the leading conditions causing morbidity and mortality in the United States and other countries. In 1984, the CDC and the U.S. state health departments collaboratively established the Behavioral Risk Factor Surveillance System (BRFSS). The goal of this surveillance system is to collect, analyze, and interpret specific behavioral risk factor data that can be used to plan, implement, and monitor health promotion and disease prevention programs.

The BRFSS gathers information about health behaviors, such as lack of physical activity, obesity, and safety belt use, primarily by telephone calls. It also gathers data about preventative health services, such as screening for breast and cervical cancer and elevated blood cholesterol. The BRFSS used these epidemiologic statistics when national objectives

were established for *Healthy People 2000*, *Healthy People 2010*, *Healthy People 2020*, and *Healthy People 2030. Healthy People 2030*, developed by the U.S. Department of Health and Human Services, sets behavioral objectives to be achieved over the third decade of the 21st century. Experts developed these objectives through a broad consultation process, built on the best scientific knowledge and designed to measure programs over time. Along with the BRFSS data, *Healthy People 2030* serves as the basis for the development of state and community plans to improve the health of their populations. Each state collects statistics for the BRFSS, and thus these data are available for nurses to access when planning educational programs for primary prevention.

Dietary factors are associated with four out of the 10 leading causes of death: heart disease, some types of cancer, stroke, and type 2 diabetes. Rates of obesity, which is defined as having a body mass index, or BMI, of 30.0 or higher, have doubled in adults and tripled in children and adolescents over the last two decades. The data are alarming (Hales et al., 2020).

The prevalence of obesity in the United States between 2017 and 2018 is as follows:

- 42.4% of adults aged 20 years and older
- 21.2% of adolescents aged 12 to 19 years
- 20.3% of children aged 6 to 11 years
- 13.4% of children aged 2 to 5 years

These are significant increases in obesity as compared to the period of 1991 to 2012 (Fig. 6.6).

The BRFSS data dramatically demonstrate the significant increase in the prevalence of obesity in the United States (Fig. 6.6). Using these data, *Healthy People 2030* identified having a BMI between 25.0 and 30.0 and obesity as major health issues in the United States. Sex and race and ethnicity

