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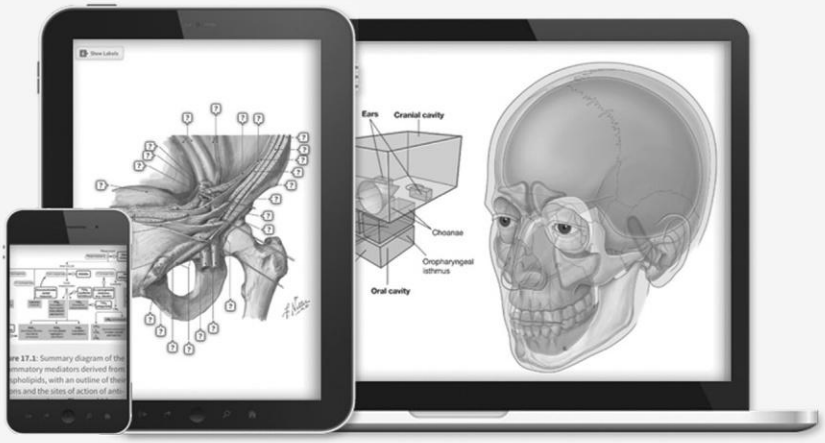

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Guccione's Geriatric Physical Therapy

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To my mother, for being an exemplary model of successful aging and love. You are an inspiration to me and so many others.

Dale Avers

To my husband, Al, for his unwavering support and encouragement, and to my children and grandchildren, who grow more precious every day.

Rita A. Wong

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PREFACE

Remarkably, much of the science that underpins geriatric physical therapy is less than 30 years old. It was only in 1990 that Fiatarone published the study that described the profound effects of progressive and high-resistance exercise on frail elders, initiating an avalanche of research about the effects of exercise on aging adults as well as spurring investigations to challenge beliefs about the inevitability of the downward health trajectory of older adults. In every area of geriatric science, remarkable strides have been made in the understanding of the systemic, clinical, and psychosocial effects of the aging process. Of particular interest to physical therapy clinicians are the intended and unintended consequences of lifestyle on the aging process. But understanding the science isn't sufficient to provide interventions to an older adult. The physical therapy clinician also uses psychosocial and clinical skills to help the older adult manage individual complexity. The fourth edition of this textbook reflects the breadth of knowledge and interventions necessary to provide best practices in the delivery of physical therapy for older adults. The development of competent, reflective geriatric physical therapy professionals, a continued focus of this text, is fostered through analysis, synthesis, and application of current science and expert opinion within a functional context in this edition. Additionally, the text has increased its international focus with the addition of several international authors, reflecting the globalization of geriatric physical therapy care.

The fourth edition includes several new chapters that reflect the application of science to clinical practice. While the basic organization of the text has not changed, the reader will note changes in each section. For example, in Part I, Foundations, a chapter on Psychosocial Aspects of Aging has been added, reflecting the wholistic nature of patient care.

Part II presents the core practices and interventions used for every older adult, across systems and pathology. New chapters in this section include Functional Performance Measures and Patient Education. Evaluation, diagnosis, and plan of care is the focus of Part III. New chapters include the Frail Older Adult, Older Patient with Neurological Conditions, and Older Patient with Cardiovascular and Pulmonary Conditions. Part IV chapters address special issues and their interventions with new chapters on Caregiving and Postsurgical Orthopedic Conditions. The continuum of care is reflected in Part V and includes a new chapter on the Acute Management of the Older Adult. Finally, Part VI provides a chapter on health policy and advocacy that addresses the role of the physical therapy professional within a societal framework.

This fourth edition reflects a change in the title to *Guccione's Geriatric Physical Therapy*. Andrew Guccione, the first editor and conceptualizer of this text, always had the goal of providing a text about geriatric physical therapy that was of the highest credibility based on current science and expert clinical thought and that would advance the provision of the physical therapy care of older adults. We are indebted to him for his vision and encouragement and hope this text reflects his intent and commitment to excellence.

Dale Avers, PT, DPT, PhD, FAPTA
Rita A. Wong, PT, EdD, FAPTA

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This textbook is a creative collaboration of the best scientists and clinicians in geriatric physical therapy. We are indebted to this highly respected and passionate team of individuals and proud to call them colleagues. We welcome our new authors and are grateful for the expertise of former and current authors. We are also indebted to those who have inspired us along the way, whose thoughts and examples have influenced our thinking, especially Davis Gardner (1926–2019) and our patients and students, from whom we continue to learn.

Elsevier's commitment to excellence is demonstrated through the thoughtful and conscientious attention Elizabeth (Betsy) McCormac has paid to the intent and content of this text. Her unending patience and advice are beyond value.

Dale Avers, PT, DPT, PhD, FAPTA
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CONTENTS

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CHAPTER

1

Geriatric Physical Therapy in the 21st Century: Overarching Principles and Approaches to Practice

Cathy Elrod

OUTLINE

INTRODUCTION

All physical therapists, not just those working in settings traditionally identified as "geriatric," should possess strong foundational knowledge about geriatrics and be able to apply this knowledge to a variety of older adults. Although the fundamental principles of patient management are similar regardless of patient age, there are unique features and considerations in the management of older adults that can greatly improve outcomes.

The first wave of the baby-boomer generation turned 65 years old in 2011. This group, born post–World War II, is much larger than its preceding generation, in terms of both the number of children born during this era (1946 to 1965) and increased longevity of those in that cohort. The 2008 landmark report of the Institute of Medicine (IOM) *Retooling for an Aging America*[1] provides a compelling argument for wide-ranging shortages of both formal and informal health care providers for older adults across all levels of the health care workforce (professional, technical, unskilled direct care worker, and family caregiver). These shortages include shortages of physical therapists and physical therapist assistants. The report provides numerous recommendations for enhancing the number of health care practitioners and the depth of preparation of these practitioners. The goal of this textbook is to provide a strong foundation to support physical therapists who work with older adults.

The U.S. Census Bureau reports that in 2016, 15% of the population was age 65 years or older; by 2030, one in five Americans is projected to be an older adult.[2] Undoubtedly, with very few exceptions, the majority of the caseload of the average physical therapist will soon consist of older adults. Despite this, physical therapists still tend to think about "geriatrics" in terms of care provided to frail individuals in a nursing home, hospital, or home care setting. Although these are important practice settings for geriatric physical therapy, physical therapists must recognize and be ready to provide effective services for the high volume of older adult patients who range from the very fit to the very frail, across inpatient and outpatient settings.

AGING

When working with the older adult, it is important to understand the concept of aging and the rationale behind the high variability and differences among older adults in the aging process. Usual aging, or typical changes in physiological functioning observed in older adults, represents a combination of normal (unavoidable) aging-related decline and modifiable factors associated with lifestyle such as physical activity, nutrition, and stress management. For many older adults, a substantial proportion of "usual" age-related decline in functional ability represents "deconditioning" as most older adults do not engage in sufficient physical activity and exercise to derive health benefits. This decline can be partially reversible with lifestyle modification.

Aging trajectories that go beyond typical aging have been described by a variety of terms such as *healthy aging*, *optimal aging*, *successful aging*, *active aging*, and *aging well*.[3] In 1997, Rowe and Kahn[4] provided a model of successful aging that includes the following components: (1) absence of disease and disability, (2) high cognitive and physical functioning, and (3) active engagement with life. Although helping older adults avoid disease and disease-related disability is a central consideration for all health care practitioners, the reality is that the majority of older adults do have at least one chronic health condition, and many, particularly among the very old, live with functional limitations and disabilities associated with the sequelae of one or more chronic health conditions. Brummel-Smith expanded the concepts of Rowe and Kahn in the depiction of optimal aging as a more inclusive term than successful aging. Brummel-Smith defines optimal aging as "the capacity to function across many domains—physical, functional, cognitive, emotional, social, and spiritual—to one's satisfaction and in spite of one's medical conditions."[5] This conceptualization recognizes the importance of optimizing functional capacity in older adults regardless of the presence or absence of a chronic health condition. Recently, the American Geriatrics Society published a *White Paper on Healthy Aging* in which they recommend that the definition of healthy aging include "concepts central to geriatrics, such as culture, function, engagement, resilience, meaning, dignity and autonomy, in addition to minimizing disease."[6]

HEALTH, FUNCTION, AND DISABLEMENT

The World Health Organization (WHO) defines *health* as a "state of complete physical, psychological, and social well-being, and not merely the absence of disease or infirmity."[7] According to this definition, "health" is best understood as an end point in the major domains of human existence: physical, psychological, and social. In contrast to assuming "complete health" as the expected end point of an episode of care, physical therapists work across the spectrum, from wellness to the end of life, to ensure outcomes associated with achieving the highest level of function possible wherever someone may be placed on that spectrum.

There have been several attempts to construct a model of health status that describes the relationship between health and function or, more precisely, describes the process of how individuals come to be disabled (disablement) and identifies factors, including therapeutic interventions, that can mitigate disablement (enablement process). The traditional medical model of disablement assumes a causal relationship between disease and illness. In this narrow perspective, disablement is primarily dependent on the characteristics of the individual (i.e., his or her pathology) that require an intervention to alleviate that can only be provided by a health care professional. The social model of disability fundamentally broadens the focus away from an exclusive concentration on the disease-related physical impairments of the individual to also include the individual's physical and social environments that can impose both disabling limitations and enabling mitigation of limitations.[8] Subsequent models of the twin processes of disablement and enablement have further explored the relationship of the environment to functional independence. In the 1960s, sociologist Saad Nagi characterized disablement as having four distinct components that evolve sequentially as an individual loses well-being: disease or pathology, impairments, functional limitations, and disability.[9,10] His work is associated with the biopsychosocial model, which recognizes the importance of psychological and social factors on the patient's experience of illness. In the late 1980s and early 1990s, Jette, Verbrugge, and Guccione began exploring the process of disablement as a framework to assist physical therapists to clarify the domains of practice.[11–15] They proposed a multifactorial disablement framework that included the influence of environmental demand and individual capabilities on disability (Fig. 1.1).

A further elaboration of Nagi's model was presented by Brandt and Pope in a 1997 report from the IOM.[16] This revised model introduced the concept of enablement that explicated the balance between inevitable and reversible disablement depending on the confluence of disabling and enabling factors at the interface of a person with the environment. If ramps were introduced to allow access to the home or therapeutic exercises implemented that improved functional performance, then the individual with a neuromuscular condition precluding his or her ability to negotiate stairs has experienced a "disabling–enabling process." The IOM model has three dimensions: the person, the environment, and the interaction between the person and the environment. Their conceptualization allows us to understand how two older adults presenting with similar impairments associated with a right cerebrovascular accident can have different levels of disability according to the uniqueness of each individual and the environment in which they live. Physical therapists can use this information to promote optimal aging in the older adult.

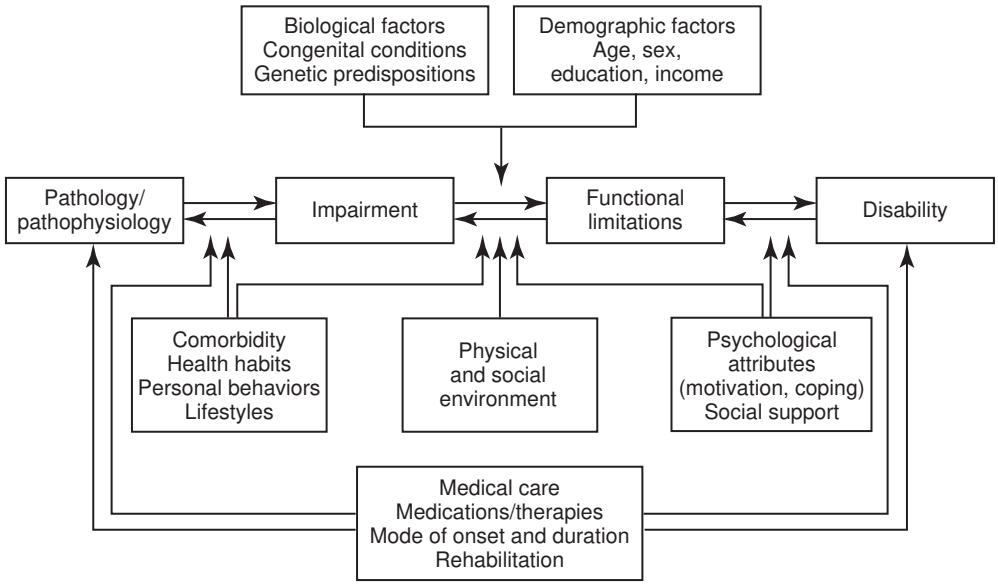

FIG. 1.1 An expanded disablement model. *(Adapted with permission from Guccione AA. Arthritis and the process of disablement. Phys Ther. 1994;74:410.)*

International Classification of Functioning, Disability, and Health

The WHO also independently took on the task of developing a conceptual framework for describing and classifying the consequences of diseases. In 1980, they presented the *International Classification of Impairments, Disabilities, and Handicaps* (ICIDH).[17] In response to concerns about the ICIDH, the WHO developed a substantially revised *International Classification of Functioning, Disability and Health* (ICF) in 2001 to "provide a unified and standard language and framework for the description of health and health-related states."[18] In 2007, the IOM endorsed the adoption of this framework "as a means of promoting clear communication and building a coherent base of national and international research findings to inform public and private decision making."[19] The 2008 House of Delegates for the American Physical Therapy Association also embraced terminology of the ICF and initiated the process of incorporating ICF language into all relevant association publications, documents, and communications (http://www.apta.org/uploadedFiles/APTAorg/About_Us/Policies/PracticeEndorsementICF.pdf#search=%22HOD%20P06-08%22. Accessed June 30, 2019).

The ICF model, illustrated in Fig. 1.2, employs a biopsychosocial approach that is compatible with many of the concepts from Nagi and the IOM's work on enablement and disablement. The ICF model is designed to encompass all aspects of health and include all situations that are associated with human functioning and its restrictions. Key operational definitions that allow interpretation and application of the ICF model are listed in Box 1.1. There are varying levels within the ICF's taxonomic

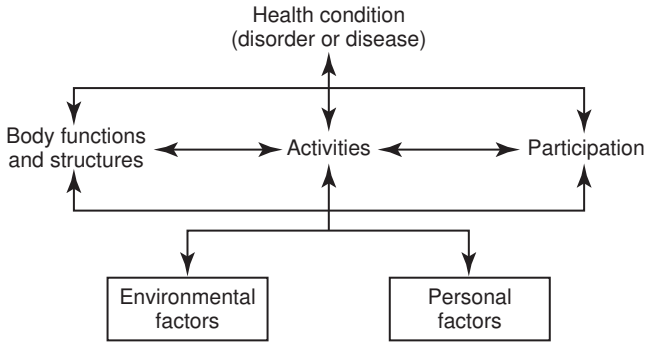

FIG. 1.2 International Classification of Functioning, Disability and Health (ICF) model. *(From the World Health Organization. International Classification of Functioning, Disability, and Health: ICF. Geneva, Switzerland: World Health Organization; 2001: 18.)*

classification schema of human functioning and disability. The first level consists of the broad categories of body functions, body structures, activities and participation, and environmental factors. Physical therapists will typically be most interested in the section that discusses activities and participation and the subsection on mobility that delineates actions associated with (1) changing and maintaining body position; (2) carrying, moving, and handling objects; (3) walking and moving; and (4) moving around using transportation. The ICF attempts to provide a common language to describe patients' behaviors and environmental situations that need to be taken into consideration when making clinical decisions, especially in regard to optimizing human performance in the older adult.

Health Condition. In contrast to focusing on disease, health condition is an ongoing pathologic state that is delineated by a particular cluster of signs and symptoms. The ICF includes any health condition that takes the individual

BOX 1.1 International Classification of Functioning, Disability and Health (ICF) Definitions

Health Condition: umbrella term for disease (acute or chronic), disorder, injury, or trauma; may also include other circumstances such as pregnancy, aging, stress, congenital anomaly, or genetic predisposition; coded using *International Classification of Disease,* 11th revision

- *Body Functions*: the physiological functions of body systems, including psychological functions
- *Body Structures*: the structural or anatomic parts of the body such as organs, limbs, and their components classified according to body systems
- *Impairment*: a loss or abnormality in body structure or physiological function (including mental functions)
- *Activity*: the execution of a task or action by an individual; represents the individual perspective of functioning
- *Activity Limitation*: difficulties an individual may have in executing activities
- *Participation*: a person's involvement in a life situation; represents the societal perspective of functioning
- *Participation Restriction*: problems an individual may experience in involvement in life situations
- *Functioning*: umbrella term for body functions, body structures, activities, and participation; denotes the positive aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environmental and personal factors)
- *Disability*: umbrella term for impairments, activity limitations, and participation restrictions; denotes the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environment and personal factors)
- *Contextual Factors*: factors that together constitute the complete context of an individual's life, and in particular the background against which health states are classified in the ICF; there are two components of contextual factors: environmental factors and personal factors
  - *Environmental Factors*: constitute a component of the ICF and refer to all aspects of the external or extrinsic world that form the context of an individual's life and as such have an impact on that person's functioning; they include the physical world and its features, the human-made physical world, other people in different relationships and roles, attitudes and values, social systems and services, and policies, rules, and laws
  - *Personal Factors*: contextual factors that relate to the individual such as age, gender, social status, life experience, and so on that are not currently classified in the ICF but which users may incorporate in their application of the classification

(From: World Health Organization. *International Classification of Functioning, Disability, and Health: ICF.* Geneva, Switzerland: World Health Organization; 2001.)

away from the "state of complete physical, psychological, and social well-being" and builds upon the evolving acceptance of wellness as an attainable goal.[18] The *International Classification of Disease,* 11th revision (ICD-11), also a product of the WHO, offers a classification schema that provides a comprehensive listing of health conditions.

Impairment of Body Structure or Function. Impairments, defined as alterations in anatomic, physiological, or psychological structures or functions, typically evolve as the consequence of disease, pathologic processes, or lesions, altering the person's normal health state and contributing to the individual's illness. For example, physical impairments, such as pain and decreased range of motion (ROM) in the shoulder, may be the overt manifestations (or symptoms and signs) of either temporary or permanent disease or pathologic processes for some, but not necessarily all, older adult patients. The genesis of an impairment can often be unclear. Poor posture, for example, is neither a disease nor a pathologic state, yet the resultant muscle shortening and capsular tightness may present as major impairments in a clinical examination. Thus, not all older adults are patients because they have a disease. Some individuals are treated by physical therapists because their impairments are a sufficient enough cause for intervention regardless of the presence (or absence) of disease or active pathology.

Given that much of physical therapy is directed toward remediating or minimizing impairments, additional elaboration of the concept of impairment is particularly useful in geriatric physical therapy. Schenkman and Butler have proposed that impairments can be classified in three ways: direct, indirect, and composite effect.[20] Direct impairments are the effect of a disease, syndrome, or lesion and are relatively confined to a single system. For example, they note that weakness can be classified as a neuromuscular impairment that is a direct effect of a peripheral motor neuropathy in the lower extremity. Indirect impairments are impairments in other systems that can "indirectly" affect the underlying problem. For example, ambulation training of a patient with a peripheral motor neuropathy may put excessive strain on joints and ligaments, resulting in new musculoskeletal impairments. The combination of weakness from the primary motor neuropathy and ligamentous strain from excessive forces on the joints may lead to a composite effect, the impairment of pain.

Using neurologic dysfunction as the vehicle, Schenkman and Butler described this three-category concept of impairment by categorizing clinical signs and symptoms into impairments that have a direct, indirect, or composite effect, thus bringing together into a cohesive relationship the diverse data of the medical history and the findings of the clinical examination. For example, consider a 79-year-old woman with severe peripheral vascular disease (PVD). Upon clinical examination, the physical therapist notes that this individual has lost sensation below the right knee. Sensory loss is an impairment that would be classified as a direct effect of PVD. As the individual is ambulating less and cannot sense full ankle ROM, loss of ROM may be an indirect effect of the patient's PVD on the musculoskeletal

system. The combination of the direct impairment (sensory loss below the knee) and the indirect impairment (decreased ROM in the ankle) may help to explain another clinical finding, poor balance, which can be understood as a composite effect of other impairments. Piecing clinical data together in this fashion allows the therapist to uncover the interrelationships among a patient's PVD, loss of sensation, limited ROM, and balance deficits. Without a framework that sorts the patient's clinical data into relevant categories, the therapist might never comprehend how the patient's problems came to be and thus how to intervene. Treatment consisting of balance activities alone would be inappropriate, because the therapist must also address the loss in ROM as well as teach the patient to compensate for the sensory loss to remediate the impairments.

Activity Limitation. Although most of us anticipate that our body systems will deteriorate somewhat as we age, an inability to do for oneself from day to day perhaps most clearly identifies when adults are losing their health. Activity limitations result from impairments and consist of an individual's inability to perform his or her usual functions and tasks such as reaching for something on an overhead shelf or carrying a package. As measures of behaviors at the level of a person, and not anatomic or physiological conditions, limitations in the performance of activities should not be confused with diseases or impairments that encompass aberrations in specific tissues, organs, and systems that present clinically as the patient's signs and symptoms.

Although most older adults seeking care for a health condition are likely to carry at least two medical diagnoses, each of which will manifest itself in particular impairments of the cardiopulmonary, integumentary, musculoskeletal, or neuromuscular systems, impairment does not always entail activity limitations. One cannot assume that an individual will be unable to perform the actions and roles of usual daily living by virtue of having an impairment alone. For example, an adult with osteoarthritis (disease) may exhibit loss of ROM (impairment) and experience great difficulty in transferring from a bed to a chair (action). Another individual with osteoarthritis and equal loss of ROM may transfer from bed to chair easily by choosing to use an assistive device or by participating in a supervised muscle-strengthening program. Sometimes patients will overcome multiple, and even permanent, impairments by the sheer force of their motivation.

