Exercise for Aging Adults

A Guide for Practitioners

Gail M. Sullivan
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Editors

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Preface

The first patient today is an 80-year-old retired ballet dancer, who now teaches French at the senior center, takes opera singing lessons, and enters Argentine tango competitions. I tell her she is my model of successful aging. She laughs and replies, "I have to exercise my mind and body or I feel too slow!" This exemplary patient inspires us as health care professionals to work harder to understand the motivations and needs of more typical older adults, those who believe that retirement signals a time to acquire a recliner and grab the remote. No matter the age or functional level, exercise in many ways resembles Ponce de Leon's fabled "fountain of youth" in enabling older adults to stay independent, at home, and with fewer conditions usually associated with aging.

Later that morning at the assisted living facility, I watch residents as they participate in the daily exercise class. One person is standing and swaying to the music. The other residents are sitting, in fact many of them dozing, while a single aide bounces a balloon towards the seated individuals. The effectiveness of this exercise class is questionable, yet currently this is the only activity available aside from walking to meals. In contrast, exercise does not mean playing a session of basketball as many older adults believe. For most older adults, movements to enhance flexibility, strength, balance, and aerobic capacity lie somewhere in between these extremes.

The goal of this book is to provide professionals working with older adults, at all levels of function and with various disease conditions, with activities that can be implemented immediately in a variety of settings. The intent of this book is to bridge the gap between what research has demonstrated is beneficial for older adults and implementation of these strategies in real-world settings. Each chapter provides key points about the topic, an illustrative case, and helpful resources, to jump start knowledge translation from the page directly to adults in common sites of care: clinic, home, assisted living, nursing home, hospital, or gym. We have also provided links to videos, developed specifically for this book, to demonstrate activities which can be used immediately for training staff, educating trainees, or demonstrating activities to older adults.

The first three chapters of this book provide justifications for implementing suggestions found in the latter chapters and can be used to prepare for discussions with administration, supervisors, trainees, or clinical staff. The up-to-date information in these chapters may be used as background information to motivate and/or reassure individuals regarding the need to start or add new activities and for leaders to start or enhance exercise programs.

The latter chapters of this book include specific, evidence-based techniques to increase physical activity for a variety of older adults. Experts describe strategies to employ with older adults with stable chronic conditions, with existing functional problems, in mixed group settings, and with specific conditions such as dementia or visual impairments that require adaptive approaches. One chapter describes in detail the motivational interviewing technique for talking to older adults about exercise, to move more older persons from ambivalence and towards commitment to making lifestyle changes. As cultural background determines in large part one's views about health and exercise, one chapter explores the state of research in this area and provides suggestions for successful programs targeted to diverse groups.

At the end of the book, chapters describe community-based and large-scale, system-wide strategies to initiate and sustain exercise programs for large groups of older adults. These programs require broad buy-in from diverse stakeholders, yet have been successfully implemented in diverse groups with a decade of experience for some interventions.

Each chapter can stand alone, such that you do not need to start at chapter one and read through to the end of the book. In today's overly busy world, we want to give you "just in time" tools that can be used with the older adults you will see and care for today. As aging "boomers" ourselves, we are passionate about adding value to years, as stated eloquently more than 50 years ago by John F. Kennedy:

> It is not enough for a great nation merely to have added new years to life—our objective must also be to add new life to those years [1].

We hope you enjoy reading this book and use it frequently. Please write and give us feedback.

Farmington, CT, USA — Gail M. Sullivan, MD, MPH
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Chapter 1
The Physiology of Aging and Exercise

Maren S. Fragala

Key Points

- Biological aging does not always align with chronological aging.
- Age-related alterations in the neuromuscular and cardiovascular systems may have the greatest impact on physical function.
- Disability and aerobic physical frailty are related and have profound effects upon outcomes important to older adults, such as nursing home residence and mortality.
- Physiologic aging mimics "disuse" syndromes.
- Exercise reverses many physiological changes commonly associated with aging.
- Disuse may actually be a key cause of primary aging.