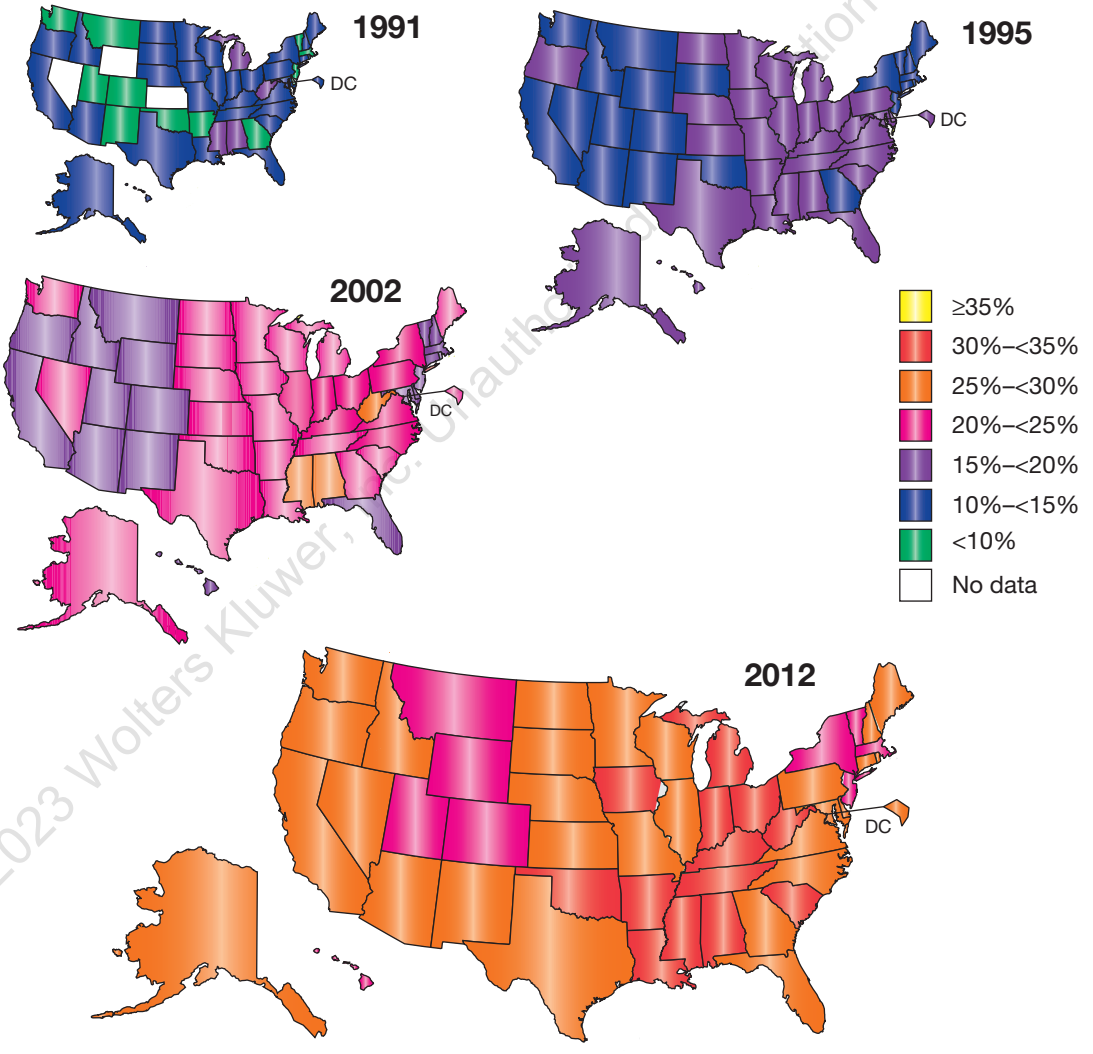

FIGURE 6.6 Changes in prevalence of obesity among U.S. adults. Note that the data are for ages 18 years and over, based on self-reported weight and height via telephone interview. Obesity is defined as body mass index ≥30. (From National Health and Nutrition Examination Survey, NCHS, CDC; BRFSS, 2012.)