The degree to which limitations in physical functional activities may be linked to impairments has not been fully determined through research, and there is a critical need to update the epidemiology of impairment and action/function among older adults. The relatively few studies that have been reported in the literature support a generally linear but modest relationship between impairments such as strength and functional status, perhaps because functional status requires a relatively low level of strength and thus experiences a ceiling effect. Such data are essential to both (1) identifying relevant functional outcomes of an intervention and (2) establishing the dose–response relationship for an efficacious intervention that is known to remediate impairments to a particular degree or magnitude and is sufficient to produce a clinically important change in an individual's functional status.

Participation Restriction. In revising the ICIDH, the WHO rejected the term *handicap* and introduced an alternative concept, *participation*, which is associated with its specific definition of *activity* and *activity limitation*.[18] It is defined as "involvement in life situations" and is characterized by a person's performance of actions and tasks in that individual's actual environment. *Participation restriction* is characterized by discordance between the actual performance of an individual in a particular role and the expectations of the community for what is normal or typically expected behavior for an adult. Being unable to fulfill desired social roles is also associated with the term *disability*.[9] The meaning of disabled is taken from the community in which the individual lives and the criteria for normal within that social group. The term *disabled* connotes a particular status in society. Labeling a person as disabled requires a judgment, usually by a professional, that an individual's behaviors are somehow inadequate based on the professional's understanding of the expectations that the activity should be accomplished in ways that are typical for a person's age as well as cultural and social environment.

The ICF has redefined the term *disability* to reflect the summative negative aspects of the interaction between an individual who has a health condition and that individual's environment and personal factors. It encompasses impairment, activity limitations, and participation restrictions. Thus, *disability* is the broadest term in the ICF framework and harkens back to the IOM conceptualization that locates disability at the interface of a person's capabilities and abilities, personal factors, and the biopsychosocial environment.

The evidence suggests that activity limitations and participation restrictions in an older adult population change over time, and not all older adults exhibit functional decline. If we follow any cohort of older adults over time, there will be more activity limitations and subsequent restrictions in participation overall within the group, but some individuals will actually improve and others will maintain their functional level. Restricting the use of the term *disabled* to describe only long-term overall functional decline in older adult populations encourages us to understand a particular older adult's activity limitations and participation restrictions in a dynamic context subject to change, particularly after therapeutic intervention. Participation restrictions depend on both the capacities of the individual and the expectations that are imposed on the individual by those in the immediate social environment, most often the patient's family and caregivers. Physical therapists who apply a health status perspective to the assessment of patients draw on a broad appreciation of

an older adult as a person living in a particular social context as well as having individual characteristics. Changing the expectations of a social context—for example, explaining to family members what level of assistance is appropriate to an older adult after a stroke—may help to diminish disability as much as supplying the patient with assistive devices or increasing the physical ability to use them.

KEY PRINCIPLES IN GERIATRIC PHYSICAL THERAPY

Role of Physical Activity and Exercise in Maximizing Optimal Aging

Lack of physical activity (sedentary lifestyle) is a major public health concern across age groups. In 2014, 26.9% of adults between 65 and 74 years and 35.3% aged ≥75 years reported participating in no leisure-time physical activity.[21] Sedentary lifestyle increases the rate of age-related functional decline and reduces capacity for exercise sustainability to regain physiological reserve following an injury or illness. It is critical that physical therapists overtly address sedentary behavior as part of the plan of care for their older adult patients.

Exercise may well be the most important tool a physical therapist has to positively affect function and increase physical activity in older adults.[22] Despite a well-defined body of evidence to guide decisions about optimal intensity, duration, and mode of exercise prescription, physical therapists often underutilize exercise, with a negative impact on the potential to achieve optimal outcomes in the least amount of time. Underutilization of appropriately constructed exercise prescriptions may be associated with such factors as age biases that lower expectations for high levels of function, lack of awareness of age-based functional norms that can be used to set goals and measure outcomes, and perceived as well as real restrictions imposed by third-party payers regarding number of visits or the types of interventions (e.g., prevention) that are covered and reimbursed under a person's insurance benefit. Physical therapists should take every opportunity to apply evidence-based recommendations for physical activity and exercise programs that encourage positive lifestyle changes and thus maximize healthy aging.

Slippery Slope of Aging

Closely linked to the concept of healthy aging is the concept of a "slippery slope" of aging (Fig. 1.3). The slope, originally proposed by Schwartz,[23] represents the general decline in overall physiological ability (that Schwartz expressed as "vigor") that is observed with increasing age. The curve is arbitrarily plotted by decade on the *x*-axis so the actual location of any individual along the *y*-axis—regardless of age—can be modified (in either a positive or negative direction) based on lifestyle factors and illness that influence physiological functioning.

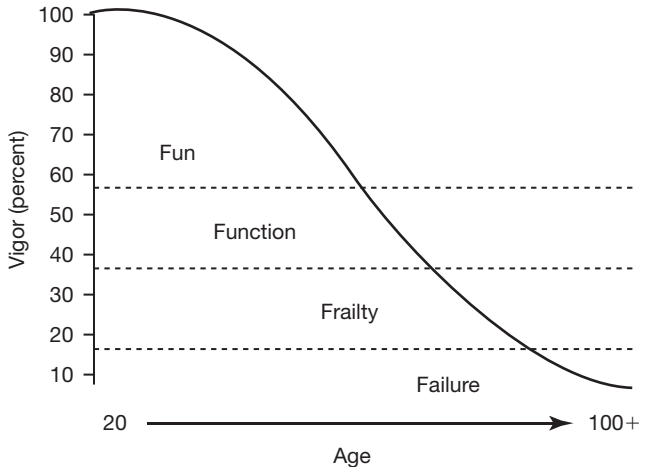

FIG. 1.3 Slippery slope of aging depicts the general decline in overall physiological ability observed with increasing age and its impact on function. *(Adapted from Schwartz RS. Sarcopenia and physical performance in old age: introduction. Muscle Nerve. 1997;20[Suppl 5]:S10-S12.)*

Schwartz has embedded functional status thresholds at various points along this slope. Conceptually, these thresholds represent key impact points where small changes in physiological ability can have a large impact on function, participation, and disability. These four distinctive functional levels are descriptively labeled fun, function, frailty, and failure. Fun, the highest level, represents a physiological state that allows unrestricted participation in work, home, and leisure activities. The person who crosses the threshold into function continues to accomplish most work and home activities but may need to modify performance and will substantially self-restrict or adapt leisure activities (fun) because of declining physiological capacity. Moving from function into frailty occurs when managing basic activities of daily living (BADLs; walking, bathing, toileting, eating, etc.) consumes a substantial portion of physiological capacity, with substantial limitations in ability to participate in community activities and requiring outside assistance to accomplish many home or work activities. The final threshold into failure is reached when an individual requires assistance with BADLs as well as instrumental daily activities and may be completely bedridden.

The concept of functional thresholds and the downward movement from fun to frailty helps explain the apparent disconnect that is often observed between the extent of change of physiological functions (impairments) and changes in functional status. For example, for a person who is teetering between the thresholds of function and frailty, a relatively small physiological challenge (a bout of influenza or a short hospitalization) is likely to drop him or her squarely into the level of "frailty," with its associated functional limitations. Once a person moves to a lower functional level (down the curve of the *y*-axis), it requires substantial effort and, typically, a longer time

period to build physiological capacity to move back up to a higher level (back up the *y*-axis). Clegg et al., as depicted in Fig. 1.4, depicted this phenomenon around a comparable threshold descriptor of "functional dependency."[24] Lifestyle changes including increased exercise activities may enhance efforts for an upward movement along the slippery slope. Moreover, the further the person is able to move above a key threshold, the more physiological reserve is available for protection from an acute decline in a physiological system. A major role of physical therapy is to maximize the movement-related physiological ability (vigor) of older adult patients/clients to keep them at their optimal functional level and with the highest physiological reserve.

Ageism

The perception of someone as being old or geriatric is a social construct that can differ greatly among cultures and social groups. A Pew Foundation survey[25] found that, on average, a representative sample of the U.S. population perceives age 68 years as the age at which a person crosses the threshold to be classified as old. However, the age of the survey respondent influenced perceptions: Respondents under the age of 30 years identified old age as starting at 60 years; those between 30 and 64 years indicated 70 years as the beginning of old age; and those older than age 64 years indicated that old age starts at 74 years. The age of 65 years, which is the typical age when individuals in the United States become eligible for Medicare, is probably the most common age identified by medical researchers and social policy advocates when categorizing individuals as old.

In reality, perceiving a specific individual as old is often more associated with the person's physical appearance and health status than his or her chronological age. An 80-year-old who is independent, fit, and healthy may not be described as old by those around her, whereas a 60-year-old who is unfit, has multiple chronic health problems, and needs help with daily activities that are physically challenging is likely to be perceived and described as old.

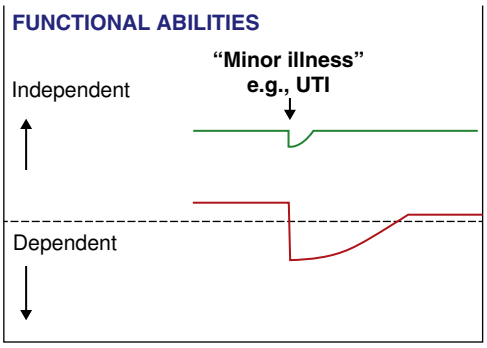

FIG. 1.4 Vulnerability of frail older people to a sudden change in health status following a minor illness. The green line represents a fit older person who, following a minor stress such as an infection, experiences a relatively small deterioration in function and then returns to homeostasis. The red line represents a frail older person who, following a similar stress, experiences a larger deterioration that may manifest as functional dependency and who does not return to baseline homeostasis. *UTI*, urinary tract infection. *Reprinted with permission from Elsevier (Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. The Lancet. 2013;381(9868):752-762).*

Ageism, stereotyping, and prejudice toward older adults, is prevalent in Western culture, including health care settings.[26] The subtle negative attitudes toward older adults that are often identified among health care practitioners become more obvious and influential when old age is combined with a perception of the patient as having low motivation, poor compliance, or poor prognosis. Ageism can result in disparate treatment for women as compared to men if they are viewed as being too frail and less encouragement of older patients to follow widely endorsed physical activity guidelines, and can lead to ineffective communication if the health condition is seen as just being associated with "old age."[27,28]

Many interactions with physical therapists occur at very vulnerable points in an older adult's life. For example, it is common to first evaluate an older adult in the midst of an acute hospitalization from a sudden and significant illness, in a skilled nursing facility for rehabilitation after hip fracture, or in the outpatient department during a disabling bout of back pain. When formulating a prognosis and making recommendations for the aggressiveness of interventions, it is easy to fall back on stereotypes suggesting old patients have low potential for improvement and low motivation for rehabilitation. It is true that some older adults enter physical therapy very low on the slippery slope of aging (frailty and failure stages). Rehabilitation may be particularly challenging given prior functional level, requiring the individual to make conscious decisions about where they want to place their efforts in the presence of substantially limited energy reserves, in which case goals not achievable through physical rehabilitation may guide their decisions. However, for most older patients, appropriately aggressive physical therapy can substantially affect functional ability and quality of life. Physical therapists who let ageist stereotypes influence their judgment are likely to make assumptions that underestimate prior functional ability of individuals and future potential for improvement. Do not let stereotypes cloud judgment about the capacity of older adults and the benefit to be achieved by appropriately aggressive rehabilitation.

Objectivity in Use of Outcome Tools

Older adults become increasingly dissimilar with increasing age. A similarly aged person can be frail and reside in a nursing home or be a senior athlete participating in a triathlon. Dissimilarities cannot be attributed to age alone and can challenge the therapist to set appropriate goals and expectations. Functional markers are useful to avoid

inappropriate stereotyping and undershooting of an older adult's functional potential. Functional tests, especially those with normative values, can provide a more objective and universally understood description of actual performance relative to similarly aged older adults, serving as a common language and as a baseline for measuring progress. For example, describing an 82-year-old man in terms of gait speed (0.65 m/s), 6-minute walk test (175 m), Berg balance test (26/56), and timed five-repetition chair rise (0) provides a more accurate description than "an older man who requires mod assistance of two to transfer, walks 75 feet with a walker, and whose strength is WFL." Reliable, valid, and responsive tests, appropriate for a wide range of abilities, enhance practice, and provide valuable information for our patients and referral sources.

Evidence-Based Practice

Evidence-based practice is an approach to clinical decision making about the care of an individual patient that integrates three separate but equally important sources of information in making a clinical decision about the care of a patient. Fig. 1.5 illustrates these three information sources: (1) best available scientific evidence, (2) clinical experience and judgment of the practitioner, and (3) patient preferences and circumstances.[29] The term *evidence-based practice* sometimes misleads people into thinking that the scientific evidence is the only factor to be considered when using this approach to inform a patient-care decision. Although the scientific literature is an essential and substantive component of credible clinical decision making, it is only one of the three essential components. An alternative, and perhaps more accurate, label for this approach is evidence-informed practice.

The competent geriatric practitioner must have a good grasp of the current scientific literature and be able to interpret and apply this literature in the context of an individual patient situation. This practitioner must also have the clinical expertise to skillfully perform the appropriate tests and measures needed for diagnosis, interpret the findings in light of age-related and condition-specific characteristics of the patient, and then skillfully apply the appropriate interventions to best manage the problem.

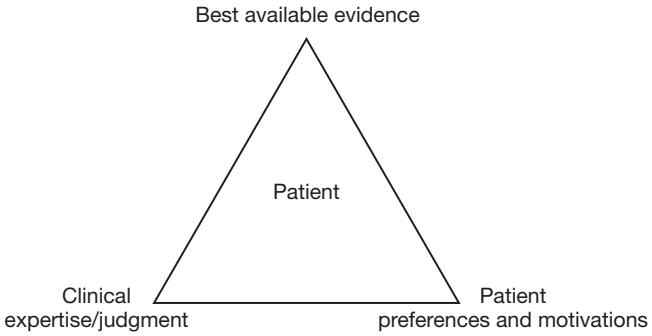

FIG. 1.5 Key elements of evidence-informed practice.

This is all done with clear and full communication with the patient to ensure the goals and preferences of the patient are a central component of the development of a plan of care.

Incorporation of best evidence into clinical decision making is an anchor of quality clinical practice. We live in an information age. For almost any topic, an overwhelming amount of information can be accessed in seconds with an Internet search. The challenge is to quickly identify and apply the best evidence. The best evidence is credible, clinically important, and applicable to the specific patient situation.

When faced with an unfamiliar clinical situation, a clinician reflects on past knowledge and experience, and may identify missing evidence needed to guide his or her decision making. A four-step process is typically used to locate and apply best evidence: (1) asking a searchable clinical question, (2) searching the literature and locating evidence, (3) critically assessing the evidence, and (4) determining the applicability of the evidence to a specific patient situation.

Sources of Evidence. Physical therapists must be competent in finding and assessing the quality, importance, and applicability of the many evidence sources available to them. As depicted in Box 1.2, each piece of evidence falls along a continuum from foundational concepts and theories to the aggregation of high-quality and clinically applicable empirical studies. On casual review of published studies, it is sometimes difficult to determine just where a specific type of evidence falls within the continuum of evidence and a closer review is often required.

The highest-quality research to answer a clinical question (i.e., providing the strongest evidence that offers the most certainty about the implications of the findings) is typically derived from the recommendations emerging from a valid systematic review that aggregates numerous high-quality studies directly focusing on the clinical question. However, only a very small proportion of evidence associated with the physical therapy management of older adults is well enough developed to support systematic reviews yielding definitive and strong recommendations. And the variety of factors that contribute to the health status of older adults makes it hard to aggregate across multiple studies or apply findings directly to your unique situation. More commonly, best evidence consists of the integration of the findings of one or several individual studies of varying quality by practitioners who then incorporate this evidence into their clinical judgments. The evidence-informed practitioner must be able to quickly locate, categorize, interpret, and synthesize the available evidence and also judge its relevance to the particular situation.

Finding Evidence. PubMed is generally the best database to search for biomedical evidence. PubMed is a product of the U.S. National Library of Medicine (NLM) at the National Institutes of Health (NIH) and thus is free to access. This database provides citations and abstracts

BOX 1.2 Continuum of Evidence: Studies Representing Early Foundational Concepts Through Integration of Findings Across Multiple Studies

Foundational Concepts and Theories	Initial Testing of Foundational Concepts	Definitive Testing of Clinical Applicability	Aggregation of the Clinically Applicable Evidence
Descriptive studies Case reports Idea papers (based on theories and observations) "Bench research" (cellular or animal model research for initial testing of theories) Opinions of experts in the field (based on experience and review of literature)	Single-case design studies Testing on "normals" (no real clinical applicability) Small cohort studies (assessing safety and potential for benefit with real patients) Clinical trials,* phase I and II	Well-controlled studies with high internal validity and clearly identified external validity: • Diagnosis • Prognosis • Intervention • Outcomes • Clinical trials,* phase III and IV	Systematic review and meta-analysis Evidence-based clinical practice guideline

*Clinical trials:
Phase I: examines a small group of people to evaluate treatment safety, determine safe dosage range, and identify side effects.
Phase II: examines a somewhat larger group of people to evaluate treatment efficacy and safety.
Phase III: examines a large group of people to confirm treatment effectiveness, monitor side effects, compare it to commonly used treatments, and further examine safety.
Phase IV: postmarketing studies delineate additional information including the documented risks, benefits, and optimal use.

from an expansive list of biomedical journals, most in English, but also including major non-English biomedical journals. All journals indexed in PubMed must meet high-quality standards, thus providing a certain level of comfort about using PubMed-indexed journals as trusted sources. PubMed Central provides a link to all articles freely available full-text.

Cumulative Index of Nursing and Allied Health Literature (CINAHL) is a database that focuses specifically on nursing and allied health literature. You must either pay to subscribe to CINAHL or gain access through membership in a library or a professional organization such as the American Physical Therapy Association (APTA). The criteria for being indexed in CINAHL are less stringent than PubMed. Thus, although there is an overlap with many journals indexed in both databases, those indexed in CINAHL but not PubMed tend to be smaller journals containing studies more likely to be representing foundational concepts.

Finally, a simple Google search can be a reasonable initial starting place. It is easy to use, is familiar to most, and handles specific search terms that other search engines might find difficult. However, the reader must pay particular attention to the source of the evidence for quality and bias. Google Scholar, which limits the search to scholarly works, provides a simple way to broadly search the peer-reviewed literature. A disadvantage is that Scholar is not limited to medicine, so it may return a variety of results across disciplines; however, it links to full-text when available.

All health care practitioners should have a strategy to regularly review current evidence in their specialty area. A simple review of the table of contents of core journals in the topic area can be useful. Most journals will send you a list of the table of contents and newly published articles when you sign up to receive them. Core peer-reviewed journals in geriatrics and geriatric physical therapy are listed in Box 1.3. In addition, choose one or two core journals in a professionally applicable subspecialty area of your choice (stroke, arthritis, osteoporosis, etc.) and check table of contents regularly.

A second approach is to go to a site such as AMEDEO (http://www.amedeo.com), which is a free service providing regular e-mails aggregating article citations specific to any interest across a wide range of health care specialties. The citations are typically taken from ongoing searches of newly published issues of core journals in the specialty area (or a subset of these journals as requested) and pushed to you through an e-mail listing. PubMed also allows an individual to identify and save a specific search strategy within it, have the search automatically run periodically to identify any new citations, and have the new citations automatically forwarded via e-mail. The PubMed approach allows you to be the most specific about the characteristics of the studies of interest and searches across the widest variety of journals.

BOX 1.3 Key Journals Particularly Relevant to Geriatric Physical Therapy

Journal of the American Geriatric Society
Journals of Gerontology: Series A, Biological Sciences and Medical Sciences
Journal of Geriatric Physical Therapy
Physical Therapy

Evidence Translation Sources. Clinical practice guidelines, particularly those based on a systematic review of the literature and expert consensus in applying the evidence to clinical practice, can be efficient sources of evidence. When examining the practice guidelines, confirm the comprehensiveness and objective analysis of the literature on which the guideline is based. The strength of the evidence should be based on quality, consistency, and number of studies supporting the recommendation.

Patient Autonomy

The scientific evidence and the expertise of the practitioner are combined with the preferences and motivations of the patient to reach a shared and informed decision about goals and interventions. Patient autonomy is grounded in the principle that patients have the right to make their own decisions about their health care. There is a tendency for health care providers to behave paternalistically toward older adult patients, assuming these patients are less capable than younger adults to make decisions about their health and rehabilitation. The reality of clinical practice is that physical therapists encounter a wide variety of decision-making capabilities in their older adult patients. Physical therapists have a responsibility to ensure their patients (and family/caretakers, as appropriate) have all pertinent information needed to make therapy-related health care decisions, and that this information is shared in a manner that is understandable to the patient and free of clinician bias. The patient should understand the potential risks, benefits, and harms; amount of effort and compliance associated with the various options; and likely prognosis.

Patients should have the opportunity to express their preferences and be satisfied that the practitioner has heard them accurately and without bias. The goals and preferences of the older adult patient may be very different from what the physical therapist assumes (or believes he or she would want for him- or herself under similar circumstances). Part of the "art" of physical therapy is creatively addressing the patient's goals using appropriate evidence, clinical skills, and available resources.

THE PHYSICAL THERAPIST IN GERIATRICS

Geriatric Care Team

Physical therapists working with older adults must be prepared to serve as autonomous primary care practitioners and as consultants, educators (patient and community), clinical researchers (contributors and critical assessors), case managers, patient advocates, interdisciplinary team members, and practice managers.[30] Although none of these roles is unique to geriatric physical therapy, what is unique is the remarkable variability among older adult patients and the regularity with which the geriatric physical therapist encounters patients with particularly complex needs. Unlike the typical younger individual, older adults are likely to have several complicating comorbid conditions in addition to the condition that has brought them to physical therapy. Patients with similar medical diagnoses often demonstrate great variability in baseline functional status and may be simultaneously dealing with significant psychosocial stresses such as loss of a spouse, loss of an important aspect of independence, or a change in residence. Thus, issues such as depression, fear, reaction to change, and family issues can compound the physical aspects and provide an additive challenge to the physical therapist. The physical therapist must be creative, pay close attention to functional clues about underlying modifiable or accommodative impairments, and listen carefully to the patient to ensure goal setting truly represents mutually agreed-upon goals.