Introduction

When an older adult complains about loss of balance or challenges during everyday activities, have you heard this response, "you have to learn to live with this as it is just a symptom of aging?" For many years, clinicians gave this discouraging response as there was no simple prescription or medication that could restore balance, improve functional capacity, or increase strength. Symptoms such as loss of balance confidence and difficulty walking long distances or rising from a toilet are frequently experienced with aging. Fortunately, there is good news: a plethora of research demonstrates that these common changes can be remedied with an important, often overlooked prescription: exercise. With habitual physical exertion

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in the form of exercise, several studies have shown that balance can be restored, functional status can be increased, and strength can be improved.

The purpose of this chapter is to provide a general overview of the physiology of aging with a focus on the body systems most affected. In addition, this chapter will discuss the physiology supporting the potential reversibility of aging through physical exercise, to challenge the common notion that physical limitations accompanying aging are inevitable.

In exploring the physiological changes that accompany aging, this chapter will discuss how these changes mimic those we see with general physical inactivity or disuse. In fact, it is difficult to decipher which physiological changes are truly aging, per se, and which are a result of sedentary behavior. As the most functionally limiting age-related changes are largely attributed to lack of exercise, physical exercise may be close to a "fountain of youth" for older adults.

Biology of Aging

To fully understand the biology of aging, we must carefully distinguish between the concepts of chronological aging and biological aging. Chronological aging refers to the numerical age of a person in years, whereas biological age refers to the physiological status and functioning of the person, and varies among individuals of the same chronological age. For example, adults who have attained 85 years differ markedly in biological robustness. One 85-year-old person may live a full, independent, and vibrant life including safely driving, playing an 18-hole round of golf, and caring for his or her home. Another 85-year-old individual may have physical ailments and functional decline that result in his stopping favorite pastimes and moving to a nursing home. Thus, physiological changes affect individuals at different chronological ages with a high degree of variation.

Theories of Aging

Several theories have been proposed to describe the biological process of aging. Suggested theories generally fall within two prevailing themes: theories based on cellular structural damage and theories based on programmed cellular obsolescence. Theories based on structural damage attribute aging to molecular damage that accumulates in cells over time, which results in their breakdown and malfunctioning. The most widely held structural damage theory is the *free radical theory*, which is based on the oxidative cell hypothesis. According to this theory, the cumulative exposure to free radicals over a lifetime eventually damages cells so that their functioning becomes impaired. Free radical exposure can result in cellular damage in the form of wear and tear, faulty reconstruction, immunosuppression, and mitochondrial damage. In contrast, programmed obsolescence theories attribute aging to an

intrinsic biological clock which determines cellular fate. According to programmed obsolescence, each cell of the body has a predetermined lifespan during which it functions, after which the cell becomes obsolete. Regardless of the specific cause, most proposed theories of aging agree that cellular dysfunction is at the root of subsequent physiological declines.

Theories of aging align in describing aging as the result of cumulative homeostatic imbalances. In cumulative cellular dysfunction, cells lose their ability to function which leads to deterioration of tissues, organ function, organ systems, and overall homeostasis of the organism. The progressive and cumulative deterioration in organ function and physiological capacity associated with aging is often referred to as *senescence*. However, senescence does not imply the presence of disease. Instead, senescence may be considered normal human aging as it is characterized by a general decrease in organ reserve capacity and resistance to stressors. Although senescence is considered "normal" in the context of aging, it presents considerable challenges to the overall health status of a person. While senescence is distinct from disease, the process of senescence can increase the risk of developing a disease, reduce the ability to recover from disease, and lead to lower quality of life measures.

As senescence progresses, it can lead eventually to *frailty*, a more severe state of physiological vulnerability. Over time, even the healthiest older adults may become frail as they age, because they have avoided the fatal consequences of diseases such as cancer or cardiovascular diseases. In contrast to the process of senescence, frailty is characterized by specific objective criteria such as generalized fatigue, weakness, and weight loss (see Chap. 10). Frailty causes older adults to be much more vulnerable to catastrophic occurrences such as falls or infection.

Since aging is considered a process due to the waning of cellular functioning, approaches to modify aging should target a reduction in cumulative cellular damage. In order to best target interventions, the causes of cellular senescence must be carefully studied with a focus on intrinsic genetic endowment as well as intervening environmental and lifestyle factors. Causes of age-characterized cellular dysfunction are described as either *primary* or *secondary aging*. Primary aging involves an unavoidable deterioration of cellular structure and function independent of disease and environment. In this context, aging is inevitable, regardless of intervention. In contrast, secondary aging involves cellular deterioration due to preventable lifestyle and environmental exposures. Thus, secondary aging offers promising opportunities for interventions, especially for lifestyle factors. In particular, physiological disuse in the form of inactivity and sedentary behavior correlates highly with aging physiological systems.