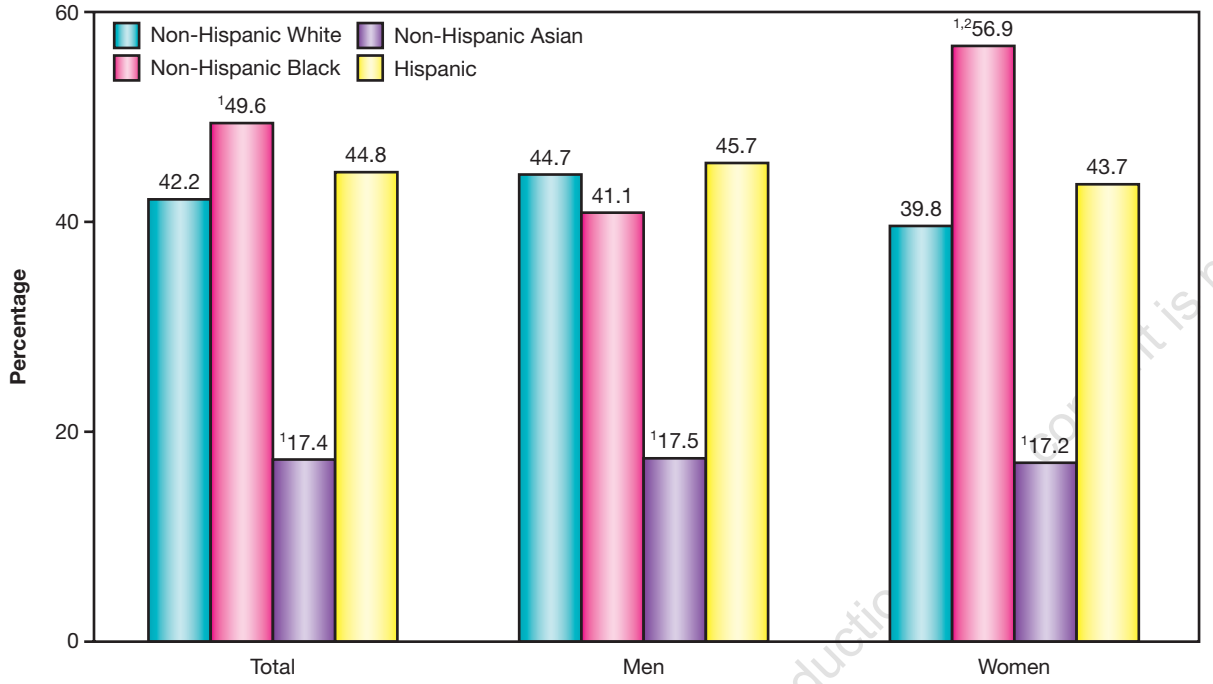

FIGURE 6.7 Age-adjusted prevalence of obesity among adults aged 20 and over, by sex and race/ethnicity: United States, 2017–2018. Note that data are age-adjusted to the 2000 standard population. Obesity is defined as body mass index ≥30. [1]Significantly different from all other race and Hispanic-origin groups. [2]Significantly different from men for same race and Hispanic-origin group. Access data table for this figure at: https://www.cdc.gov/nchs/data/databriefs/db360_tables-508.pdf#2 (Hales, C. M., Carroll, M. D., Fryar, C. D., & Ogden, C. L. [2020, February]. *Prevalence of obesity and severe obesity among adults: United States, 2017–2018* [NCHS Data Brief, No. 360]. Centers for Disease Control and Prevention: National Center for Health Statistics. https://www.cdc.gov/nchs/data/databriefs/db360-h.pdf)

are also important factors in the development of obesity (Fig. 6.7). Overweight is most prevalent in African American females and Hispanic males. These findings are largely related to SDOH that affect marginalized populations. If nurses find that such statistics apply to the members of their own community, they can conduct further assessments to get to the root of the problem and develop interventions or programs to address the underlying problem.

Practice Point

Use statistics to demonstrate the need for program development and community interventions.

Evidence for Practice

The prevalence of childhood obesity is increasing. Over 30% of children and adolescents in the United States are assessed as having a BMI of 25.0 or higher, signaling a concerning public health problem. By the age of 14, children who were overweight in kindergarten are at four times the risk for obesity than children who had a healthy weight at kindergarten age. Lower socioeconomic status (SES) and family factors have been identified as risk factors.

The Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) provides a nationally representative sample of 14,000 children born in the United States in 2001. The diverse participants were followed up from birth to entry to kindergarten. The parental surveys focused on child health, development, care, and education, and were deployed at the child's birth, followed by 9 months, 24 months, and 4 to 5 years of age. Trained assessors visited the homes of the children and parents, collecting data for each round, including height and weight, that were used to calculate BMI. Following the CDC's recommendations, a BMI greater than 85% was classified as overweight or obese.

Researchers (Williams et al., 2018) analyzed the data to build a model of childhood obesity from parental and child risk factors associated with the development of childhood obesity. Just more than half (53%) of the sample of children were White, 25% were Hispanic, and 14% were Black. Females accounted for 49% of the sample. Thirty-six percent of children in the sample had a BMI that fell in the overweight or obese range.

The researchers found that race and ethnicity, SES, birth weight, parental smoking, and having family meals were associated with obesity. Findings included: (1) Children in the lowest quintile of SES were 70% more likely to have a BMI in the overweight or obese range than children in the highest quintile; (2) Black and Hispanic children had a 60% increased risk of overweight or obesity when compared with White children; (3) Every 100-g increase in birth weight was associated with a 7% increased risk of overweight or obesity; (4) Parental smoking was associated with a 49% higher risk of childhood overweight or obesity; and (5) Eating dinner as a family was associated with a 4% risk reduction for overweight or obesity.

The study results supported previous findings on the association of SES and race with childhood obesity. Having used a composite variable for SES, which included education and occupation in addition to household income, the researchers propose that a combination of socioeconomic factors "contribute to children's early obesogenic environment" (p. 519). They recommend development of interventions that target parents of different income and educational levels and in varied occupations.

Preventing and Controlling Outbreaks

The investigation of an epidemic or **outbreak** is an example of the epidemiologic process in action. Epidemics occur when there is an increased incidence of a disease or event beyond that which is normally found in the population. Although the term *outbreak* is often used synonymously with epidemic, outbreaks are usually limited to a localized increase in the incidence of the illness. The steps of investigating an outbreak are presented in Box 6.1. A detailed description of outbreak investigations is provided in Chapter 14.

Public health nurses may be involved in any of the steps of the outbreak investigation. The nurse's role varies with the workplace. Generally, nurses are involved in education of the public, mobilization of community resources, and implementing regulatory and control measures.

6.1 How to Investigate an Outbreak

- Establish the existence of the outbreak.
- Describe the outbreak according to person, place, and time.
- Formulate and test hypotheses as to the most probable causative factors.
- Implement a plan for control of the outbreak and prevention of further outbreaks.
- Evaluate results, prepare reports, and conduct further research if necessary.

Practice Point

When you are investigating unusual events, determine whether the incidence is greater than what normally would occur at that time and place.

Contributing to a Safe and Healthy Environment

Individual and community risk assessments should include detection of real or potential threats from the environment. Environment includes physical, biologic, social, cultural, or any other external factors that can influence the health status of individuals or populations. The principles of epidemiology, normally used in investigating disease and illness, can be applied to the human effects of natural disasters such as hurricanes and earthquakes, as well as to industrial disasters such as injuries, air pollution, nuclear accidents, and release of toxic chemicals.