In addition, the older patient is likely to be followed by multiple health care providers, thus making the physical therapist a member of a team (whether that team is informally or formally identified). As such, the physical therapist must share information and consult with other team members, recognize signs and symptoms that suggest a need to refer out to other practitioners, coordinate services, provide education to the patient and caretaker/family, and advocate for the needs of patients and their families.

Geriatric Competencies

Following the 2008 IOM report on the critical need to "retool" the health care workforce,[1] 21 professional organizations representing 10 different health professions (including physical therapy) came together to develop a consensus document of core competencies applicable across health disciplines. The *Multidisciplinary Competencies in the Care of Older Adults at the Completion of the Entry-Level Health Professional Degree*[31] emerged and was subsequently endorsed by 31 professional organizations, including the APTA.

Six key competency domains emerged as critical to all professions when serving older adults: (1) health promotion and safety, (2) evaluation and assessment, (3) care planning and coordination across the care spectrum, (4) interdisciplinary and team care, (5) caregiver support, and (6) health care systems and benefits. Competency and subcompetency statements listed under each domain were specific enough to provide structure and direction for each profession to operationalize yet general enough to allow customizing to the needs of each profession. Each profession was encouraged to provide guidance statements that tailored the competencies to practitioners within their field.

Over the next several years, three different national task forces appointed by the Academy of Geriatric Physical Therapy, using the multidisciplinary competency

document as a framework, customized the original document to three levels of practitioner within physical therapy[32]: completion of physical therapist entry-level program of study, completion of physical therapist assistant entry-level program of study, and physical therapist completion of a postprofessional program of study such as geriatric residency programs. The concepts and competencies embedded within each domain are captured across the various chapters of this book. A review of the competencies attests to the breadth and depth knowledge, skills, and attitudes needed for best practice as a geriatric physical therapist.

Expert Practice

Jensen and colleagues[33] provide compelling insights into the process of moving from novice to expert in physical therapy clinical practice. All experts, regardless of specialty area, were found to be highly motivated with a strong commitment to lifelong learning. Experts sought out mentors and could clearly describe the role each mentor had in their development, whether for enhanced decision making, professional responsibilities, personal values, or technical skill development. Experts had a deep knowledge of their specialty practice and used self-reflection regularly to identify strengths and weaknesses in their knowledge or thought processes to guide their ongoing self-improvement. The expert did not "blame the patient" if a treatment did not go as anticipated. Rather, the expert reflected deeply about what he or she could have done differently that would have allowed the patient to succeed.

The geriatric clinical specialists interviewed by Jensen and colleagues each provided reflections about how they progressed from novice to expert. In describing their path from new graduate generalist to geriatric clinical specialist, the geriatric experts noted that they did not start their careers anticipating specialization in geriatrics. They each sought a generalist practice experience as a new graduate and found themselves gradually gravitating toward the older adult patient as opportunities came their way. They came to recognize the talent they had for working with older adults and were called to action by their perceptions that many at-risk older adults were receiving inadequate care. They became firm believers in the principles of optimal aging and had a genuine high regard for the capabilities of older adults if given the opportunity to fully participate in rehabilitation. These specialists model clinical excellence by not settling for less than what the patient is capable of. Physical therapists are essential practitioners in geriatrics. The physical therapist must embrace this essential role—and recognize the positive challenge—of mastering the management of a complex and variable group of patients.

Physical therapists who find geriatrics particularly rewarding and exciting enjoy being creative and being challenged to guide patients through a complex maze to achieve their highest level of healthy aging. Navigating an effective solution in the midst of a complex set of patient issues is professionally affirming and rarely dull or routine.

Clinical Decision Making

The complexity of clinical decision making can be daunting because of the sheer volume of information and detailed considerations unique to the individual. However, physical therapists who make movement-related human performance the central focus of their decision-making process and approach each decision-making step systematically with a clear organizational strategy for gathering and utilizing information will find it easier to identify and apply pertinent information. Many approaches are organized around the five components of the *Guide to Physical Therapist Practice*'s Patient/Client Management Model (Fig. 1.6). Schenkman and Butler argue that task analysis in the environmental context is one of the skills that defines the physical therapist and is essential for effective decision making.[20] They also include the previously described enablement–disablement process as a fundamental organizing principle to formulate clinical hypotheses that guide the analysis, synthesis, and judgments made by physical therapists about the physical therapy management of their individual patients (Fig. 1.7).

Examination. Older adults typically enter physical therapy with a referral that may contain a few useful facts about the patient's medical history or the medical reason for the referral. In these circumstances the first question to ask oneself is, "Given the facts about the patient that are available before the examination, have any impairments or activity limitations been identified even before the patient is seen for the first time?" The collection of two kinds of clinical data should be integrated into the format for the first clinical encounter. First, as summarized in Box 1.4, there are a number of factors identified in the literature and reviewed elsewhere in this text that may influence the trajectory of a patient from disease to disability. Physical therapists should always account for these potentially enabling–disabling influences as part of the patient examination. Additional information that would assist in setting goals and designing intervention, and information from other disciplines can also be very helpful. Data on the individual's current medical conditions and medications, for example, are extremely relevant.

If the overall goal is to optimize patient function, then one of the first steps is to ascertain the patient's current level of function. Whenever the patient's communication ability is intact, the initial interview begins by allowing patients to identify what they see as the primary activity limitations that have prompted the need for physical therapy. In their formulation of a hypothetico-deductive

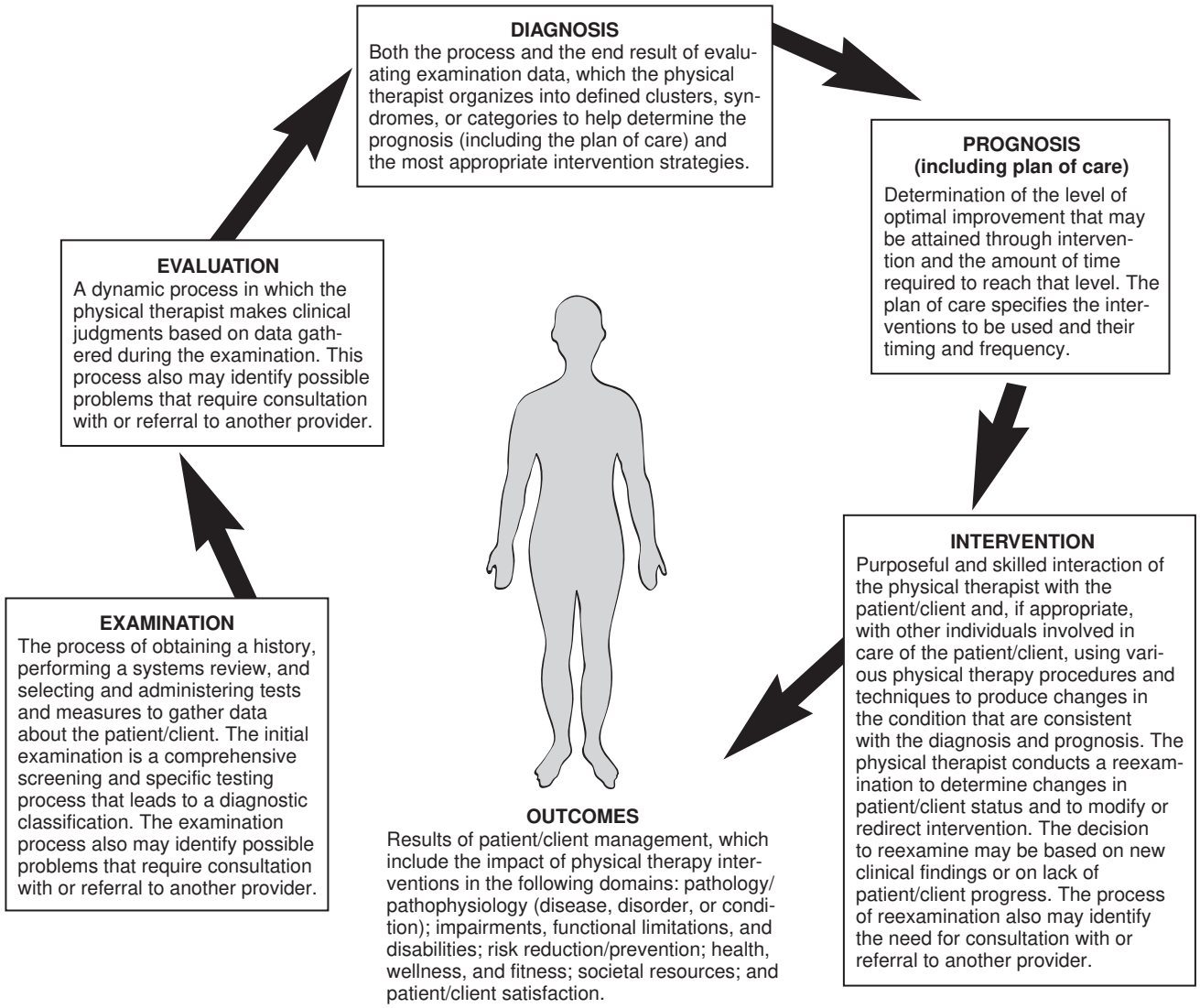

FIG. 1.6 The elements of patient/client management. *(Redrawn from the American Physical Therapy Association. Guide to Physical Therapist Practice. Alexandria, VA: American Physical Therapy Association; 2001: 32.)*

strategy for making clinical judgments, Rothstein and Echternach emphasize the value of listening as patients identify their problems and allowing the individuals to express the desired goal of treatment in their own terms.[34] By talking with the patient, the therapist begins to develop not only a professional rapport but also an appreciation of the patient's understanding of the situation. The input of the patient in terms of preferences, motivations, and goals are central pieces of "evidence" in an evidence-based approach to decision making.[35] This is especially pertinent to care provided to older individuals, who may find their ability to control their own personal destinies compromised by professional judgments made "in their best interests." When the patient is unable to communicate effectively, the therapist may turn to proxy information. The patient's family and friends may be able to give some insight as to what the patient would regard as the goals of intervention. The therapist may also hypothesize about a patient's functional deficits based on previous experience with similar patients.

Data from the history, as well as data on how the patient's problems have been treated in the past, allow the therapist to hypothesize that certain impairments or activity limitations might exist by virtue of the individual's medical condition(s) and sociodemographic and other personal characteristics. For example, suppose the physical therapist learns from the patient's history that the patient has a medical diagnosis of Parkinson disease, that she is 81 years old, and that she lives alone. The diagnosis of Parkinson disease suggests the possibility of the following impairments: loss of motor control and abnormal tone, ROM deficits, faulty posture, and decreased endurance for functional activities. Using epidemiologic research about what activity limitations are likely for women living alone, specific questions about independence in instrumental activities of daily living (IADLs),

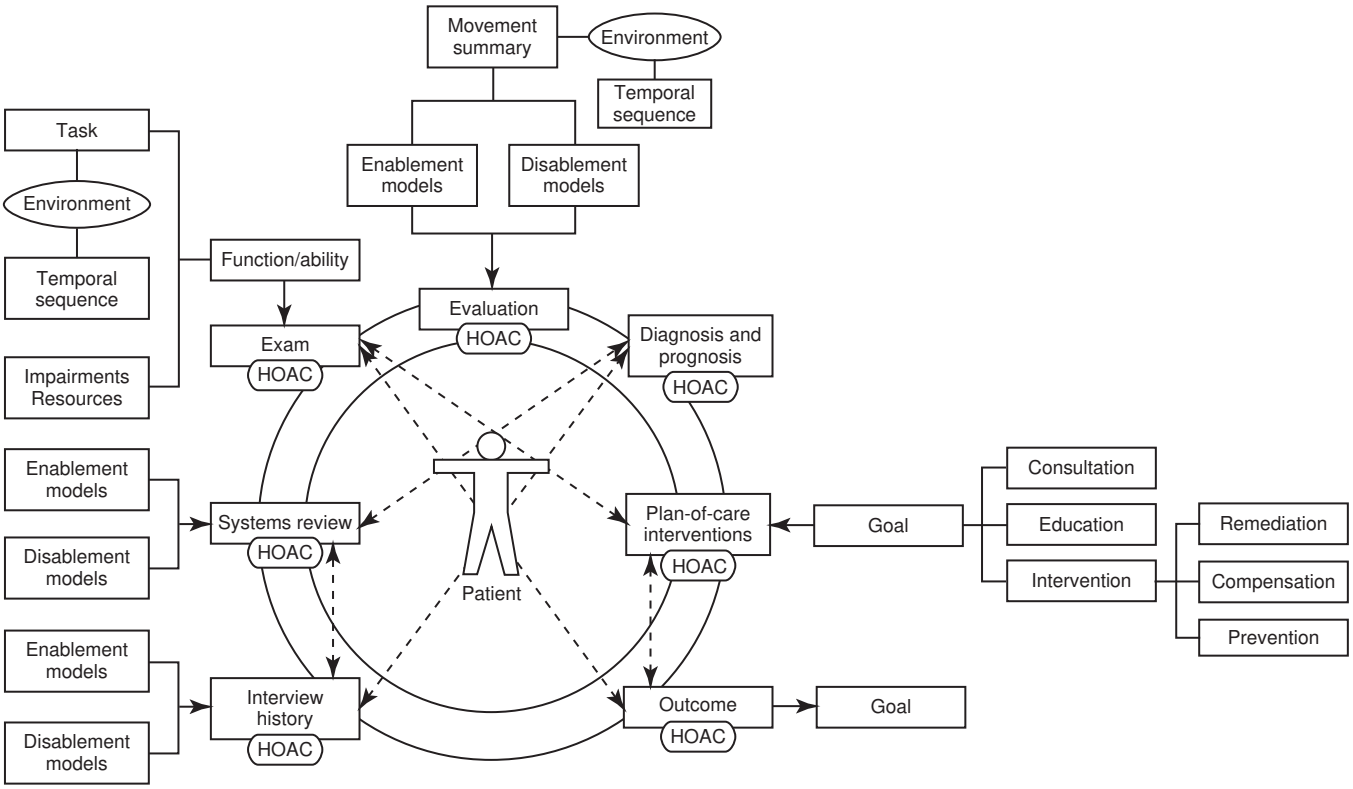

FIG. 1.7 Schenkman's model of integration and task analysis. *HOAC*, Hypothesis-Oriented Algorithm for Clinicians. *(Redrawn from Schenkman M, Duetsch JE, Gill-Body KM. An integrated framework for decision making in neurologic physical therapist practice. Phys Ther. 2006;86:1683.)*

BOX 1.4 Components of Patient History

HISTORY

Previous	Current
• Demographics	• Current conditions
• Social history	• Chief complaint
• Work/school/play	• Current function
• Living environment	• Activity level
• General health status	• Medications
• Health habits	• Clinical labs/tests
• Behavioral health	• Review of other systems
• Family history	
• Medical/surgical history	

with specific tests and measures as indicated, would be appropriate to include in the examination. Social isolation, for example, may lead to depression, which could further aggravate a person's functional difficulties.

Because there is a lot of variability (e.g., physical fitness, cognition, chronic conditions) in older adults, a screen of all systems is crucial to ensure that the physical therapist does not miss a critical finding. Screening begins with a thorough patient history as the physical therapist relies heavily on the clinical presentation of the patient and any signs or symptoms that indicate the need for specific screening tests or questions.[36] Therapists must recognize, for example, when integumentary signs may be indicative of systemic connective tissue disorders or oncologic disease, when the patient would concomitantly benefit from the services of other health care professionals, and when additional signs and symptoms may suggest other impairments that would benefit from physical therapy. The combination of the patient history and screening of systems leads to more focused tests and measures. As physical therapists strive to be efficient, they realize that performing all tests to rule in or out a potential diagnosis is time prohibitive. Expert clinicians rely on "pattern recognition" as well as early generation of hypotheses for interpreting collected data.[37] Concurrent with these observations and interim judgments, the physical therapist may reach a conclusion that the signs and symptoms are not consistent with any pattern of disease or illness that is in the scope of physical therapist practice and may refer the patient to another health care professional.

The therapist initially makes a working hypothesis regarding the underlying cause of any deficits noted during the history and systems review and then selects specific tests and measures that would most likely confirm his or her suspicions about a tentative diagnosis. The process of confirming or refuting clinical impressions is the substance of the examination. Without knowing what you are looking for, it is difficult to know when you find it.

Without this important list of possible conditions or issues, a therapist can get lost in the multitude of impairments and functional deficits that may be present. Thus, the clinical hypothesis (or hypotheses) provides focus for the examination.

During the examination, the therapist should begin by performing a detailed analysis of functional activities (e.g., transferring from the bed to a chair) that also takes into consideration the environment in which the task is being performed. Functional activities will inform impairments that are observed to affect function. Movement analysis is at the crux of establishing a diagnosis that can point to an intervention in the domain of physical therapist practice. Physical therapists are well prepared to identify dysfunction at the level of actions by examining the movement-oriented component of tasks. Specific tests and measures are used in the examination to clarify and characterize the nature and extent of activity limitations and further implicate impairments and other factors that impede performance. Is the inability to climb stairs in an older adult associated with knee and hip extensor weakness? What about balance deficits due to sensory loss in the feet and ankles? Thus, broadening the examination to focus on observing and critiquing the performance of actions and tasks is crucial to ensure a thorough evaluation of the patient's inability to perform specific goal-directed activities. The inability to perform movements needed to execute specific goal-directed activities is particularly relevant to physical therapist practice as they capture the complex integration of systems that permits an individual to maintain a posture, transition to other postures, or sustain safe and efficient movement.

Evaluation and Diagnosis. After the examination, the therapist evaluates the data by making clinical judgments about their meaning and their relevance to the patient's condition and to confirm or reject hypotheses posed during the examination. The therapist then hypothesizes which findings contribute to the patient's functional deficits and will be the focus of patient-related instruction and direct intervention.

It is not unusual for older patients to have multiple impairments and activity limitations, many of which can be identified by a physical therapist and treated using physical therapy procedures. However, the overall purpose of evaluation is twofold: (1) to indicate which deficiencies in functioning prevent a person from achieving optimal well-being and (2) to identify the actions and tasks that are most associated with the patient's current level of function and must be remediated for the patient to reach an optimal functional level. An element of assessing data on the patient's ability to perform functional activities is to determine whether the manner in which actions and tasks are done represents an important quantitative or qualitative deviation from the way in which most people of similar age would perform them. In the absence of norms for age-stratified functional performance, the therapist must bring previous experience with similar patients to bear on this judgment. Even if the therapist concludes that the patient's performance is other than "normal," this judgment does not imply that a person cannot meet socially imposed expectations of what it means to be independent or that an individual is permanently disabled. Furthermore, identifying the impairment alone may not fully explain the inability to perform an activity as the individual's motivation to perform the activity as well as the environment in which it is performed may affect goal achievement. Thus, the physical therapist must review activity limitations in light of other clinical findings that identify the patient's impairments and other psychological, social, and environmental factors that modify function in determining whether a patient will become disabled. Upon completion of the evaluation, physical therapists establish a prognosis and plan of care, if needed.

Physical therapists are encouraged to take an integrated approach to diagnosing deficits in human performance. Deconstructing movement in the context of human performance requires the examination of the complex interaction of sensoriperceptual, biomechanical, neuromotor, respiratory, and circulatory capabilities as well as the influence of personal motivation, cognition, behavior, and the environment on movement. Physical therapists must determine if the limitation in activity is at the level of task, action, and/or impairment. Ultimately, the physical therapist will pose a hypothesis or several hypotheses linking an inability to perform an action to a specific impairment or cluster of impairments. Consider, for example, the range of impairments that might explain the deficit in performing the required actions to accomplish the tasks that compose the activity limitation that is reported as "I can't get to my mailbox to get my mail." Furthermore, suppose that we know that individual has low vision, lives in a second-floor walk-up, is somewhat reluctant to go outside particularly in strong daylight, has osteoarthritis in one knee, and is currently on medication for early stages of congestive heart failure. Each component of this activity (getting the mail) involves a series of tasks to be accomplished (e.g., opening a door, descending stairs, negotiating terrain, handling latches) that require specific actions (e.g., standing, walking, stepping, turning, pulling, grasping, carrying). It is highly likely that several impairments such as decreased muscle strength, reduced joint mobility, limited dynamic balance, or diminished endurance will need to be hypothesized and confirmed to account for this activity limitation.

Prognosis and Plan of Care. The physical therapist uses the data gathered in the evaluation and diagnosis process to state a prognosis, which is a prediction about the optimal level of function that the patient will achieve and the time that will be required to reach that level. Having done that, the therapist and the patient can then mutually agree upon anticipated goals of treatment, which generally are related to expected outcomes of care. Therefore,

the functional outcomes of treatment should be stated in patient-centered (behavioral) terms. On the basis of these anticipated goals and expected outcomes, the physical therapist then completes a plan of care that specifies the interventions to be implemented, including their frequency, intensity, and duration.

When the therapist's attention turns toward planning intervention, the key question is: Of the impairments that are hypothesized to be causal to the patient's activity limitations, which ones require a physical therapist intervention? Furthermore, if the patient's impairments cannot be remediated initially or even with extensive treatment, the physical therapist then seeks to determine how the patient may compensate by using other abilities to accomplish the action or task, and also how the task can be adapted so that the activity can be performed within the restrictions that the patient's condition imposes on the situation. The current evidence base for determining the optimal proportion, timing, and sequence of remediation, compensation, and adaptation of both initial and subsequent plans of care is shallow. Therefore, physical therapists must consider the balance among each of these three intervention approaches dynamically, depending on the persistence of deficits in structure or function, availability of compensatory resources without unintended negative consequences for other functioning, likelihood of full recovery with further remediation, and surmountability of environmental challenges. If it is decided that an individual's impairments and activity limitations are amenable to physical therapy intervention, the therapist should establish a schedule for evaluating the effectiveness of the intervention. If the patient achieves the anticipated goals for changes in impairments but does not also achieve the expected functional outcomes, this is an indication that the therapist has incorrectly hypothesized the relationship between the patient's impairments and functional status. In this instance, the therapist may reexamine the patient to modify the plan of care.