Aging of the Body's Systems

Although senescence can affect all tissues, organs, and physiological systems in the body, the deterioration of some specialized cell types has more profound effects on the physical ability to perform tasks of daily living and maintain independence.

Among the body's systems, combined aging of the musculoskeletal and cardiorespiratory systems appears to produce the most functional limitations. As skeletal muscle function weakens, cardiorespiratory capacity decreases, body composition shifts toward fat accumulation, and older adults sense more fatigue and weakness in daily activities. Interestingly, specific physiological changes of aging, for most body systems, parallel those seen with decreased physical activity participation at any age. Before exploring how exercise can potentially remediate declines in physiological functioning, we will examine how primary body systems are affected by biological aging.

The Aging Musculoskeletal System

Skeletal muscles play an essential role in maintaining posture, stabilizing joints, moving the body, and regulating body temperature—all functions that decline with age to some extent. Age-related changes in skeletal muscle are highly prevalent in normal aging; when severe, this condition is termed *sarcopenia*. Loss of muscle mass usually begins by age 40 years and accelerates in the sixth decade of life. By age 90 years, an older adult may retain only half of his or her young adult muscle mass while fat mass increases.

Losses in strength and mobility accompany the decrease in muscle mass such that individuals with low muscle mass are four times more likely to have a physical disability than those with normal muscle mass. Sarcopenia affects roughly one in seven 60 year olds and one out of two of those aged 80 years and older [1]. Furthermore, the relative importance of muscle mass has been challenged by qualitative features of the muscle, which may better determine function. Considerations of muscle quality stem from observations that muscle strength decreases at a faster rate with age than muscle size.

With aging, decrease in overall muscle size is due to a decrease in both muscle fiber size and number. In comparison to a 30 year old, a 72 year old may have 25 % fewer muscle fibers in the medial vastus lateralis (thigh) muscle [2]. In addition, muscle composition changes with a reduction in the amount of myofibrils and contractile tissue and increase in the relative amount of connective tissue. The fiber loss is most noticeable in the fibers with high force-producing capability and fast contraction speeds, the type II fibers. Loss of type II fibers limits the capacity of aging muscle to produce shorter term, higher intensity energy and movements. Accompanying this change is an increase in relative proportion of slow oxidative fibers—type I fibers. As a result, the entire muscle fiber composition shifts toward slow, type I, characteristics: fatigue resistant and slow contraction velocity. This selective loss in type II fibers, which possess greater contraction velocity, impacts the muscle's ability to generate maximal force.

These changes in skeletal muscle are variable such that leg muscles responsible for mobility and locomotion experience the greatest decreases. For example, these

changes are much more apparent in the type II fibers of the vastus lateralis, an important muscle for locomotion, compared to the masseter, a muscle used for chewing [3]. Such anatomical discrepancies suggest that muscle atrophy observed with aging may be attributed to decreased use of particular muscles.

Contractile characteristics of muscle are largely dictated by the motor nerves that innervate them. With aging, nerve conduction slows, nerve fibers become smaller, and motor units are lost. As these changes occur, motor units rearrange and calcium release from the sarcoplasmic reticulum is hindered. This in turn impairs neuromuscular functioning and contributes to declines in strength and power.

In addition to contractile changes, skeletal muscle also demonstrates metabolic changes with aging. Glycogen metabolism is hindered as the number of glycosomes decreases. Also, muscle's capacity for aerobic metabolism becomes impaired by changes in muscle contents resulting from reduced blood flow. Aged skeletal muscle is propagated with fewer blood vessels which produces reduced myoglobin and mitochondria within the muscle. Finally, several age-related changes to mitochondrial function impair older muscles' oxidative capacity. Aged mitochondria show decreased enzyme activity, ATP synthesis, protein synthesis rates, protein content, gene transcripts for mitochondrial proteins, DNA (mtDNA) abundance, and increased DNA oxidative damage.