Practice Point

Evaluate your community, and subsets of the community, for potential environmental hazards.

When healthcare professionals gather demographic data, vital statistics, and epidemiologic morbidity and mortality statistics, they should also consult environmental health sources. Using detailed individual or community client databases, nurses then have the potential to link environmental exposure to illness and disease. Nurses often provide case management for both communicable and chronic illnesses that result from environmental exposure. Nurses also may be risk consultants, communicators, and educators, working with community groups, agencies, and industry to protect the health of their workers.

CASE STUDY

Shayna asks the public health nurses to assess the neighborhood surrounding the school to determine whether it is obesogenic and contributing to the increased prevalence of obesity within the school-age population. What characteristics in a low-income neighborhood could be contributing to an obesogenic environment? Think about the social and environmental determinants of health.

The World Health Organization (WHO), the National Institute for Occupational Safety and Health (NIOSH) in the United States, and other international and national agencies review existing knowledge about chemicals, radiation, and other environmental hazards that have immediate and long-term effects on health, and issue reports concerning environmental health criteria. See Chapter 19 for detailed information regarding environmental assessment.

Evaluating the Effectiveness of Health Services

Public health professionals who collect epidemiologic data during assessments and use them for establishing the need for health programs can also use them to evaluate those services. Evaluation requires a systematic and objective process that determines the relevance, effectiveness, and impact of the health service. Creating objectives that are measurable assists in this process. Nurses should continuously monitor the health status indicators in the community, especially for vulnerable populations. Age-specific mortality rates, low birth rates, infant mortality rates, health service utilization, and other indexes specific to the characteristics of the community are examples (see Chapter 7). This information assists in identifying gaps and detecting emerging problems early so that appropriate responses can be facilitated. In addition, nurses and other healthcare professionals can also use epidemiologic principles to develop surveys to gather specific information from targeted populations such as child-care centers or the population of census tracts that may be at high risk.

The primary way to demonstrate prevention or control of a health problem is to compare epidemiologic statistics before and after the implementation of the health service. Planning and evaluation are continuous processes. As new data become available, modification in health services may be necessary, and those modifications require evaluation.

Practice Point

Use your program objectives to evaluate your interventions.

CASE STUDY

How could the school nurses evaluate the effect of the nutritional and physical activity changes made in the school to decrease the prevalence of obesity?

KEY CONCEPTS

- Early attempts at understanding the reasons for disease were primarily a direct result of trial-and-error observations of individual people.
- Study of illness and causes of death in groups of people began in the 17th century. Founders of epidemiology as the science of preventative medicine included John Graunt, William Farr, John Snow, and Florence Nightingale.
- Epidemiology is defined as the study of the distribution and determinants of the states of health and illness in human populations, with the goal of preventing or limiting consequences and maximizing states of health.
- Individual and community assessments, using epidemiologic principles, form the database that provides the evidence and rationale for interventions.
- Promoting healthy lifestyles uses epidemiologic data such as that found in the BRFSS. The U.S. publication *Healthy People 2030* defines measurable objectives to be achieved over the third decade of the 21st century.
- Nurses, in their care of individual and community clients, have the potential to link environmental exposure to illness and disease.
- Epidemiologic data, collected during assessments that establish the need for health programs, are also used to evaluate those services.

CRITICAL THINKING QUESTIONS

1. Jeff is 11 years old and has a body mass index (BMI) that falls in the overweight range. His father is a truck driver who was recently diagnosed with type 2 diabetes. His mother is a licensed practical nurse at the local hospital. At a recent health science fair at his school, a student-led screening clinic documented Jeff's blood pressure at 136/83 mm Hg.
   a. Is Jeff at risk? If so, for what?

CRITICAL THINKING QUESTIONS *(Continued)*

b. Utilizing the *Guidelines for High Blood Pressure in Adults* (Goetsch et al., 2021), what is Jeff's future risk from adolescence through adulthood?
c. What other data do you need?
d. How do epidemiologic data define hypertension in a child of Jeff's age?
e. What recommendations would you make?
f. Are there health promotion activities that you would recommend?

2. Look through several major newspapers for articles containing health statistics.
   a. What are the implications of these statistics for your community?
   b. What further data would you obtain to document the problem in your community?
3. Go to the CDC website www.cdc.gov. Pick a topic to explore. Show how epidemiologic information has been used to describe the topic.