Although a host of procedures and techniques might be used to remediate an impairment or minimize an activity limitation, those that are most likely to promote the outcome and that consider cost-effectiveness should be chosen for inclusion in the plan of care. The combination of direct interventions used with any particular patient will vary according to the impairments and activity limitations that are addressed by the plan of care for that individual. Three patients may have the same activity limitation, for example, an inability to transfer independently from bed to chair, yet require entirely different programs of intervention. If the first individual lacked sufficient knee strength to come to a standing position, then the plan of care would incorporate strengthening exercises to remedy the impairment and improve the patient's function. If the second patient lacked sufficient ROM at the hip owing to flexion contractures to allow full upright standing, then intervention would focus on increasing ROM at the hip to improve function. The third individual may possess all the musculoskeletal and neuromuscular prerequisites to allow function but still require appropriate instruction to do it safely and with minimal exertion. Each individual may achieve a similar level of functional independence, yet none of the three would have received the exact same treatment to achieve the same outcome.

Most of the direct interventions used by physical therapists are aimed at remediating impairments that underlie activity limitations. Although physical therapists sometimes apply therapeutic exercise in the position of function (e.g., standing balance exercises) or try to simulate the environment in which the functional activity is performed (e.g., a staircase), the functional activity in and of itself should not be confused with the core elements of a physical therapist's plan of care, that is, therapeutic exercise and functional training. It is particularly helpful for the therapist working with older adult patients to appreciate that there are some impairments that will not change, no matter how much direct intervention is provided. This realization will diminish unnecessary treatment. In these instances, physical therapists may still achieve positive patient outcomes by teaching patients how to compensate for their permanent impairments by capitalizing on other capabilities or by modifying the environment to reduce the demands of the task. One of the beneficial consequences of a careful deconstruction of an activity limitation into tasks and actions is that this analysis indicates what kinds of outcomes are most suitable to demonstrating the success of the intervention. The most proximate outcomes of the remediation of impairments can be found in an improved ability to perform actions, somewhat irrespective of personal and environmental factors that are outside of the physical therapist's control. In comparison, activity limitations are typically measured with respect to broader outcome measures such as basic and instrumental activities of daily living. Relevant chapters of this book provide recommendations for valid and reliable functional measures to assess the outcomes of a physical therapy episode of care.

SUMMARY

The key principles underlying contemporary geriatric physical therapy practice described in this chapter are woven throughout the remainder of this book. The need is great and opportunities abound for talented physical therapists committed to optimal aging and ready to apply best evidence, to fully develop their clinical expertise, and work collaboratively with their patients and other health care providers. It is a time full of opportunity to be a geriatrically focused physical therapist. However, whether as a geriatrically focused physical therapist or a physical therapist who occasionally treats older patients, the number and complexity of the older adult patients among the caseload of all physical therapists will increase in the decades to come, emphasizing the clinical relevance of the material in this book.

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CHAPTER

2

Aging Demographics and Trends

Dale Avers

OUTLINE

INTRODUCTION

The older adult population, most commonly referring to individuals 65 years and older, is a diverse group, so much so that it is impossible to describe an 82-year-old individual accurately. An 82-year-old could be scaling the most challenging rock faces,[1] running a marathon, regularly fast-speed walking, sedentary but independent, or frail and near death. What are the implications of this variability in how one ages on physical therapy practice? The purpose of this chapter is to review the sociodemographic characteristics of older adults in America, then relate these factors to mortality, morbidity, and function in this population. In doing so, we shall find that conflicting portrayals of older persons as active and healthy or as sick and frail are neither incorrect nor contradictory, but more appropriately applied to only some segments of an increasingly heterogeneous population.

Although physical therapists implement plans of care that are individualized, they also tend to categorize patients according to the various physical, psychological, and social characteristics they expect to encounter associated with these characteristics. Knowing that individuals with certain characteristics—for example, being a particular age or sex—are more likely to experience a particular health problem can assist physical therapists in anticipating some clinical presentations, placing an individual's progress in perspective, and even sometimes altering outcomes through preventive measures. It is also useful to know the prevalence of a particular condition (i.e., the number of cases of that condition in a population) and its incidence (the number of new cases of a condition in a population within a specified time period). Taken beyond examination of a single person, physical therapists can use this information to plan and develop services that will meet the needs of an aging society whose members span a continuum across health, infirmity, and death.

However, when considering a demographic such as the high prevalence of dementia in women over the age of 85 years, it is easy to stereotype all 85-year-old women as being confused or unmotivated. This stereotyping, albeit unintentional, is called ageism. Ageism is the negative stereotyping that leads to prejudice and therefore discriminatory practice[2] such as low expectations or inadequate exercise prescription. Although a study of demographics may appear to easily promote stereotyping because of the nature of population statistics, viewing these demographics from the perspective of the diversity of the older adult population will help decrease stereotyping and optimize person-centered care for each older adult.

There is one critical caveat to any of the inferences about aging or older persons that may be drawn from the data given later. Much of what we know in the United States about gerontology and geriatrics has been derived from two specific cohorts. Many of the first cohort, born between 1885 and 1920 and reaching age 65 between 1950 and 1985, came to America as impoverished child immigrants or were born into families recently arrived in

America. Thus, the initial emergence of gerontological research in the 1970s is based largely on these individuals, whose early health and vitality into adulthood were determined long before the medical advances and economic prosperity that marked the "American Century." Their children, born between 1910 and 1945 and turning age 65 between 1975 and 2010 and the parents of the baby boomers, make up the second cohort, whose experiences define our current-day understanding of aging. Geriatric and gerontological research in this group is contextually situated in the defining events of the first half of the 20th century: two world wars and the Great Depression. Therefore, whenever we analyze aging in terms of physical health or social well-being, we must appreciate that our understandings are based on a unique cohort and not necessarily what will be the norm in the future. A very different, third cohort of older adults, called the post–World War II "baby boom" generation, were born between 1946 and 1965. This cohort began to turn 65 years of age in 2011. Typical of this generation, we can expect that gerontological theories and geriatric practice—geriatric physical therapy included—will change markedly by the mid-21st century to accommodate new findings that emerge from scientific study of this third and markedly distinct cohort. Many "boomers" will be more active in their later years. They'll continue to bike, hike, swim, sail, and ski. They'll be more likely to relocate and go where the physical and intellectual action is. Boomers expect to work at least part time after retirement and will be adept with technology compared to their parents. These trends will be described in this chapter.

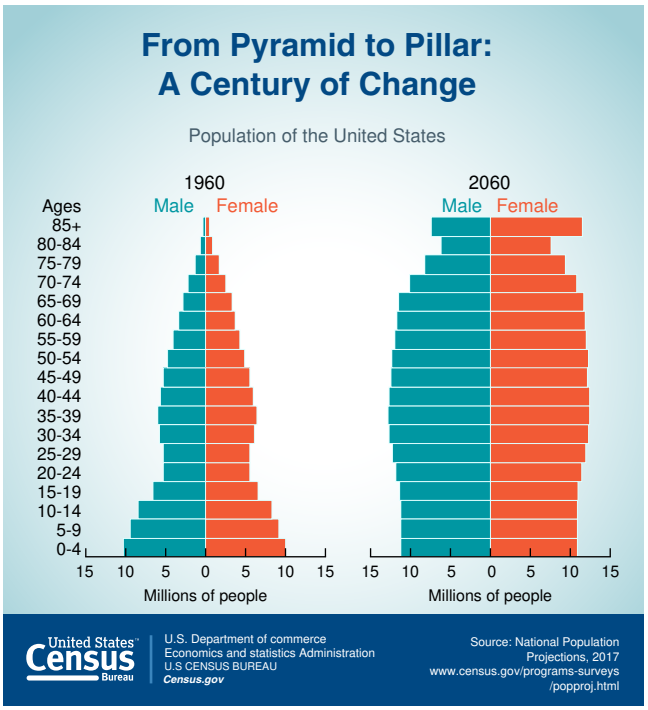


FIG. 2.1 1960 pyramid to 2060 pillar. *(From National Population Projections. 2017. http://www.census.gov/programs-surveys/popproj.html.)*

DEMOGRAPHY

Defining "Older" Adult

The first gerontological question is, how does a particular segment of a population come to be categorized as "older"? The chronological criterion that is presently used for identifying the older adult in America is strictly arbitrary and usually has been set at age 65 years. However, the onset of some "geriatric" health problems of older individuals may occur in the early 50s. And athletes over the age of 40 may be called "master athletes." As the mean age of the population increases and more individuals live into their 9th and 10th decades, we can expect that our notion of who is "older" will change.

Population Pyramids

Population pyramids are useful to view large trends of population in graphic form. From a population pyramid you can view the size of various age groups by year and sex and how they compare over several generations. Historically, as illustrated in the 1960 pyramid of Fig. 2.1, an age–sex pyramid had the longest bars of the graph at the bottom of the pyramid, indicating a large population of infants and children, with declines toward the top due to death rate. However, the shape of this pyramid has gradually changed over time such that, by 2060, the pyramid is projected to reflect a more rectangular shape, indicating a very slow rate of population growth as shown in the 2060 pyramid of Fig. 2.1. This slow rate of growth reflects a lower birth rate for more recent years and longer lives for those born in earlier generations. For example, in the current pyramid of 2020 (Fig. 2.2) the sharper point reflects the last of the World War II generation and the majority of the pyramid is more rectangular, indicating, as in the 2060 pyramid, a slowing population growth (declining birth rate) and an aging population (declining death rate).

Another way to think about population structure is to examine dependency ratios. Dependency ratios provide an indicator of the *potential* burden on the working-age (i.e., tax-paying) population. Youth dependency is the ratio of the population under age 20 to the population aged 20 to 64, whereas old-age dependency is the ratio of the population age 65 and older to the population aged 20 to 64. Although the youth dependency ratio is projected to increase slightly between 2020 and 2040, indicating a slightly higher birth rate compared to those between ages 20 and 64, the old-age dependency ratio is projected to skyrocket, increasing by more than 50% by 2030.[3] Implications are that the labor force is reduced,

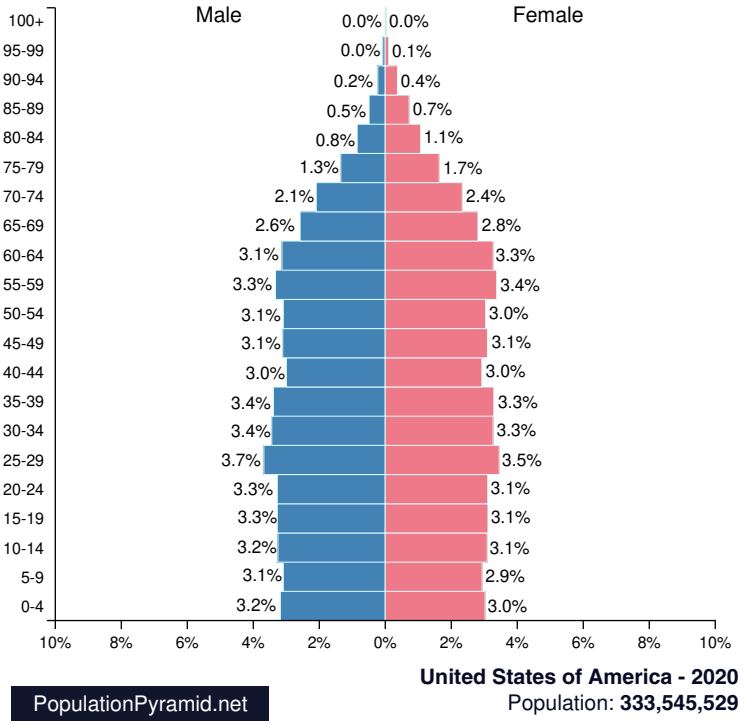


FIG. 2.2 2020 pyramid. *(From PopulationPyramid.net.)*

decreasing overall economic spending and tax revenues. At the same time there is increased government spending through payment of pensions and social security and in higher health care costs. This increased dependency on government services with fewer people contributing to the federal budget through the workforce will create budget issues and will drive policy. Although these implications can be viewed as an economic crisis, two factors can be seen as mitigating this potential crisis. Immigration may introduce more adults of younger, working age into the workforce, and children born in the 1980s and 1990s entering the workforce will partly offset the boomer exit. There is much debate about the meaning of the high old-age dependency ratio, a debate that will drive policy. But as will be mentioned many times throughout this chapter, physical therapists can positively impact the effects of this trend by helping older adults stay healthy and therefore less dependent.

U.S. Population Estimates and Age Structure

The number of Americans age 65 years and older continues to grow at an unprecedented rate. In 2015, the best available estimate of persons age 65 years or older was 47.8 million,[4] reflecting the major changes in the population structure of the United States in the past century. In 1900, individuals who had reached their 65th birthday accounted for only 4% of the total population. In 1940, they were 6.9% of the population, and by 1950, they were equal to 8.2%. Although they represented just fewer than 10% of the population in 1970, they currently account for nearly 15% of the U.S. population.[4] By 2020, for the first time in history, people age 65 and over will compose 20% of the population and will outnumber children under the age of 5.

Those individuals born between the years 1946 and 1965 (the baby boomer cohort) currently represent nearly 25% of the overall U.S. population. This boomer cohort will be responsible for the majority of the growth in the 65-and-older population between the years 2010 and 2030. By 2030, older adults are predicted to account for nearly 20% of the total U.S. population.[5] Fig. 2.3 illustrates the impact of the baby boomer generation on aging in the United States.

Despite the "young-old" baby-boomer group being the prime group responsible for the rapid increase in the overall older adult population, the segment within the older population that is growing the fastest is the "old-old" group, that is, individuals over 85 years of age. Individuals older than 85 years of age grew from just over 100,000 in 1900 to 6 million in 2014 and is projected to grow to 20 million by 2060 (Fig. 2.4).[6] In 2014, older women accounted for 66% of the population age 85 and older. Between 1980 and 2016, the centenarian population experienced a 44% growth, a larger percentage increase than in the total population. In 2016, there were 81,896 persons age 100 and over (0.2% of the total 65-and-over population), a number that is more than double the 1980 figure of 32,194.[7] More than 80% of centenarians were female.

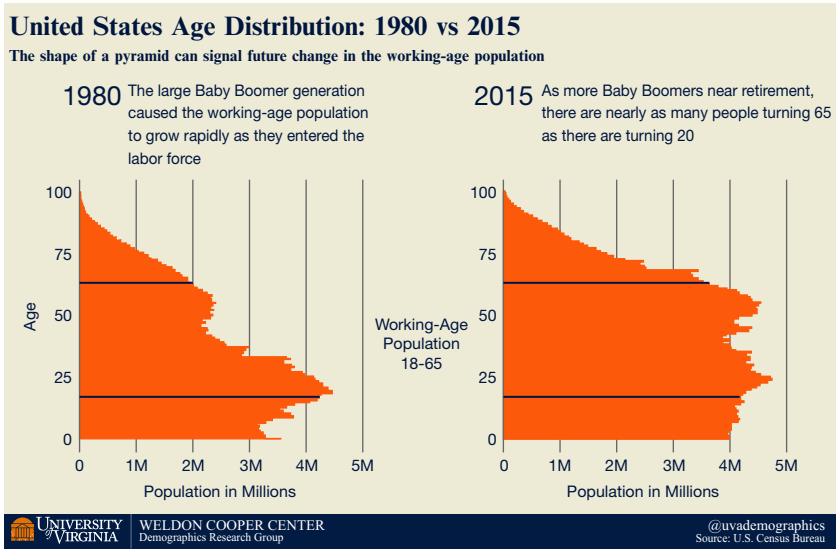
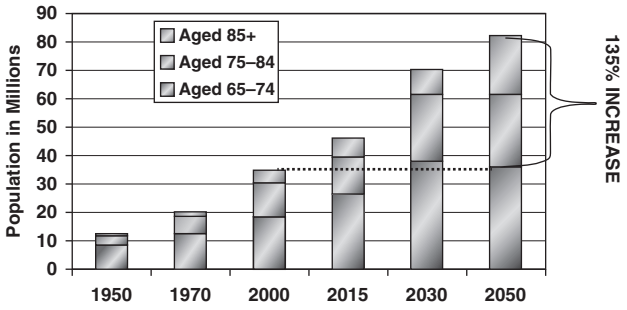


FIG. 2.3 Impact of the Baby Boomer generation on aging in the United States. *(From Weldon Cooper Center, Demographics Research Group @uvademographics. Source: U.S. Census Bureau. http://statchatva.org/2016/11/02/in-most-of-the-united-states-the-working-age-population-is-now-shrinking/.)*



Source: (NP-T4) Projections of the Total Resident Population by 5 Year Age Groups, Race, and Hispanic Origin with Special Age Categories: Middle Series, 1999 to 2100

Population of Americans Aged 65 and over, in Millions

FIG. 2.4 Growth of populations over age 65 and over age 85. *(From https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1464018/; Knickman JR, Snell EK. The 2030 problem: caring for aging baby boomers. Health Serv Res. 2002;37(4):849-884.)*

Life Expectancy

A child born in 2016 could expect to live 78.6 years, more than 30 years longer than a child born in 1900 (47.3 years). In the first half of the 20th century, mortality declined primarily as a result of advances in health at birth and younger ages, especially infant mortality. However, by 2000, the changes in life expectancy were primarily the result of reduced mortality at older ages, not the least of which was the dramatic increase in the number of adults who lived to age 80 years and beyond. In 1900, a person who lived until age 65 years might expect another 12 years of life. In 2016, additional life expectancy had grown to 19.4 years: 20.6 years for women and 18 years for men.[7] Female life expectancy continues to outpace male life expectancy, despite gains made for both sexes, although the gap has begun to decrease. There is some concern that because of a variety of factors (e.g., past smoking, current obesity levels, socioeconomic inequalities, and environmental issues), especially for women age 50 and over, life expectancy may begin to decrease rather than increase as evidenced in the decrease of life expectancy from birth, from 78.7 years in 2016 to 78.6 years in 2017, as illustrated in Fig. 2.5.[8,9]

Racial differences in life expectancy have been demonstrated. White women generally live the longest, whereas black women and white men live about the same as each other and black men have the lowest survivorship.[10] Table 2.1 illustrates the projections in life expectancy for the years 2012 and 2050 by sex, race, and Hispanic origin at birth, if one survives to age 65 and to age 85.[10]

Growth of Race and Ethnicity Populations

The United States' older population is becoming increasingly more racially and ethnically diverse as the overall minority population grows and experiences increased longevity and the shrinking of the non-Hispanic white-alone population.[11] Between 2016 and 2030, the white (non-Hispanic) population age 65 and over is projected to only increase by 39%, compared to 89% for older racial and ethnic minority populations.[7] Racial and ethnic minority populations have increased from 6.9 million in 2006 (19% of the older adult population) to 11.1 million in 2016 (23% of older adults) and are projected to increase to 21.1 million in 2030 (28% of older adults). Fig. 2.6 provides a breakdown of this growth by racial and ethnic group.[12]

One of the significant challenges facing the geriatric physical therapist will be the increasing diversity among older adults. From 2015 to 2060, the number of black

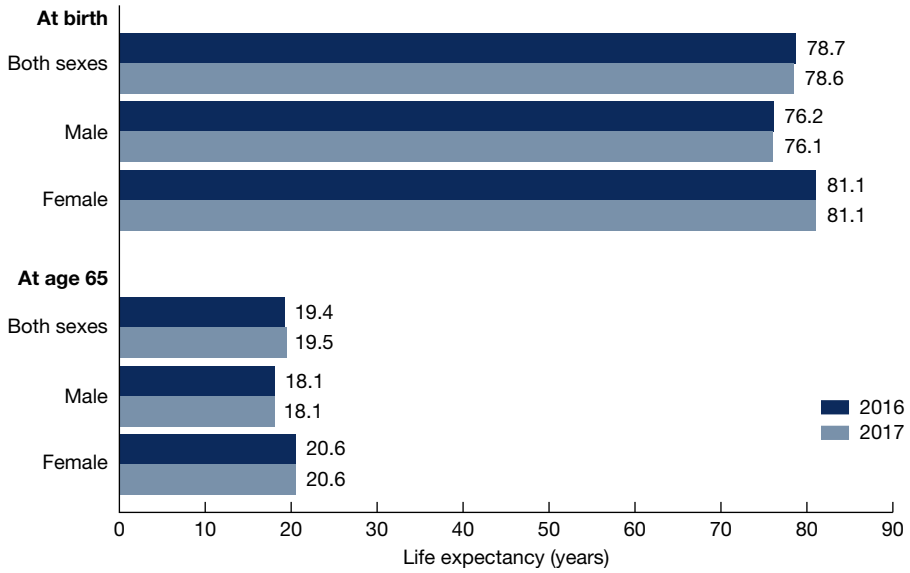


FIG. 2.5 Life expectancy for years 2016 and 2017. *(From https://www.cdc.gov/nchs/products/databriefs/db328.htm.)*

TABLE 2.1 Projections of Life Expectancy by Sex, Race, and Hispanic Origin at Ages 0, 65, and 85 Years

		Age 0		Age 65		Age 85	
		2012	2050	2012	2050	2012	2050
Race and Hispanic Origin	Sex			Added Years		Added Years	
Non-Hispanic white and Asian or Pacific Islander	M	77.1	82.2	18.1	20.6	6.0	7.0
	F	81.7	86.2	20.7	23.5	7.1	8.5
Non-Hispanic black and American Indian or Alaska Native	M	71.7	79.0	16.3	19.2	6.3	7.0
	F	78.0	83.5	19.5	22.3	7.4	8.4
Hispanic (of any race)	M	78.9	82.2	19.5	20.6	7.1	7.0
	F	83.7	86.2	22.1	23.5	8.0	8.5

Source: U.S. Census Bureau 2012 National Projections.