Many of these age-related changes in skeletal muscle appear due to a reduction in physical activity, as opposed to aging per se. Yet some age-related changes in muscle structure and function may not be preventable. While numerous studies have demonstrated older skeletal muscle's robust ability to adapt to exercise stress, the function of older muscle after training still remains below that of younger adults participating in similar training. Ultimately, reductions in muscle mass and strength can be attributed to impaired protein synthesis in aged muscle. Alterations in protein synthesis result in diminished protein quality and muscle contractile function.

The Aging Nervous System

In addition to innervating skeletal muscle to stimulate movement, the nervous system functions to detect and respond to stimuli by coordinating the activities of other systems. With aging, physiological changes occur in both the central and peripheral nervous system which produces changes in cognition, reaction, and response. Within the brain, neurons are lost which results in reduced brain size and impaired information transfer. Blood flow to the brain is reduced due to accumulation of sclerotic plaques. Synaptic organization changes, which affects the body's ability to respond to internal and external cues. Reaction time is prolonged and proprioception decreases. In addition, the number of dendrite branches and interconnections decreases. As a result, older adults may be slower to react to stimuli and may have more difficulty coordinating body movements.

Body Composition

Changes in body composition are an almost universal characteristic of normal aging. In older adults, muscle mass decreases are typically accompanied by fat mass increases. Functionally, the low lean mass to total body mass ratio can impede performance in mobility tasks such as walking or rising from a chair. In addition, body composition changes are associated with frailty and nursing home admission. Body fat also redistributes from the periphery to visceral deposits surrounding organs. While visceral adipose increases fat surrounding the organs in the trunk, intramuscular fat also infiltrates skeletal muscle, which results in metabolic and functional changes. Intramuscular lipid accumulation in older adult muscle actually may be due to a decrease in physical activity. Lipolysis requires activity of the enzyme, hormone-sensitive lipase, which is stimulated through muscle contraction and epinephrine release during exercise.

The Aging Cardiovascular System

The cardiovascular system, comprised of the heart muscle and vessels, is responsible for the internal transport of nutrient-rich blood to and removal of waste products from all cells of the body. At rest the heart functions well below its functional capacity and is somewhat unaffected by aging. It is during periods of increased use, such as physical exertion, where age-related changes in the cardiovascular system become apparent. During exercise the cardiovascular system must respond in order to meet the increased demand of the body's cells, particularly the cells in skeletal muscle tissue which are responsible for producing the energy (ATP) to fuel physical movements of muscle. Thus, with exercise the cardiovascular system must greatly increase its ability to transport nutrient-rich blood to working muscles. To do so it increases heart rate and stroke volume (the amount of blood pumped per contraction), dilates blood vessels, and opens additional capillaries to facilitate delivery of more blood to the working muscle. The capacity of the cardiovascular and respiratory systems to increase cardiac output and deliver oxygen to working cells determines the capacity of an individual to perform aerobic, or endurance, exercise.

Aging is associated with decreased cardiorespiratory functional capacity due to structural and functional changes. With aging functional capacity declines by approximately 5–14 % per decade, such that by age 80 years, a person's cardiorespiratory functional capacity is roughly half of that at age 20 years [4–6]. Structural changes in the cardiovascular system are the primary cause of this loss in functional capacity. In older adults the aging heart shows myocardial hypertrophy and reduced left ventricular compliance, or relaxation, similar to that seen due to years of hypertension. Though less common, it is also possible for the myocardium to atrophy with aging. The collagen content of cardiac tissue increases, particularly in the epicardial and endocardial layers of the heart tissue. In addition, the muscular

myocardial layer becomes thicker and less compliant. As a result of increased collagen content and decreased compliance, the aging heart loses its capacity to increase its stroke volume—the amount of blood ejected from the heart per beat—with increased exertion.

Stroke volume is a critical determinant of cardiac output and is responsible for the large cardiac outputs achieved by endurance athletes. While the increased thickness of the cardiac tissue may seem detrimental to function, some evidence suggests that it may actually provide a protective advantage to the aging heart. Thickening of heart tissue with aging may enable the heart to pump against the increased resistance in blood vessels that is also common with aging. Thicker heart walls may also protect the heart from damage by allowing stress on the heart to spread out over a larger area, which could prevent any one region from experiencing excessive strain.