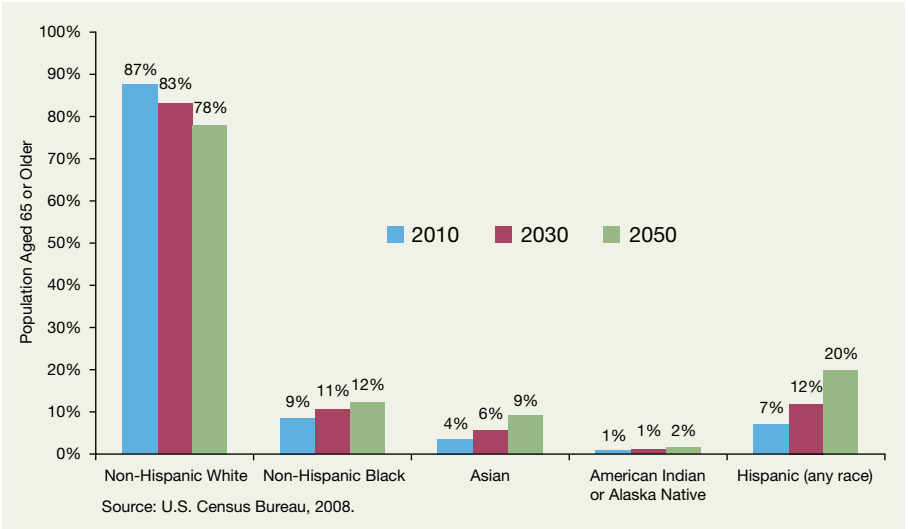


FIG. 2.6 U.S. population aged 65 years or older and diversity 2010–50. *(From Centers for Disease Control and Prevention. State of Aging and Health in America 2013. https://www.cdc.gov/aging/agingdata/data-portal/state-aging-health.html. Accessed February 9, 2019.)*

older adults in the United States will nearly triple and the number of Hispanic older adults will more than quintuple, whereas the number of whites will less than double. This increase is the result of both higher birth rates and immigration. Hispanics and Asians are changing the balance between majority and minority, just as Southern and Eastern European immigrants did a century ago when their numbers overtook those for immigrants from Northern and Western Europe. Immigration is driven largely by young people from Asia and Latin America drawn by economic opportunities, who themselves will become older someday.

While most foreign-born elders have been in the United States many years, the numbers of older newcomers, especially from Asia and Latin America, are increasing. Older immigrant arrivals are typically the parents of children who are US citizens; often, these children sponsor their parents' immigration so they can help with childcare and housework.[13] Newcomers differ from the elders who arrived earlier. They are less familiar with American customs and less fluent in English. On average, they are more socioeconomically disadvantaged than U.S.-born older adults or long-term immigrants. Without jobs, pensions, or government benefits, they often look to offspring for support.[13] Clearly, the geriatric physical therapist must be prepared to communicate in languages other than English and practice cultural humility,* especially in increasingly diverse areas. For example, approximately 60% of the residents of the District of Columbia are black and 60% of the residents of Hawaii are Asian/Pacific Islander. In New Mexico, California, and Texas—the states with the highest proportion of Hispanics—more than 30% of people age 65-plus are not white.[14] About one-third of older adults in California (35%), New Mexico (35%), and Hawaii (30%) spoke a language other than English at home in 2014. About one-fourth in Texas (26%) and New York (25%) were non–English speaking at home.[14]

Sex Distribution and Marital Status

The ratio of men to women changes over the human life span. For every 100 female births, 105 male births occur. As time passes, the number of males continues to exceed females until the third decade (ages 20 to 29). Because of life events such as war and accidents, from that age on, women increasingly outnumber men. For every 100 females in the 65 to 74 age group, we find only 86 males. Their number continues to drop to 72 for 100 females in the 75 to 84 age group. For the 85 and older age group, the sex ratio becomes even more pronounced, expanding to an astounding 49 men for every 100 women. Clearly, the oldest-old segment is dominated by women.

In 2017, a larger percentage of older men were married as compared with older women—70% of men, 46% of women. Widows accounted for 33% of all older women in 2017. There were more than three times as many widows (8.9 million) as widowers (2.5 million).[7] Divorce and separated rates have increased since 1980 when approximately 5.3% of the older population were divorced or separated/spouse absent compared with 15% in 2017.[7]

It has been long thought, based on one study, that married people (especially men) have a lower mortality at all ages than their unmarried peers.[15] However, closer scrutiny reveals that the study made an assumption that divorced or widowed individuals never were married, an obvious misrepresentation.[16] What is known is that two groups of people live the longest: those who got married and stayed married, and those who stayed single. This is true for both men and women. What seems to matter to longevity is consistency, not marriage.[16,17] However, women may do better than men when living alone, whereas men do relatively better when they live with other people, typically a wife.[17] This may be because of a greater freedom to pursue one's own interests if single and female and the positive effect of socialization. Men are less satisfied with the number of friends they have, whereas women are always more satisfied with the number of friends they have, regardless of living situation.[17] However, the male boomers are generally a more independent group, and thus, this trend may change.

In addition to the caregiving burdens and socioeconomic implications of being partnered, loss of a significant other brings its own set of psychosocial challenges to the individual in contemporary society. Any individual whose identity is linked to being a couple or part of a long-term relationship may experience a severe disruption of social roles when left alone. This disruption complicates the search for self-validation through the recognition, esteem, and affection of another who may have been present in a marital or partnered relationship.

Living Arrangements and Environments

As depicted in Fig. 2.7 illustrating 2017 data, 59% of community-dwelling older persons lived with their spouse or partner. The vast majority were men (72%), compared with 48% of older women. This proportion decreased with age, especially for women. Of women 75 years of age and older, 66% lived alone.[7]

Living arrangements differed by race and Hispanic origin for older adults. For example, older black and non-Hispanic white adults were most likely to live alone compared with Asian and Hispanic older adults (Fig. 2.8).[6] Additionally, older women of black and non-Hispanic white groups were almost twice as likely to live alone (43% black and 37% non-Hispanic white) as were Asian and Hispanic older women (20% Asian

*The reader is referred to the chapters on psychosocial principles and patient education within this text for discussions of cultural humility (see Chapters 4 and 11).

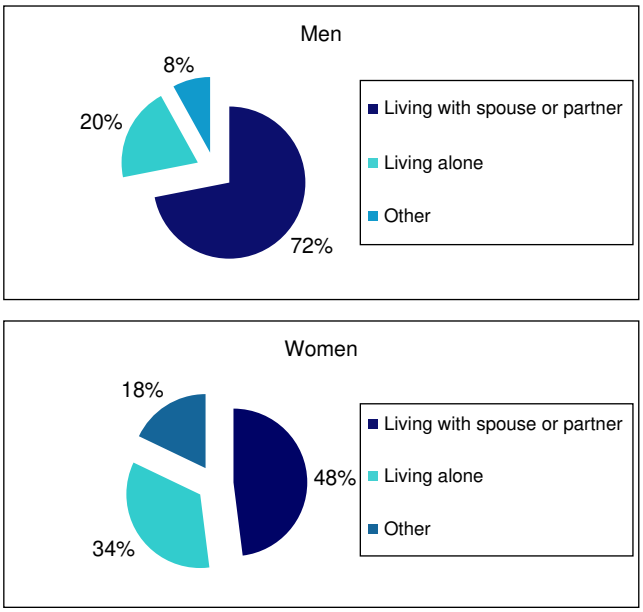


FIG. 2.7 Living arrangements by sex of persons 65 and older. *(Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement/U.S. Census Bureau, American Community Survey; Current Population Survey, Annual Social and Economic Supplement 1967 to present; Table AD3. Living arrangements of adults 65 to 74 years old, 1967 to present; Table AD3. Living arrangements of adults 75 and over, 1967 to present.)*

and 23% Hispanic). About 30% of older black men lived alone compared with 20% of non-Hispanic white men and just 10% of older Asian men.[6]

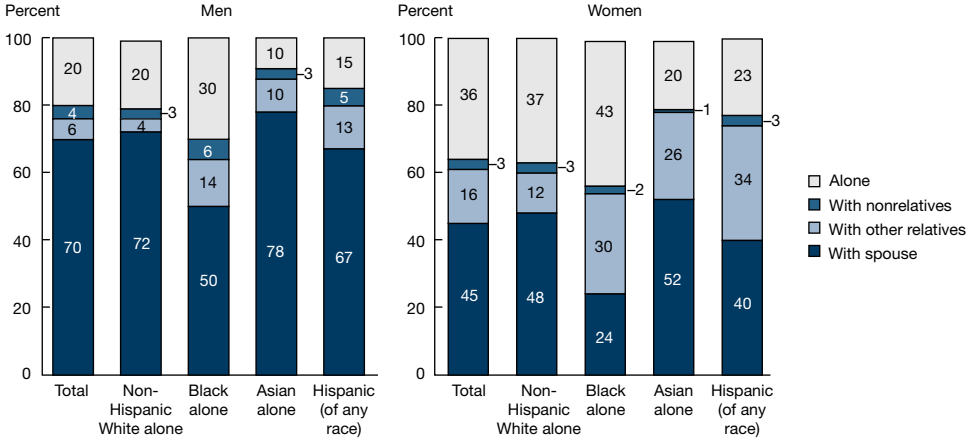
The Pew Research Center found that multigenerational family households were increasing, driven in part by the job losses and home foreclosures of recent years but also because of social factors including delayed marriage of children and the wave of immigration that has occurred since 1980.[18] Since 1990, the share of those aged 65 years and older who live in multigenerational family households has grown to 20%, compared with 17% in 1990.[18] Racial minorities and Hispanics were far more likely to live in multigenerational homes than non-Hispanic white older adults.[19] Of those older adults who live with children, 58% were the household head.

A majority of housing occupied by older adults (88%) in 2011–15 consisted of either detached single-family houses (68%) or apartments/condos (19%). Attached one-family houses (6%), mobile homes or trailers (6%), or boats, recreational vehicles, vans, and so forth (0.1%) made up the balance of older adult-occupied units.[19] Of the housing units occupied by older adults, 44% were built in 1969 or earlier, which has implications for the ability to age in place. Renovations and repairs are likely to be needed in older housing to make the housing safe and accessible. Twenty-four percent rented their housing. Approximately 44% of older householders spent more than one-third of their income on housing costs—36% for owners and 78% for renters.[7]

The vast majority of individuals aged 65 years and over (93%) live in traditional community settings as described previously but may receive help through informal care by family and friends, in-home support (e.g., meals), personal care assistants, adult day care, and senior

The living arrangements of America's older population are linked to income, health status, and the availability of caregivers.

Living arrangements of the population age 65 and over, by sex and race and Hispanic origin, 2015



NOTE: Living with other relatives indicates no spouse present. Living with nonrelatives indicates no spouse or other relatives present. The term "non-Hispanic White alone" is used to refer to people who reported being white and no other race and who are not Hispanic. The term "Black alone" is used to refer to people who reported being Black or African American and no other race, and the term "Asian alone" is used as a method of presenting or analyzing data. The U.S. Census Bureau uses a variety of approaches.
Reference population: These data refer to the civilian noninstitutionalized population.
SOURCE: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement.

FIG. 2.8 Living arrangements by sex, race, and Hispanic origin. *(Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement.)*

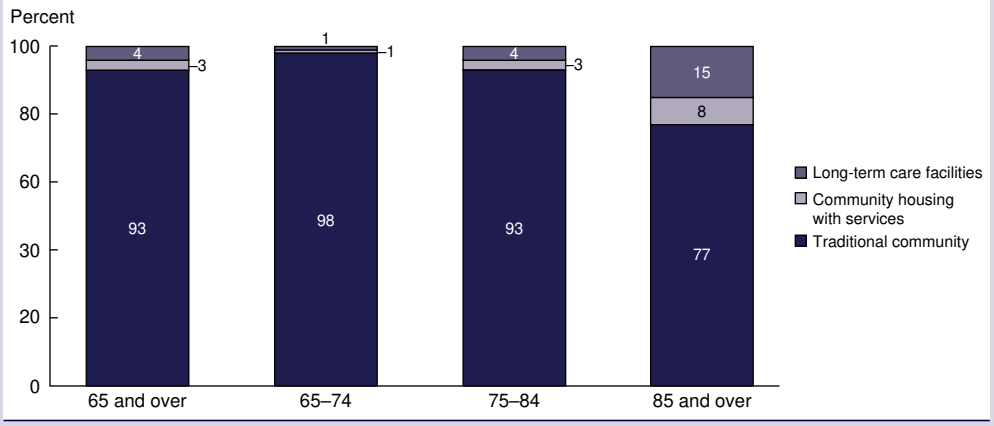
living residences. Residential housing with services such as meals, medication assistance, household cleaning, and transportation provides an option for those who choose or cannot live independently. Approximately 3% live in residential housing with services such as assisted living.[6] Another 3.1% live in a long-term care setting (1.5 million), which has decreased since the year 2000 (5%). The percentage who reside in long-term care settings dramatically increases with age as shown in Fig. 2.9. Of those who reside in long-term care, only 1% are persons aged 65 to 74 years; 4% are persons aged 75 to 84 years and 15% are persons aged 85 years and above.[7] In addition, people with dementia and women were more likely to move into long-term care facilities during the last months of life.[20] The vast majority of long-term care residents are non-Hispanic white (76%, compared with 14% non-Hispanic black and 5.2% Hispanic).[21] Obviously physical therapists working in a short-term or long-term rehabilitation setting will be treating patients who are considered "old-old" and may be near the end of their life, a point of consideration and awareness.

The increasing number of older adults combined with the value of independency has pushed the industry to develop other residential options that provide non-health-related services. Of those aged 85 years and older, 15% live in community housing with non-health-related services.[6] In 2014, approximately 180,000 older adults received care in adult day service centers and 780,000 individuals aged 65 years and over lived in residential care communities such as assisted living centers.[6] However, 59% of the cost of residential options is covered by the public sector, with out-of-pocket expenses accounting for the other 41%.[22] As the pool of individuals aged 85 and over swells in 2030 and beyond, economists warn of the crisis that is looming in providing long-term care for all who may need it. Again, an opportunity for physical therapists is to create the expectation that older adults can age successfully and remain independent to age in place (as most older adults desire), and to assist them to do this. Projections from work done in the late 1990s suggest that reducing the rate of disability of 1.5% a year over the coming decades would maintain the current level of economic burden of long-term care.[23] In fact, there is some data that suggests that disability rates are declining at a 2.2% per annum rate (1999–2004), driven by improving health. However, concerns exist about whether these recent trends will be sustained owing to the obesity prevalence.[24]

Economic Status

The tendency to regard older adults as a homogeneous group biases any understanding of their economic status. The heterogeneity of this population group is perhaps best illustrated by considering who is financially well-off and who is economically disadvantaged among older adults. Overall, the entrance of the youngest stratum of older adults, who benefit from private and workers' pension programs, has improved the economic well-being of older adults as a whole, as the proportion of older adults living

Percentage distribution of Medicare beneficiaries age 65 and over residing in selected residential settings, by age group, 2013



NOTE: Community housing with services applies to respondents who reported they lived in retirement communities or apartments, senior citizen housing, continuing care retirement facilities, assisted living facilities, staged living communities, board and care facilities/homes, and similar situations AND who reported they had access to one or more of the following services through their place of residence: meal preparation, cleaning or housekeeping services, laundry services, or help with medications. Respondents were asked about access to these services, but not whether they actually used the services, A residence (or unit) is considered a long-term care facility if it is certified by Medicare or Medicaid: or has 3 or more beds, is licensed as a nursing home or other long-term care facility, and provides at least one personal care service; provides 24-hour, 7-day-a-week supervision by a nonfamily, paid caregiver.
Reference population: These data refer to Medicare beneficiaries.
SOURCE: Centers for Medicare & Medicaid Services, Medicare Current Beneficiary Survey, Access to Care.

FIG. 2.9 Percentage distribution of Medicare beneficiaries aged 65 and over residing in selected residential settings, by age group, 2013. *(Source: Centers for Medicare & Medicaid Services, Medicare Current Beneficiary Survey, Access to Care. U.S. Department of Health and Human Services. Key Indicators of Well-Being | ACL Administration for Community Living. https://acl.gov/aging-and-disability-in-america/data-and-research/key-indicators-well-being. Published 2018. Accessed February 6, 2019.)*

in poverty has shrunk from 35% in 1959 to 9.3% in 2016.[7] Poverty increases after age 75 years, however, with women more often in poverty than men, and older Hispanics and older blacks experiencing greater economic deprivation than non-Hispanic whites.[7] Furthermore, although older adults may be less likely to enter into poverty than individuals younger than age 18 years, people age 65 years and older who do enter poverty are less likely to transition out than their younger counterparts.

Social security benefits accounted for 33% of the aggregate income of the older population and accounted for 90% or more of total income received by 33% of beneficiaries.[7] The four highest-budget items accounting for nearly 80% of an older adult's expenditures were for housing (33%), transportation (17%), food (12.6%), and health care expenditures, which increased with age from 12.2% for those aged 65 to 74 to 15.6% for those aged 75 years and older.[25] Health costs incurred on average by older consumers in 2016 consisted of $4159 (69%) for insurance, $913 (15%) for medical services, $715 (12%) for drugs, and $207 (3%) for medical supplies.[7]

MORTALITY

Causes of Death

As displayed in Table 2.2, heart disease and cancer are the leading causes of death for females and males over 65 years of all races and ethnicities, accounting for nearly half of all deaths in 2016.[26,27] Despite the position of heart disease as the leading cause of death since before 1980 and stroke as one of the top four causes of death, age-adjusted death rates in the United States from heart disease and stroke have declined in the past 35 years, most likely because of improvements in the detection and treatment of hypertension as well as improvements in emergency and critical care. However, death rates for both diabetes and respiratory diseases increased dramatically in the same period as shown in Table 2.2. Given the role of physical activity, exercise, and behavior change in primary and secondary prevention as well as rehabilitation of all of these conditions, physical therapists are able to make a major contribution to the well-being of the geriatric population.

MORBIDITY

Chronic Conditions

Chronic diseases are broadly defined as conditions that last 1 year or more and require ongoing medical attention or limit activities of daily living or both. Chronic disease health care management is responsible for over 90% of the $3.3 trillion annual health care costs in the United States (all ages) and account for most of the deaths in the United States.[28] Approximately 60% of adults (individuals 18 years and older) have at least one chronic disease/condition and 12% had five or more as illustrated in Fig. 2.10.[29] The risk of having a chronic condition increases with age. For example, based on 2012 data from community-dwelling Medicare beneficiaries, 63% of individuals aged 65 to 74 years had multiple chronic conditions, which increased to 78% for those aged 76 to 84 years and to 83% for those aged 85 years or older.[30] Specifically, Alzheimer disease (the fifth-leading cause of death for older people) and infectious diseases such as flu and pneumonia affect older adults at higher rates.[30] Individually, as the number of chronic conditions

TABLE 2.2 Leading Causes of Death and Numbers of Deaths for Those Aged 65 Years and Older, 1980 and 2016

	1980		2016	
Rank	Cause of Death	Deaths	Cause of Death	Deaths
1	Diseases of heart	595,406	Diseases of heart	507,118
2	Malignant neoplasms	258,389	Malignant neoplasms	422,927
3	Cerebrovascular diseases	146,417	Chronic lower respiratory diseases	131,002
4	Pneumonia and influenza	45,512	Cerebrovascular diseases	121,630
5	Chronic obstructive pulmonary diseases	43,578	Alzheimer disease	114,883
6	Atherosclerosis	28,081	Diabetes mellitus	56,452
7	Diabetes mellitus	24,844	Unintentional injuries	42,479
8	Unintentional injuries	24,844	Influenza and pneumonia	53,141
9	Nephritis, nephrotic syndrome, and nephrosis	12,968	Nephritis, nephrotic syndrome, and nephrosis	41,095
10	Chronic liver diseases and cirrhosis	9519	Septicemia	30,405
	Total	1,341,848	Total	2,003,458

Source: National Vital Statistics System. Vital Statistics for the United States, 1980. Volume II – Mortality, Part A. 1985; Public-Use 2016 Mortality File. Xu JQ, Murphy SL, Kochanek KD, Bastian B, Arias E. Deaths: final data for 2016. National Vital Statistics Reports. Hyattsville, MD: National Center for Health Statistics; 2018, vol. 67. Available from https://www.cdc.gov/nchs/products/nvsr.htm. See Appendix I, National Vital Statistics (NVSS).

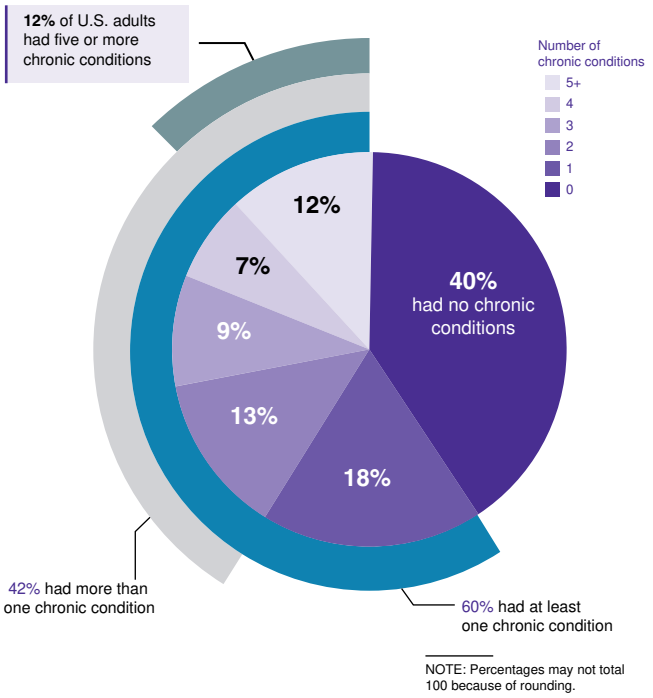


FIG. 2.10 Prevalence of chronic conditions. *(From Buttorff C, Ruder T, Bauman M. Multiple Chronic Conditions in the United States. Santa Monica, CA: Rand Corporation; 2017. https://www.rand.org/content/dam/rand/pubs/tools/TL200/TL221/RAND_TL221.pdf. To get permission: www.rand.org/pubs/permission.)*

TABLE 2.3 10 Most Common Chronic Diseases and Behaviors for Adults Aged 65 Years and Older

Disease	Percentage of Older Adults	Behaviors Causing Most Chronic Diseases*
Hypertension	58%	Tobacco use and exposure to second-hand smoke
Hyperlipidemia	47%	Poor nutrition, including diets low in fruits and vegetables and high in sodium and saturated fats
Arthritis	31%	Lack of physical activity
Ischemic heart disease	29%	Excessive alcohol use
Diabetes mellitus	27%	
Chronic kidney disease	18%	
Heart failure	14%	
Depression	14%	
Alzheimer disease and dementia	11%	
Chronic obstructive pulmonary disease	11%	

*From https://www.cdc.gov/chronicdisease/about/index.htm.
Adapted from https://www.ncoa.org/blog/10-common-chronic-diseases-prevention-tips/.

increases, the risk for dying prematurely, being hospitalized, and even receiving conflicting advice from health care providers increases. The most common chronic conditions for adults over age 65 years and the risk behaviors causing most chronic diseases are listed in Table 2.3.[31,32]

Besides being the cause of most deaths for older adults, chronic diseases/conditions often affect quality of life and ability to perform important and essential activities, both inside and outside the home. The physical limitations that so often accompany chronic conditions such as arthritis and stroke are of particular concern to physical therapy professionals. Loss of the ability to care for oneself can mean a loss of independence and lead to the need for a more restrictive environment such as residential care. The inability to perform daily activities can adversely affect an individual's engagement in life and enjoyment of family and friends. Social isolation and depression can result.

Much of the illness, disability, and premature death from these conditions can be prevented with healthier behaviors, more supportive environments, and better access to preventive health services. Efforts to prevent chronic disease and its sequalae will be a major focus of health care professionals and others in the years to come, offering physical therapists an opportunity to better the health of Americans for decades. However, much needs to be done to promote healthy lifestyles. The low rates of older adults engaging in even minimal physical activity, discussed next, is an area physical therapists must address.

Social Participation

The World Health Organization's *International Classification of Functioning, Disability and Health* (ICF) (Fig. 2.11) defines participation as involvement in a life situation at the societal level.[33] Participation includes activities and tasks within the social role. In this section, social participation will be discussed in terms of physical activity, work, and recreation.

Work. More older Americans are working, and working more, than ever before. The rate of labor force

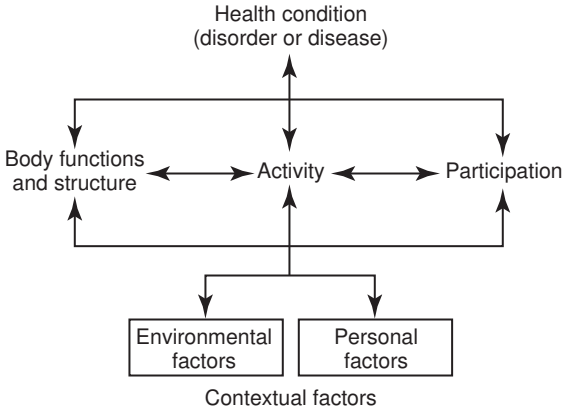


FIG. 2.11 The World Health Organization's International *Classification of Functioning, Disability and Health*.

participation for older Americans, as presented in Fig. 2.12, has grown steadily since 2002 and is projected to continue to grow[34] from the smallest segment of any age group to more than the labor force of the 16- to 24-year age group. Older workers now represent over 20% of the labor force. These numbers are increasing the most rapidly for older women as shown in Fig. 2.13.[7,35] Although the number of older workers working fewer than 35 hours per week has decreased since 2000, they still make up 40% of the part-time labor force, the highest percentage of any age group.[35] Older Asians (20.2%) and whites (19%) are somewhat more likely to be working after age 65 than older blacks (16.7%).[36]

People are working later in life for a number of reasons. They are healthier and have a longer life expectancy than previous generations. They are better educated, which increases their likelihood of staying in the labor force. Changes in federal regulations have raised the minimum age at which individuals may receive full Social Security benefits, and mandatory retirement at a specific age for

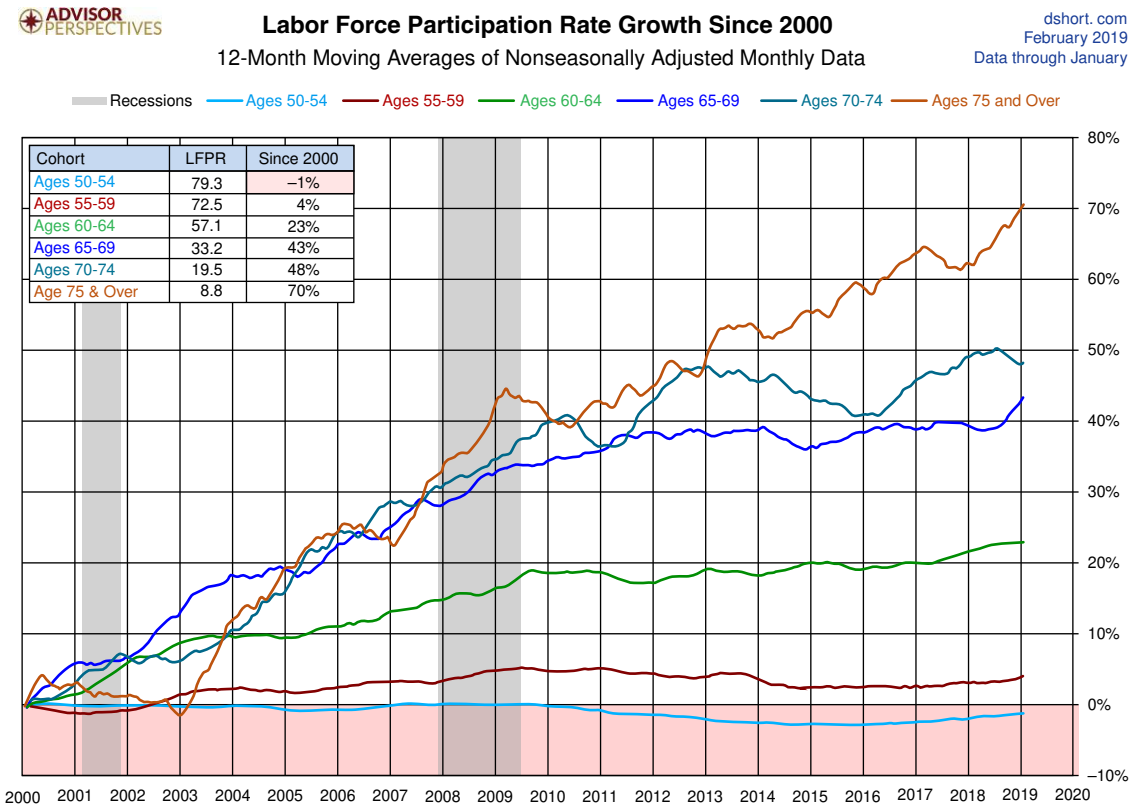


FIG. 2.12 Labor force participation rate (LFPR) growth since 2000, ages 50 to over 75 years. *(From https://www.advisorperspectives.com/dshort/updates/2019/02/05/demographic-trends-for-the-50-and-older-work-force.)*

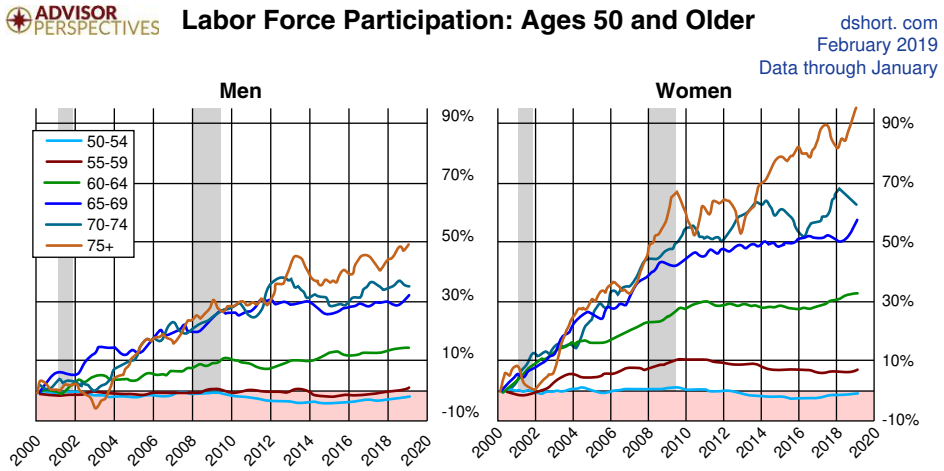


FIG. 2.13 Labor Force Growth Rates: Age 50 and Older. *(https://www.advisorperspectives.com/dshort/updates/2019/08/06/demographic-trends-for-the-50-and-older-work-force?utm_source=dshort_feed&utm_medium=rss&utm_campaign=item_link.)*

most occupations is not typically permitted. Therefore, older adults who want to, or need to, remain in the workforce may do so if they are physically able to perform the tasks of their employment. And it appears the Baby Boomer generation is working at older ages than previous generations, especially women. Fig. 2.13 illustrates that the rate of women in the labor force has risen about 96% since the turn of the century compared to men at 49%.[34]

The most frequently seen job type for older adults is management, professional, and community service–related jobs and least likely are computer and mathematical, food preparation, and construction-related occupations.[36] Interestingly, as depicted in Fig. 2.14, older adults have much higher rates of self-employment than younger workers.[35] Perhaps years of experience and knowledge of the industry better position older adults to be self-employed.

Volunteerism. Estimates to the extent to which older adults participate in volunteer activities vary, but it is generally accepted that approximately one-quarter of individuals over age 50 participate in some sort of volunteer activity; this figure is likely to increase as an anecdote to retirement. Volunteerism seems to be for the young-old, as the rate of volunteerism begins to drop after age 70. Individuals are likely to continue to volunteer as they age if the activity is professional or managerial, with a 74.8% retention. Women are somewhat more likely than men to say they expect to do volunteer work when they are older (83% women vs. 77% of men).[37] Individuals older than age 65 were slightly more likely to volunteer with secular groups compared with those aged 50 to 64 years, who were slightly more likely to volunteer with religious groups.[37]

Volunteerism affords many benefits to older adults and to society that physical therapists should be aware of. Volunteers tend to be more physically active, have a higher sense of self-esteem and personal control, experience increased socialization, and be more likely to practice good health behaviors.[38] Volunteerism can reduce the likelihood of frailty and falls and enhance physical activity.[39] Volunteerism is known to improve psychological well-being and therefore may reduce depressive symptoms and cognitive decline[40] and is even linked to living longer. Society benefits as well, although this has not been studied extensively. For example, improved academic performance was seen in an older adult volunteer program focused on K-6 schools.[41] In anticipation of the retirement wave of aging boomers, volunteerism may be a solution to unmet needs that are not filled by younger workers. Ideally, as the benefits of volunteerism become more apparent, further opportunities for those who are not as physically able will become a focus so that all older adults, no matter their physical abilities, can derive the benefits that come from volunteering and continued engagement.

Caregiving. A significant role of older individuals is that of caregiving, whether caregiving for a spouse, a friend, or grandchildren. Although most informal caregivers were middle-aged, older spouses provided 31% of the total hours of informal care in 2011.[6] About two-thirds of older adults needing care receive *only* informal care provided by family or friends.[6,18] Grandparenting is another significant role for older individuals. Eighty percent of those age 65 and older have grandchildren. In 2016, approximately 1 million grandparents age 60 and over were responsible for the basic needs of one or more grandchildren under age 18 living with them. Of these caregivers, 58% were grandmothers and 42% were grandfathers[7] and they were more likely to be black and Hispanic than white. More older adults caring for grandchildren has occurred since 2007, when the economy took a significant downturn. But the sharpest increase since the recession has been among whites at a 9% increase, compared to an increase of just 2% among black grandparents and no change among Hispanic grandparents.[42] Older adults with children who have intellectual and developmental disabilities find themselves caring for them when they become adults. Twenty-four percent of these had caregivers aged 60 and over.[7] A take-home from these demographics is the importance of family involvement and the need for appropriate education regarding caregiving. Chapter 12 in this text provides a deeper look at the ramifications of providing intensive care in one's later years.

Leisure Activities. In 2014, older Americans spent, on average, more than one-quarter of their time in leisure activities. The amount of time spent in leisure activities increased with age, so that Americans over age 75 reported spending 33% of their time in leisure activities.[6] Leisure activities are preferred and enjoyable activities one participates in during free time and characterized as representing freedom and providing intrinsic satisfaction.[43] Leisure activities may provide social support, increase social participation, and help one adapt to potential

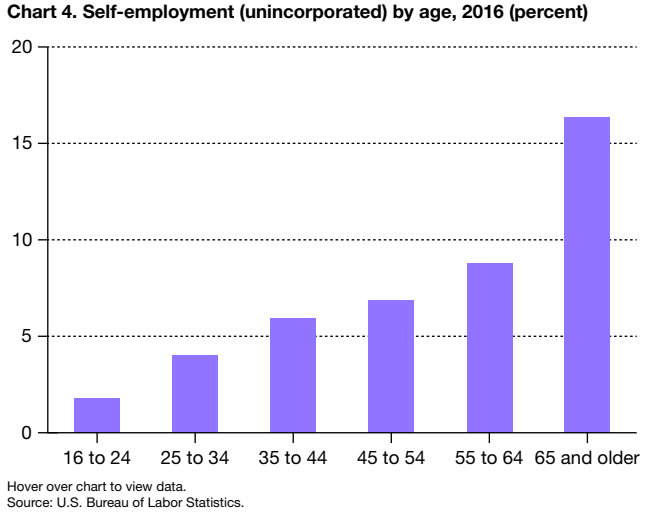


FIG. 2.14 Self-employment rates. *(Source: U.S. Bureau of Labor Statistics. https://www.bls.gov/careeroutlook/2017/article/older-workers.htm.)*

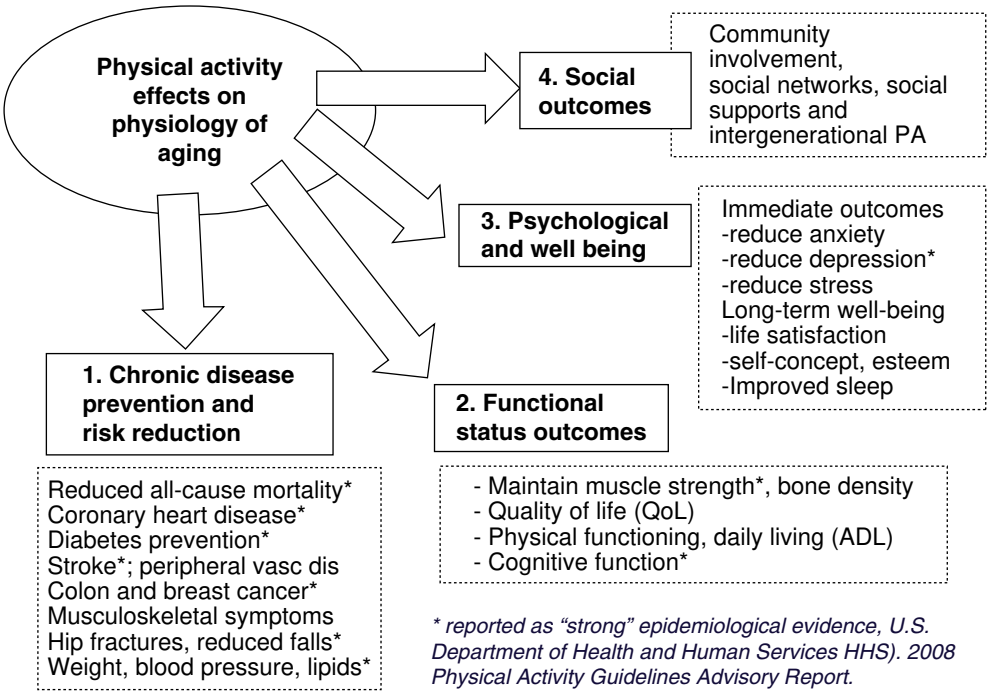


FIG. 2.15 A conceptual framework for the benefits of physical activity in older adults. *(From Updating the evidence for physical activity: summative reviews of the epidemiological evidence, prevalence, and interventions to promote "active aging." Gerontologist. 2016;56[Suppl 2]:S268-S280. https://doi.org/10.1093/geront/gnw031. Gerontologist | © The Author 2016. Published by Oxford University Press on behalf of the Gerontological Society of America. All rights reserved.)*

restrictions of chronic diseases and conditions, recover from stress, and overcome negative life events (e.g., losing a spouse).[43] Chang et al. found that leisure-time activities, particularly physical ones, had a positive effect on physical and psychosocial functioning.[43] However, most older adults engage in passive leisure-time activities. When asked how they engaged in specific leisure activities in the past 24 hours, 90% reported talking with family or friends, 83% reading, and 77% watching an hour or more of television.[44] Watching television made up over half (56%) of daily leisure time.[6] This is concerning, because sedentary habits, mobility disability, and cognitive deficits are linked to 4 to 5 or more hours of television viewing per day.[45–47]

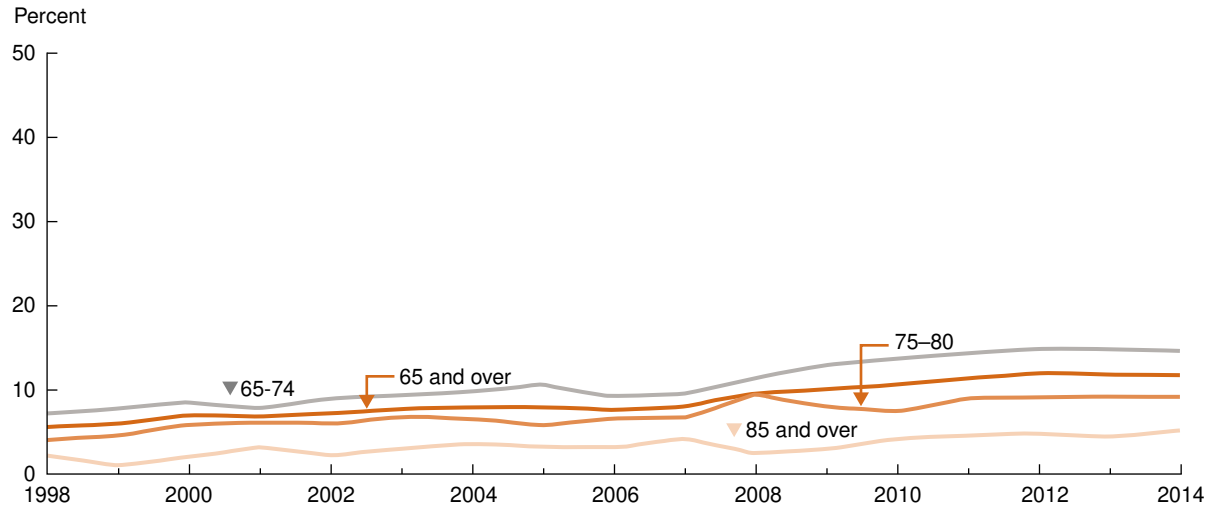
Physical activities are no less important than work to maintain a sense of well-being. Clearly, more older men and women today are maintaining interests in recreational sports that they developed earlier in life. Others are discovering the pleasures of recreational sports as older adults as described in Chapter 28 on the senior athlete elsewhere in this text. Many adults enjoy dancing and gardening, which require a relatively high degree of balance, flexibility, and strength.[48] Even sedentary activities, such as stamp collecting or playing chess, require a certain degree of physical ability in the hand and upper extremity, and therefore may be functional measures of the outcomes of intervention for some older adults. Including participation in less passive leisure-time activities would be a worthy goal that physical therapists might encourage.

Physical Activity. Physical therapists are aware of the many benefits of engaging in physical activity listed in Fig. 2.15. Physical activity, comprising leisure-time aerobic and muscle-strengthening activities, is generally measured in terms of the 2008 federal physical activity guidelines of 150 minutes/week of moderately intense activity. Unfortunately, physical activity typically declines with age, and although the number of people reporting recommended levels has increased since 1998, Fig. 2.16 illustrates that only about 12% of people age 65 and over reported meeting this recommended amount.[6] Men are more likely to meet the guideline (15%) than women (9%). Non-Hispanic whites age 65 and over reported higher levels of physical activity than non-Hispanic black (9%) and Hispanic (7%) individuals.[6] When looking at aerobic and strengthening exercise separately, the picture improves. Thirty-seven percent of older adults reported participating in at least 150 minutes of aerobic exercise per week, and 17% reported engaging in muscle-strengthening activities at least twice per week.[6] Clearly these statistics have room for improvement with many benefits at the individual and societal level.

FUNCTION

Limitations in physical function and mobility have many consequences including reduced access to goods and services, which leads to poor health outcomes. For example, older adults with limited mobility are less

Percentage of people age 65 and over who reported participating in leisure-time aerobic and muscle-strengthening activities that meet the 2008 Federal physical activity guidelines, by age group, 1998-2014



NOTE: This measure of physical activity reflects the 2008 federal physical activity guidelines for Americans (available from: http://www.health.gov/PAGuidelinesf/). The 2008 federal guidelines recommend that adults age 65 and over who are fit and have no limiting chronic conditions perform at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week. In addition, they should perform muscle-strengthening activities that are moderate or high intensity and involve all major muscle groups on 2 or more days a week, because these activities provide additional health benefits. The measure shown here presents the percentage of people who fully met both the aerobic activity and muscle-strengthening guidelines, irrespective of their chronic condition status.
Reference population: These data refer to the civilian noninstitutionalized population.
SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.