Age-related changes within the heart itself also impact its rate of filling. The early diastolic phase of the heartbeat, when the heart relaxes to enable filling, takes longer. This is believed to be due to a slower ability of the heart chambers to initially relax during diastole. However, the heart compensates for this lag time by filling more quickly in the later diastolic period. Regardless of the compensation, the slowed diastolic filling makes the aging heart more dependent on atrial contraction to function properly.

In addition, cardiac functioning is impaired by changes in the cardiac valves. Similar to the heart walls, the valves of the heart also thicken with calcium deposits and collagen. Thickening impairs valve function, especially of the mitral and aortic valves. For example, the mitral valve between the left atrium and left ventricle is slower to close in older adults, causing blood to pool in the left atrium. Slowed closure of the aortic valve can result in reduced ejection of blood from the heart, as more blood remains in the ventricles.

An age-related reduction in maximal heart rate also contributes to an inability to increase cardiac output with exercise. With age, the maximal heart rate decreases from about 200 bpm at age 20 years to about 145 bpm at age 80 years. Age-associated changes in maximal heart rate are due to prolonged cardiac contraction and relaxation times with aging. The sympathetic nervous system initiates increases in heart rate with exertion by signaling the specialized cells of the SA node, the heart's pacemaker. With aging, fibrous tissue and fat deposits may interfere with these sympathetic signals, while the SA node also loses some of its specialized cells. This sympathetic interference results in an attenuated ability to increase heart rate, and thus maximal cardiac output, with age.

Cardiac hypertrophy in older adults generally results from reduced arterial compliance (relaxation). In the circulatory vessels, arterial compliance decreases as the arterial walls thicken and calcify, which causes increased opposition to the flow of blood. In addition, a reduction in vascular sensitivity to sympathetic nerve activity can impair vascular dilation. Reduced vessel diameter results in the heart having to work harder to push against greater resistance. Reduced vessel compliance is particularly problematic in the large arteries such as the aorta.

Other vascular changes with aging reduce renal, intestinal, skin, cerebral, and myocardial perfusion. Blood flow is impaired by diminished angiogenesis, which is

the ability to grow new blood vessels. In addition, the endothelial cellular function of the intimal layer of the vessel becomes less responsive which impedes vessel dilation. Plaque formation in the blood vessels, reduced elasticity of elastic arteries, weakened venous valves, and fewer blood vessels overall also contribute to increased vessel resistance.

These cumulative aging changes to the cardiovascular system result in a reduced ability to elevate cardiac output which diminishes maximal functional capacity. For example, during exercise a younger adult may be able to increase his cardiac output fourfold to about 20 quarts/min. In comparison, an older adult may be able to increase his cardiac output only twofold. As a result, older adults may perceive this impaired functional capacity as fatigue with increased exertion, in activities such as walking fast or climbing a flight of stairs.

The Aging Respiratory System

The respiratory system functions in conjunction with the cardiovascular system to determine functional capacity. The respiratory system delivers oxygen from the ambient air to the alveoli of the lungs where gases (O_2 and CO_2) can be exchanged in capillary blood. Similar to the heart, structural changes within the aging respiratory system can impede functional capacity in older adults. With aging, lung tissue loses elasticity, which reduces its ability to inflate and deflate. As a result, in comparison to healthy younger adults, older adults have a lower vital capacity or ability to exchange large volumes of air. The reduction in vital capacity is largely due to an increased residual volume or volume of air remaining in the lungs after exhalation.

Also limiting respiratory capacity are changes in the alveoli of the lungs. While the number of alveoli in the lungs does not change markedly with aging, alveolar walls thicken. Thickening of the alveolar walls reduces the surface area available for gas exchange between ambient air and capillary blood. As a result, oxygen exchange capacity becomes impaired. While the cumulative structural changes to the lungs do not generally impair ability to perform tasks of daily living in healthy older adults, these changes can impair functional capacity during physically demanding activities. Older adults may recognize respiratory limitations as labored breathing and fatigue when walking long distances or climbing stairs.

Aging of Other Body Systems

Although the neuromuscular, cardiovascular, and respiratory systems play the largest roles in maintaining physical performance and function with aging, interactions among physiological systems are also important in understanding the effects of aging upon function. Many other organ systems contribute to the maintenance of internal homeostasis during exercise and assist in tasks such as recovery, heat dissipation, and fluid regulation in response to physical activities (see Fig. 1.1).