FIG. 2.16 Older Adults who meet the 2008 federal physical activity guideline by age group. *(From Edwards JJ, Khanna M, Jordan KP, et al. Older Americans 2016: key indicators of well-being.* Federal Interagency Forum on Aging-Related Statistics. *https://doi.org/10.1136/annrheumdis-2013-203913. Published 2016. Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.)*

able to access grocery stores and supermarkets, thus providing fewer nutritional options, which affects health outcomes.[49] Another consequence is the increased risk for injury and health problems related to sedentary activity. Consequences of injury and the sequelae of health problems can lead to residential and institutional living. Mobility disability, defined as difficulty walking one-quarter of a mile, climbing a flight of stairs, or standing for long periods of time, is associated with reduced socialization, depression, and frailty, which again has a cascade of undesired effects leading to a poor quality of life.[50] It is well established that the prevalence of functional limitations and disability is associated with aging.[51] To help mitigate these untoward effects, the physical therapist should recognize that much mobility disability and functional limitations can be addressed through lifestyle counseling and physical therapy services.

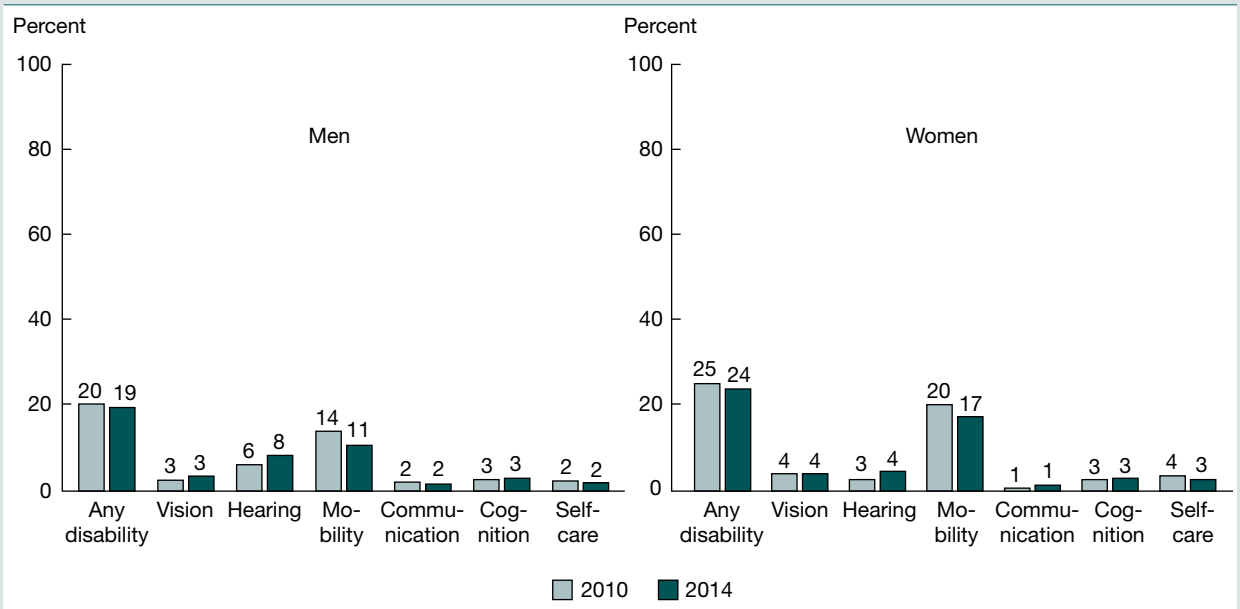
Physical Function and Disability

In general, independent physical function declines with age, and this decline is influenced by a host of biological, psychological, and social factors. Function is not a static phenomenon, and individual transitions in functional status are more the norm than the exception. Function is also a sociological phenomenon. Physical function activities can be subdivided into five areas: mobility, which includes transfers and ambulation; basic self-care and personal hygiene (activities of daily living [ADLs]); more complex activities essential to an adult's living in the community, known as instrumental ADLs (IADLs); work; and recreation.

Fig. 2.17 illustrates that, in 2014, 22% of community-dwelling people age 65 and older reported at least one disability as defined by limitations in vision, hearing, mobility, communication, cognition, and self-care. Of those, two-thirds had difficulty in walking or climbing stairs.[58] This same report documents that 42% of community-dwelling adults 85 years of age or older self-identified difficulty with mobility. Difficulty with independent living, such as visiting a doctor's office or shopping, was the second-most-cited disability, followed by serious difficulty in hearing, cognition, bathing or dressing, and vision.[52]

Lower education and economic levels adversely affected independence. For example, 13% of older adults with a disability lived in poverty, compared with 7% of those without a disability who lived in poverty.[52]

Percentage of people age 65 and over with a disability, by sex and functional domain, 2010 and 2014



NOTE: Disability is defined as "a lot" or "cannot do/unable to do" when asked about difficulty with seeing, even if wearing glasses (vision); hearing, even if wearing hearing aids (hearing); walking or climbing steps (mobility); communicating, for example, understanding or being understood by others (communication); remembering or concentrating (cognition); and self-care. such as washing all over or dressing (self-care). Any disability is defined as having difficulty with at least one of these activities. The data source and measures presented have changed from previous editions of *Older Americans*. Data labels in this chart are based on rounded values.
Reference population: These data refer to the civilian noninstitutionalized population.
SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.

FIG. 2.17 Percentage of people age 65 and over with a disability, by sex and functional domain, 2010 and 2014. *(Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.)*

Likewise, women and those of racial and ethnic minority status were also more likely to report a disability.[52]

Activities of Daily Living

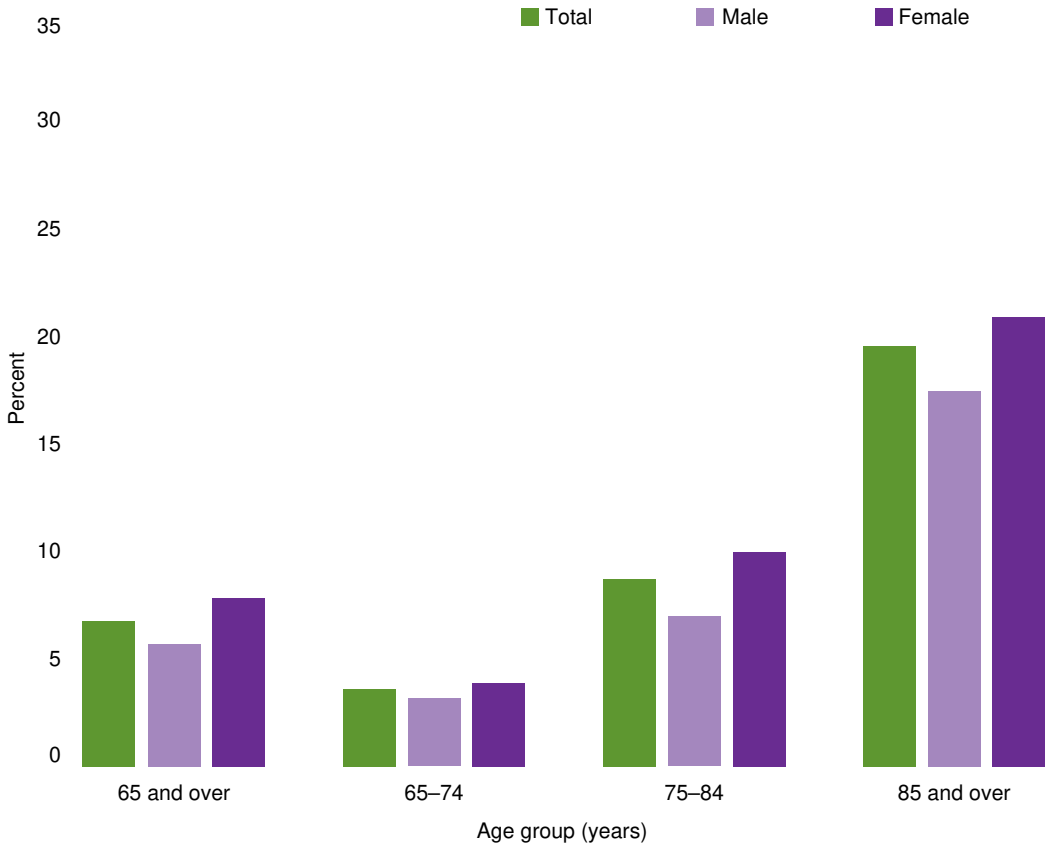
Basic Activities of Daily Living. Basic ADLs include all of the fundamental tasks and activities necessary for survival, hygiene, and self-care within the home. ADLs consist of eating, bathing, grooming, dressing, bed mobility, and transfers. As depicted in Fig. 2.18 and based on 2016 data, 20% of individuals 85 years of age and older required assistance with one or more ADLs, compared with 7% of those aged 75 to 84 and 3.4% of those aged 65 to 74. In 2013, about two-thirds of people who reported difficulty with one or more ADLs received personal assistance or used special equipment; 7% received personal assistance only, 35% used equipment only, and 25% used both.[6]

An inability to perform ADLs, especially toileting and bathing, often means a transition to some form of residential living as indicated by nearly 70% of older adults in residential care using assistance for ADLs.[53] The number of chronic conditions adversely affects the ability to perform ADLs as shown in Fig. 2.19, with ADL limitations increasing with the number of chronic conditions.

Instrumental Activities of Daily Living. Instrumental activities of daily living encompass eight areas of focus listed in Box 2.1. In 2013, 13.6% of those age 65 and over reported some limitation in IADLs. Increasing age adversely affected limitations, with 15.4% of those age 85 and over reporting limitations in IADLs compared with just 9.8% of those aged 65 to 74 years. The number of chronic conditions also adversely affects IADL limitations as shown in Fig. 2.20.

Relationship Between ADLs and IADLs. Most older adults living in the community are generally independent in both ADLs and IADLs. However, as the number of limitations grows, the risk for residential housing with services, including long-term care, grows. For example, as depicted in Fig. 2.21, 67% of those living in a long-term care facility had three or more limitations in ADLs, compared with only 17% living in other residential living facilities with services and 9% living in the community.[6] Limitations in IADLs frequently occur first, especially when cognitive issues are present. Poor self-rated health and depression were the strongest risk factors for needing assistance in one or more ADLs in a survey of a large sample of individuals aged 60 to 69 in Norway. Excessive sitting time, physical inactivity, and short or prolonged sleeping time were the most important lifestyle risk factors for ADL/IADL disability.[54] Again, the opportunity for physical therapists is clear.

Mobility. Those reporting no mobility limitation composed the majority of people over 65 years; however,



NOTES: Data are based on household interviews of a sample of the civilian noninstitutionalized population. Personal care needs, or activities of daily living, include eating, bathing, dressing, and getting around inside the person's home.

Source: NCHS, National Health Interview Survey, Family Core component.

FIG. 2.18 Percentage of adults aged 65 and over who needed assistance with activities of daily living, January–June 2018. *(Source: National Center for Health Statistics, National Health Interview Survey, Family Care Component.)*

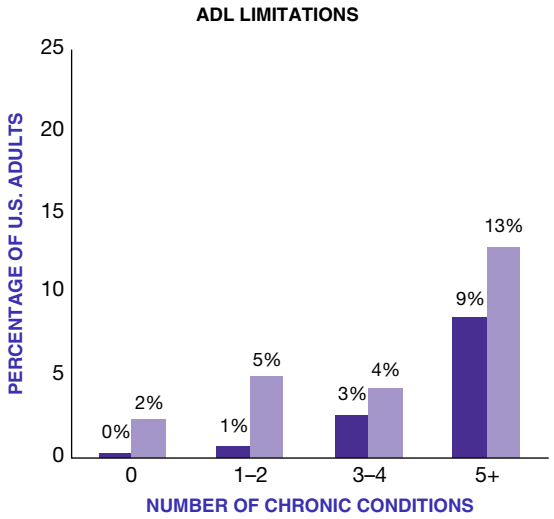


FIG. 2.19 Relationship of activities of daily living (ADL) limitations and number of chronic conditions. *(From Buttorff C, Ruder T, Bauman M. Multiple Chronic Conditions in the United States. Santa Monica, CA: Rand Corporation; 2017. https://www.rand.org/content/dam/rand/pubs/tools/TL200/TL221/RAND_TL221.pdf.)*

BOX 2.1 Instrumental Activities of Daily Living: Eight Focus Areas

Ability to use the telephone
Laundry and dressing
Shopping and running errands
Transportation
Meal preparation
Medication management
Housekeeping activities
Ability to manage finances

similar to those with ADL and IADL limitations, older age groups reported more difficulty with mobility. For example, only 26% of those aged 85 years and older reported no mobility limitations. And the majority of these older individuals also reported limitations in ADLs and IADLs (65.3% reported mobility, ADL, and IADL difficulties, compared with 25.5% of those aged 65 to 74).[55] Mobility limitations increased for residents of long-term care facilities, with a staggering 93.2% of 85-plus-year-olds reporting a combination

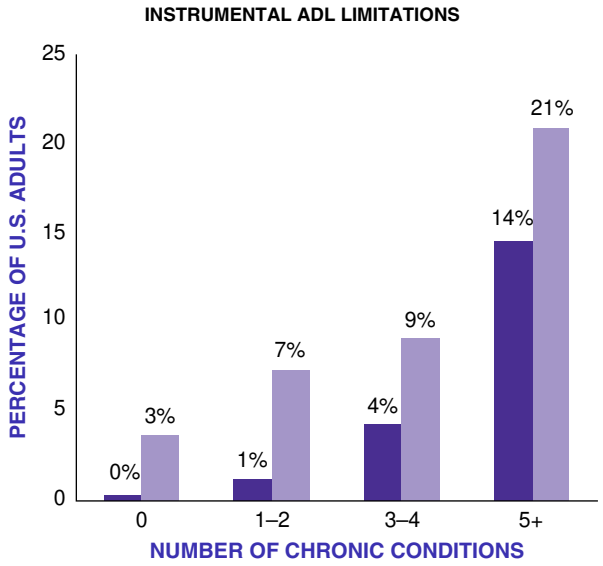


FIG. 2.20 Relationship of instrumental activities of daily living (ADL) limitations and number of chronic diseases. *(From Buttorff C, Ruder T, Bauman M. Multiple Chronic Conditions in the United States. Santa Monica, CA: Rand Corporation; 2017. https://www.rand.org/content/dam/rand/pubs/tools/TL200/TL221/RAND_TL221.pdf.)*

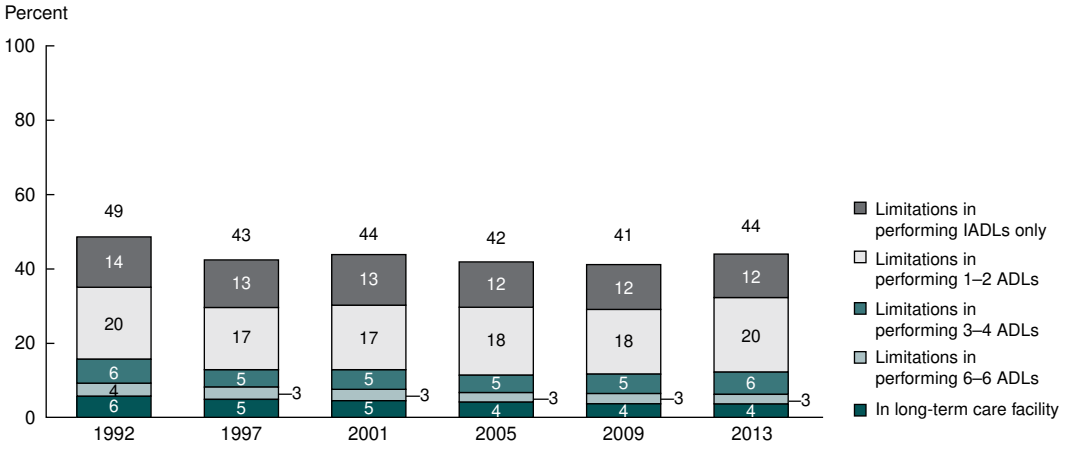
of mobility, ADL, and IADL limitations.[56] Black non-Hispanic and Hispanic older adults at any age were more likely to report mobility limitations.[56] Interestingly, one study found an association between less proximity to goods and services and barriers to walking difficulty, as these older individuals reported more mobility disability than other older adults,[57] which provides an opportunity to consider the impact of the environment on mobility.

HEALTH AND HEALTH CARE UTILIZATION

Self-Rating of Health

In 2017, though 45% of community-dwelling older people assessed their health as excellent or very good (compared to 64% for adults 18 to 64 years of age), non-Hispanic blacks and Hispanics were more likely to rate their health as fair or poor. About 31% of persons aged 60 and older reported height/weight combinations that placed them in the obese category. Only 9% reported they were current smokers and 8% reported excessive alcohol consumption.[7] Not surprisingly, those who were residents of long-term care facilities were far less likely to rate their health as very good or excellent (10.5%). In fact, the majority of individuals residing in a long-term care facility rated their health as fair or poor: 68% of individuals 65 to 74 years of age, 68.2% of individuals 75 to 84 years of age, and 60.2% of individuals 85 years of age and older.[56]

Percentage of Medicare beneficiaries age 65 and over who have limitations in performing activities of daily living (ADLs) or instrumental activities of daily living (IADLs), or who are in a long-term care facility, selected years 1992-2013



NOTE: A residence is considered a long-term care facility if it is certified by Medicare or Medicaid; has three or more beds, is licensed as a nursing home or other long-term care facility, and provides at least one personal care service; or provides 24-hour, 7-day-a-week supervision by a caregiver. Limitations in performing activities of daily living (ADLs) refer to difficulty performing (or inability to perform for a health reason) one or more of the following tasks: bathing, dressing, eating, getting in/out of chairs, walking, or using the toilet. Limitations in performing instrumental activities of daily living (IADLs) refer to difficulty performing (or inability to perform for a health reason) one or more of the following tasks: using the telephone, light housework, heavy housework, meal preparation, shopping, or managing money. Percentages are age adjusted using the 2000 standard population. Estimates may not sum to the totals because of rounding.
Reference population: These data refer to Medicare beneficiaries.
SOURCE: Centers for Medicare & Medicaid Services, Medicare Current Beneficiary Survey, Access to Care.

FIG. 2.21 Percentage of Medicare enrollees aged 65 and over who have limitations in activities of daily living (ADLs) or instrumental activities of daily living (IADLs) or who are in a long-term care facility. *(Source: Edwards JJ, Khanna M, Jordan KP, et al. Older Americans 2016: Key Indicators of Well-Being. Federal Interagency Forum on Aging-Related Statistics; https://acl.gov/aging-and-disability-in-america/data-and-research/key-indicators-well-being. Published 2018. Accessed February 6, 2019.)*

Utilization of Services and Expenditures

As illustrated in Fig. 2.22, health care costs increase with age, with the oldest-old (age 85 years and older) incurring higher costs than for any other group. In 2016, consumers age 65 and over averaged out-of-pocket expenditures of $5994, an increase of 38% since 2006 and considerably less than younger consumers ($4331). Older individuals account for 34% of all prescription medication use, with 48% of all older adults reporting taking a prescription drug, compared with 39% 10 years earlier.

Twenty percent of older individuals age 75 years and older reported 10 or more visits to a health care practitioner in the past year, compared with 13% of adults aged 45 to 64 years. The type of provider seen differs with age. The younger the person is, the more exclusively they saw a physician, whereas older adults were more likely to see nonphysician providers (e.g., nurse practitioner, physician assistant) (41.3%). Utilization of specialized services such as home health and hospice increase with age as shown by Fig. 2.23.[6]

The number of chronic conditions increases health care utilization and cost. For example, 14% of those with one to two chronic conditions visited the emergency department within a year compared with 32% of those with five or more chronic conditions.[29] Twice as many drugs on average are used by those with five or more chronic conditions/diseases compared with those with three or four conditions.[29] And people with five or more conditions averaged 20 doctor visits per year, compared with 12 visits for those with three or four conditions.[29] This greater utilization by those with more chronic diseases results in the staggering statistic that those with five or more chronic diseases account for 41% of total health care spending while making up only 12% of the population.[29]

Challenges and Future Possibilities

Changes in the demographic characteristics of the U.S. population represent a critical challenge to, and opportunity for, geriatric physical therapists. Two different cohorts will be aging simultaneously: the World War II and Great Depression cohort, who make up the old-old category, and the boomer cohort, who make up the young-old category. A flexible approach to deal with such different cohorts will be needed, with individualized expectations responsive to each older adult's vision for his or her own aging. Additionally, older adults are expected to live longer than ever before, but the quality of their lives in these added years is still a matter of conjecture. Aging with multiple chronic conditions/diseases and poor participation in physical activity and other healthy lifestyle behaviors further aggravates a propensity toward physical decline with advanced age. Function deficits are the expected outcomes of disease or permanent effects of an injury; in turn, functional limitations predict decreased social participation, increased utilization of services, further morbidity, and death. The physical therapy profession is uniquely positioned to add life to years as medical science adds years to life.

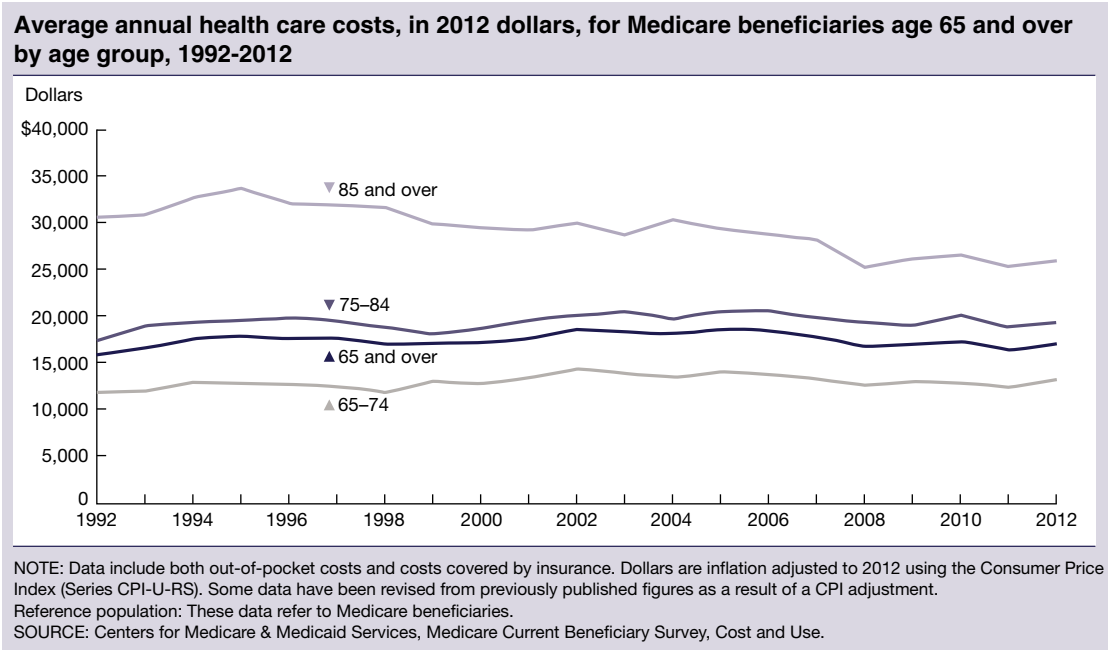


FIG. 2.22 Health care costs by age. *(Source: Centers for Medicare & Medicaid Services, Medicare Current Beneficiary Survey, Cost and Use. U.S. Department of Health and Human Services. Key Indicators of Well-Being | ACL Administration for Community Living. https://acl.gov/aging-and-disability-in-america/data-and-research/key-indicators-well-being. Published 2018. Accessed February 6, 2019.)*

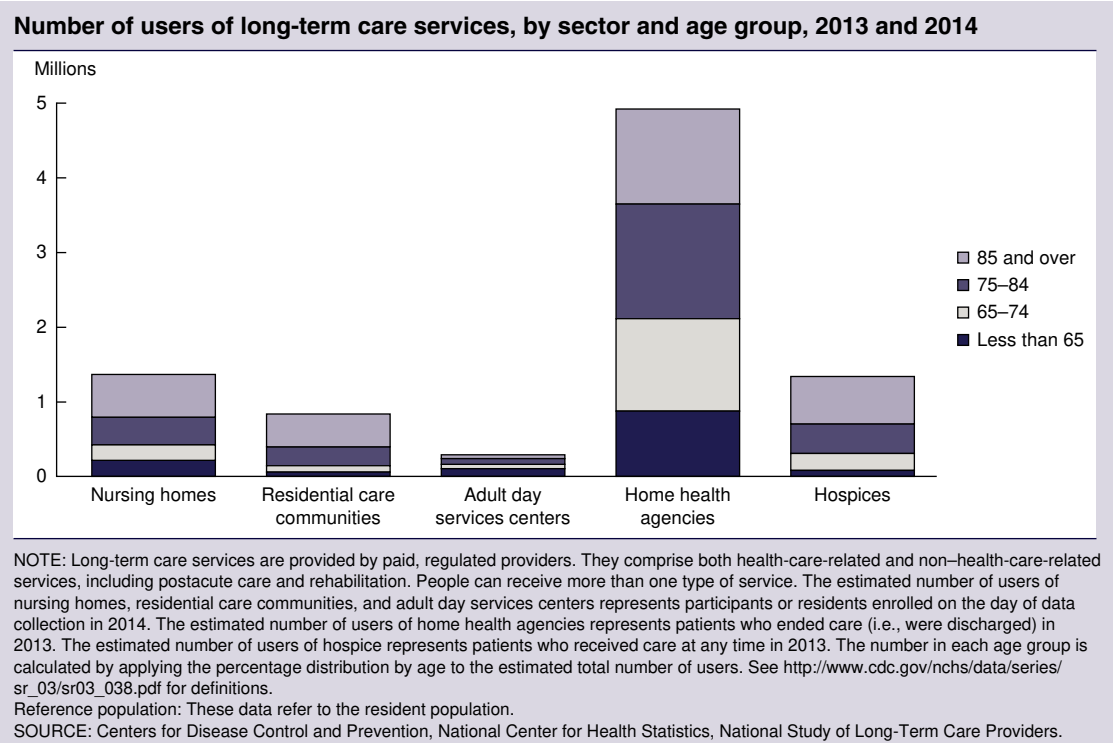


FIG. 2.23 Specialized service use by age. *(Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Study of Long-Term Care Providers.)*

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CHAPTER

3

Age-Related Physiological Changes: An Overview

Carol Sames

OUTLINE

INTRODUCTION

Aging is a fundamental process that affects all of our systems and tissues by causing numerous alterations and damage within molecular pathways. The rate and magnitude of change in each system may differ from person to person, but decline across multiple body systems is an inevitable part of life. As such, aging is the most significant risk factor for most noncommunicable diseases, including cardiovascular disease, cancer, diabetes, and neurologic diseases.[1]

Although there are a multitude of theories that describe proposed mechanisms for the aging process, there is no singular unifying theory that satisfactorily accounts for all the changes the body undergoes. Proposed mechanisms include oxidative stress, mitochondrial changes, DNA damage/repair, telomere length, and genotoxicity that interact with genetics, lifestyle choices, and environment to impact biological aging. Although enormous strides have been made in our understanding of the aging process, there is still much to discover about the science of age-related decline. The recognition that whole-body inflammation is an important contributor to age-related decline is a significant shift from concepts such as wear and tear and the biological clock based on genetic programming. In addition, research with identical twins has identified that depending on the outcome variable, 25% to 50% of the decline with age has a genetic basis, which becomes stronger with greater longevity.[2] Most age-related change is the consequence of lifestyle choices, such as inadequate nutrient intake, excess body weight (which puts stress on tissues, increases inflammation, and predisposes toward disease), and variables such as smoking and excessive alcohol intake and a sedentary lifestyle. The lack of physical activity may have the most impact on successful aging.[3–8]

Even though age-related decline may result in the loss of strength, power, aerobic endurance, bone mass, and vital capacity, we have enough tissue reserve in each of our systems to get through 80 to 90 years without infirmity. For example, master athletes (>40 years old) who compete in endurance and ultra-endurance events (>6 hours) demonstrate improvement in their endurance performance at a faster rate than their younger counterparts in swimming, cycling, and running.[9]

Because so much of the decline with aging is lifestyle related, physical therapists are uniquely positioned to intervene along the way, with successful results likely at any age. Indeed, there is a growing body of evidence indicating that exercise is a powerful modifier of inactivity-related decline, even for sarcopenia, the age-related wasting of muscle.[3–5,8,10,11] Loss of skeletal muscle mass and force is inevitable with aging and can be further exacerbated by a host of variables, such as nutrition and disease; however, sedentary lifestyle is likely to take the greatest toll.[4,5,10,11] In the latest position stand on exercise and physical activity for older adults, the American College of Sports Medicine (ACSM) states that although no amount of physical activity can stop the biological aging process, there is strong evidence that regular exercise can minimize the physiological effects of an otherwise sedentary lifestyle and increase active life expectancy by limiting the development and progression of chronic disease and disabling conditions.[12] By and large,

men and women who include physical activity in their daily routine should have sufficient muscle mass and force to achieve all of the fundamental activities of daily living throughout their life span.

Aging and longevity are controlled by multiple cellular and subcellular changes within all tissues that interact with lifestyle and environmental choices and factors. The intent of this chapter is to describe what occurs in selected systems for the purpose of understanding the functional consequences of aging as they present to the physical therapist clinically. For example, the natural decline in bone mineral content may predispose patients to osteoporosis through cellular and hormonal changes that can be exacerbated with lifestyle choices such as a sedentary lifestyle and poor nutrition. It is not uncommon for those with osteoporosis to manifest postural changes that affect balance, diminish lung capacity and strength, and shorten step and stride length. Once cellular changes are described, other inactivity- and lifestyle-related events that further contribute to systemic decline will be addressed. Thus, to develop an effective treatment plan, physical therapists must consider all the sequelae of health disorders.

Although there is not a single tissue or system that does not undergo age-related changes, only those systems that physical therapists treat directly or affect the ability to render optimal care are the focus of this chapter. Gastrointestinal or genitourinary systems, for example, will not be discussed in detail. Skeletal muscle, cognitive changes with aging, and exercise interventions to improve function in older adults are covered in later chapters. This chapter is an overview of the aging process in specific systems and will start with a discussion of the decline in homeostasis and demographics on functional loss and ability with aging. Next, changes with aging in the musculoskeletal system, collagenous tissues, and cardiovascular, nervous, somatosensory, immune, and endocrine systems will be introduced. Lastly, research on exercise for reversing decline and preventing disease will be presented in addition to the consequences of adopting a sedentary lifestyle. A comprehensive discussion of impaired muscle performance, motor performance, cognition, exercise, and physical fitness for older adults and wellness for the aging adult will be covered in subsequent chapters.

AGING: A DECLINE IN HOMEOSTASIS

Homeostasis refers to the physiological processes that maintain a stable internal environment of the body and is a critical element in the aging process. The extent to which the body can adapt to physiological stressors and maintain homeostasis will influence susceptibility to illness and injury and is known as adaptive homeostasis. As individuals age, the expansive ability of the adaptive homeostatic range diminishes, and this decline has been suggested to contribute to the higher incidence of disease development among older populations.[13] With increasing

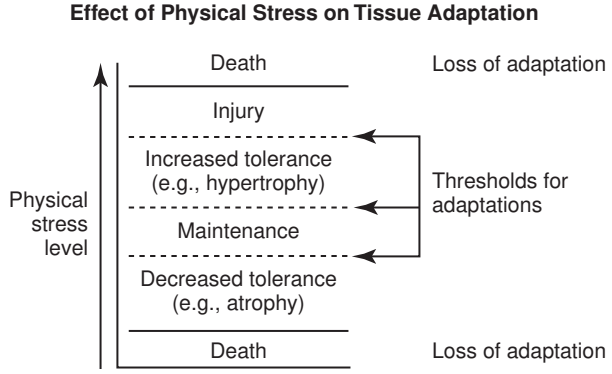

FIG. 3.1 Effect of varying levels of physical stress (inadequately low to excessively high) on tissue's ability to adapt and to maintain homeostasis. *(Reprinted with permission from Muellér MJ, Maluf KS: Tissue adaptation to physical stress: a proposed "Physical Stress Theory" to guide physical therapist practice, education, and research. Phys Ther 82(4):383–403, 2002.)*

age, the capacity to tolerate stressors decreases but remains partially modifiable with lifestyle adaptations. The physical stress theory (PST) proposed by Mueller and Maluf[14] captures the essence of homeostasis. The basic premise of the PST is that changes in the relative level of physical stress cause a predictable adaptive response in all biological tissue.[14] Fig. 3.1 illustrates the relationship between various levels of physical stress and the adaptive responses of tissue. Fig. 3.2 provides a conceptual picture of the relationship of successful and unsuccessful aging to a tolerance for challenges to homeostasis and the effect of varying levels of challenge on homeostasis.

The successfully aging older adult maintains a high capacity to tolerate physiological stress, whereas the person who is aging unsuccessfully generally has a low tolerance to physiological stressors that challenge the aging body's homeostasis. The ability to improve tolerance for physiological stress and, thus, provide a wider homeostasis window is possible using principles incorporated in the PST. Tolerance range increases in response to exercise and decreases with the addition of chronic disease and greater inactivity. The older individual with very low tolerance to physiological stressors is highly susceptible to illness and has low capacity to combat the effects of the illness: A bout of influenza may kill.

When a person is in homeostasis, exercise results in robust positive changes with systemic adaptation. Strength and balance can increase, as can aerobic and muscle endurance. When the inactive older adult with stable chronic disease engages in exercise, positive changes also occur, albeit not at the same magnitude as their active counterparts. Under both sets of circumstances, a widening of the window of homeostasis occurs, providing greater tolerance to physiological stress, thus reducing the possibility of moving from homeostasis into illness and disease. The wider the window of homeostasis is, the greater the chance of survival and of maintaining

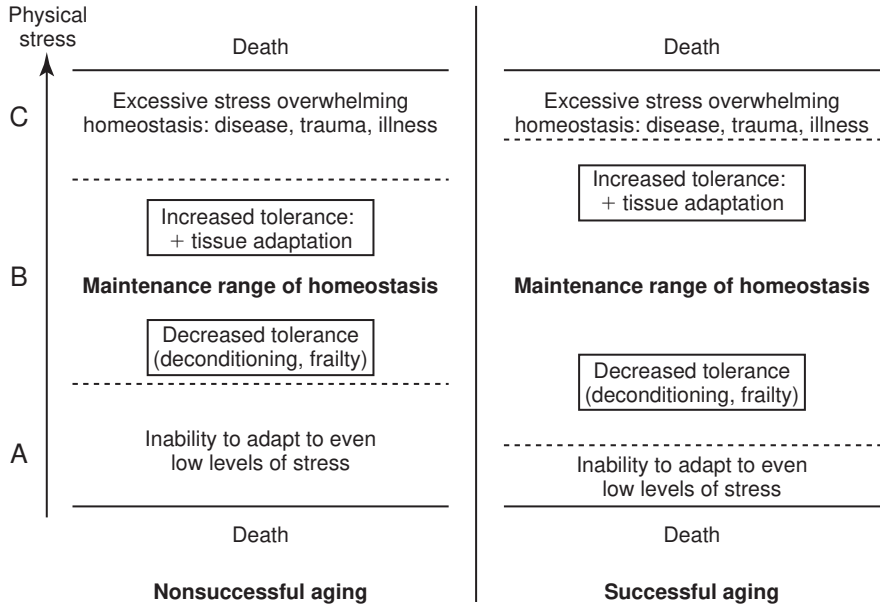

FIG. 3.2 A depiction of the differences in range of homeostasis tolerance and ability to adapt to stress in individuals who have aged nonsuccessfully and those who have aged successfully. The dotted lines represent the limits of homeostasis centered around the range of physical stress that maintains tissue at physiological equilibrium and the effect of increased or decreased stress on tolerance to challenges to homeostasis. **A,** Inadequate ability to adapt (maintain tissue homeostasis) against even small stresses. **B,** Level of stress that maintains homeostasis tolerance at the same level. **C,** Level of stress that overwhelms the tissue's ability to maintain homeostasis.

independence in physical function, and the greater the physical reserve as well as resilience—the capacity of the body to draw on a "well" of immune function, strength, and endurance among other resources to meet the demands of life. One of the biggest challenges of physical therapy practice is to promote and maintain enough physiological reserve to maintain homeostasis even in the presence of large stressors. Thus, physical therapists should promote wellness and enhance quality of life as part of every episode of care.

When discussing physiological changes with aging, it is important to define several terms. *Cachexia* typically refers to an inexorable decline in muscle (and body) wasting that cannot be arrested nutritionally.[15,16] Cachexia is rapid and relentless muscle wasting that frequently occurs before death and is associated with end-stage cancer, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), and certain infectious diseases as a response to one or more pathologies that overwhelm the body. Although some young adults with more "reserve" may recover from a cachectic state, most people do not, and rarely do older adults recover from cachexia. The cachexia of old age typically precedes death, and even though the cause of cachexia is not well defined, it is believed to be the consequence of a massive increase in inflammatory cytokines, which will be discussed later in this chapter.[17,18]

The other term that must be defined is *sarcopenia*, which is the muscle wasting of old age.[19] First described by Rosenberg in 1989 as the progressive decrease in muscle mass and strength during aging, there is currently not a universally accepted definition; however, an expansion of the definition now includes a decline in muscle strength, power, and functional quality.[16,20] Sarcopenia is present if muscle mass, as determined by dual-energy x-ray absorptiometry, is two or more standard deviations below values obtained for young adults.[15,20] It has been estimated that between 22% and 33% of community-dwelling older adults have sarcopenia, and for those older than age 80 years that number approaches 50%, with a higher percentage for men than women.[21–23] Because the underlying pathophysiology of cachexia and sarcopenia is different, it is not surprising that they respond differently to strength training. Indeed, sarcopenic muscle is capable of responding to strength-training exercise, with significant increases in muscle mass and strength. There is strong evidence that progressive resistance training has a profound effect on virtually all of the physiological mechanisms in the nervous and muscular system in older individuals, including those with mobility issues.[24–26] In contrast, cachexic muscle does not respond to progressive resistance training, and physical therapy treatment to improve strength with this condition is generally unwarranted.

Sarcopenia is frequently the hallmark of increasing disability in aging adults. In Western society as many as 42% of individuals over 60 years of age have difficulty performing activities of daily living; 15% to 30% report being unable to lift or carry 10 pounds; and >30% have some type of physical disability.[27] Because sarcopenia is associated with increasing disability in aging adults, the increasing number of aging adults with decreasing functional ability provides limitless opportunities for positive impact through physical therapy. A detailed discussion of

sarcopenia is included elsewhere in this text. Physical changes occur in all systems in the aging adult. The age-related changes in the systems most applicable to physical therapy are presented in the following sections. The potential for enhanced tissue and organ function through physical therapy is also discussed.

MUSCULOSKELETAL SYSTEM

Skeletal Tissue

Skeletal tissue is remarkably susceptible to change in response to nutritional status, activity/inactivity, weight bearing, hormones, and medications.[28] Peak bone mass is reached at skeletal maturity (20 to 30 years of age) and is followed by a progressive and slow decline (Fig. 3.3). In postmenopausal women this loss is more severe, with an increased rate of bone resorption immediately after menopause clearly indicating a hormonal influence on bone density in women.[29] The most likely explanation for this increased resorption is the drop in ovarian estrogen production that accompanies menopause.[29] Bone loss begins to accelerate approximately 2 to 3 years before the last menses, and this acceleration ends 3 to 4 years after menopause. For an interval of a few years around menopause, women lose 2% of bone annually.[30] Afterward, bone loss slows to about 1% to 1.5% per year in women unless there is an underlying condition or immobilization that increases the rate.[31] Men also lose bone mass with age, but their bone loss acceleration begins after the age of 75.[32]

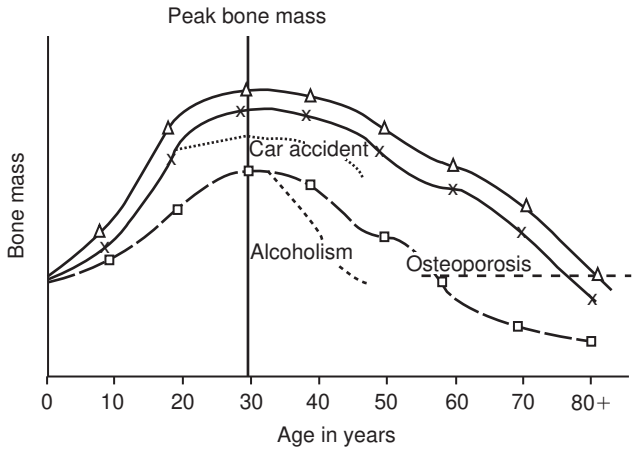

FIG. 3.3 Bone mass profiles of three women throughout the course of a lifetime. The *top line* (Δ) represents usual lifestyle, including adequate nutrition including calcium, occasional or no weight-bearing exercise, some outdoor time (vitamin D exposure), minimal inactivity-related diseases including obesity, modest alcohol intake, and no drugs that diminish bone. The *middle line* (X) reflects optimal bone mass in a woman who embraced a healthy lifestyle over the course of her lifetime. Healthy lifestyle includes adequate nutrition including protein and calcium intake, a regular weight-bearing exercise program, routine exposure to sunshine, minimal disease burden, modest alcohol consumption, and no drugs that diminish bone. The *bottom line* (□) reflects one of several possibilities: inadequate calcium during the teenage years and/or amenorrhea as a teen or early adult stage of life, or anorexia as a teenager with inadequate calcium and protein intake. Anorexia often results in low estrogen values as well. Major points: Calcium intake during adolescence is critical; loss of normal serum estrogen results in accelerated bone loss with age or failure to maximize bone stock in youth; poor lifestyle choices (e.g., alcoholism, sedentary lifestyle, poor nutrition) diminish bone at all ages; and serious physical compromise (e.g., car accident with prolonged bed rest) has lifelong consequences.

Bone is composed of three cell types: the osteoclast, which breaks down bone; the osteoblast, which produces and increases bone mineral; and the osteocyte, which maintains bone. These three cell types form the basic metabolic unit (BMU) of bone as suggested by Frost.[33] In normal bone remodeling there is a balance between osteoblast and osteoclast activity. With aging, there are alterations in the maturation and function of the osteoblast and the osteoclast, which results in greater bone removal than replacement. Thus, with advancing age, the BMU favors bone catabolism rather than bone anabolism. With the onset of menopause, the rate of bone remodeling increases, which magnifies the impact of bone loss.[34] The loss of bone tissue leads to a disordered skeletal architecture and an increase in fracture risk.[34]

Factors other than aging may affect the bone health of men and women throughout the life span and account for more decline in bone mass than aging alone. Some of these factors are nonmodifiable, but many factors affecting bone mass are modifiable with lifestyle. Factors that are modifiable with lifestyle and those that are not modifiable are summarized in Box 3.1. It is important to realize that estrogen is critical for the maintenance of bone mass in

BOX 3.1 Nonmodifiable and Modifiable Risk Factors for Bone Loss

Nonmodifiable Risk Factors for Bone Loss
Genetics: women with small frames
Caucasian race
Hispanic women
Age: female older than age 50 years
Family history of osteoporosis
Premature at birth
Low estrogen: menopause
Childhood malabsorption disease
Seizure disorder—using Dilantin
Age-associated loss of muscle mass

Modifiable Risk Factors
Calcium intake: 1200 mg/day or more is required
Excessive alcohol intake: maximum allowable is not defined
Smoking cigarettes
Low body mass index (<18.5)
Low estrogen: amenorrhea, anorexia
Low estrogen: ovariohysterectomy
Inactivity, immobilization
Substituting soda for milk, especially among children
Insufficient protein at all ages
Inadequate vitamin D
Hyperthyroidism
Prednisone and cortisone use, hyperparathyroidism