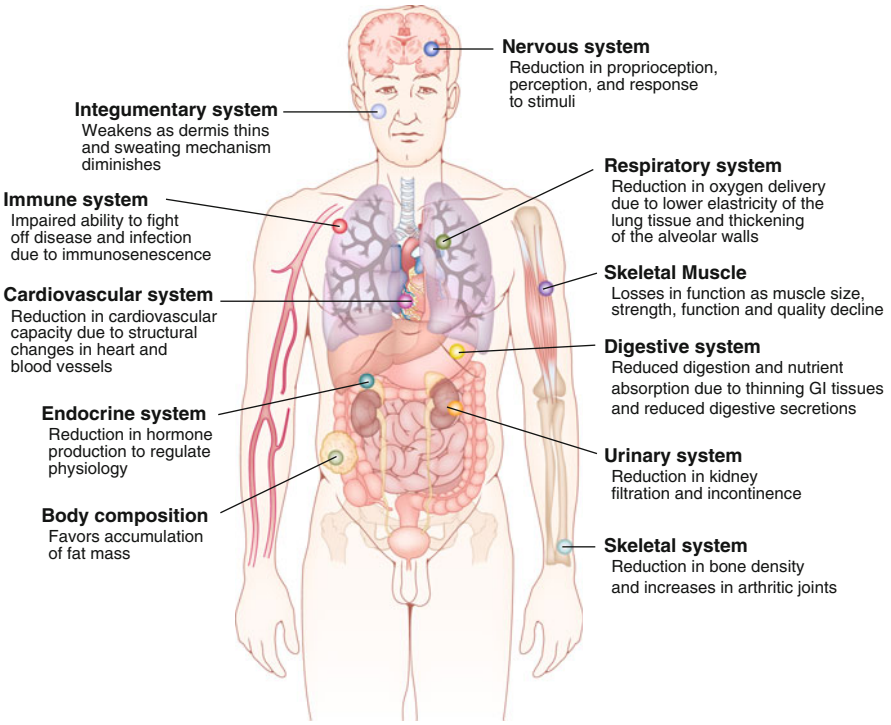

Fig. 1.1 Common age-associated changes to body's physiological systems

Aging vs. Disuse

The cumulative result of the body's aging physiological systems can result in profound functional disability. Nevertheless, it remains difficult to distinguish the consequences of primary biological aging from secondary aging related to disuse. Some evidence suggests that disuse may in fact be a primary driver of aging. In fact, among the many causes of age-related physical disability, physical disuse appears to be the only strategy to both prevent and reverse functional loss.

Aerobic physical frailty is the level at which low aerobic function predisposes older adults to catastrophic consequences. Recently, thresholds to indicate aerobic physical frailty have been defined as a peak volume of oxygen consumption of less than 18 ml/kg/min [7]. Similarly, thresholds of clinically relevant muscle weakness (grip strength of <26 kg in men and <16 kg in women) have been established [8]. These thresholds are strongly associated with mobility limitations and mortality. Importantly, both aerobic fitness and muscular strength can be markedly improved with exercise training.

Effects of Physical Exercise

Physical exercise is an important strategy to avert many of the observed age-related physiological decrements. Overall, physical exercise participation slows physiological changes of aging that impair functional capacity. Studies show that exercise can alleviate age-related changes in body composition, promote psychological and cognitive well-being, reduce risks of disability, and increase general longevity [9, 10].

Primary adaptations to exercise occur in the cardiorespiratory and musculoskeletal systems from both aerobic (endurance) and resistance (strengthening) types of training. In particular, aerobic exercise slows the loss of circulatory functioning with age, primarily through improved cardiovascular diastolic function. In addition, exercise improves blood vessel elasticity and endothelial function by reducing free radical damage and maintaining the production of nitric oxide. Physical exercise has been recognized as a means to delay aerobic fitness frailty as well as delay nursing home residence [11].

In skeletal muscle, physical exercise consistently attenuates several characteristics of aged muscle: intramuscular adipose infiltration; physical performance, strength, size, and function; muscle fiber area; and muscle quality. In older adults, endurance exercise training increases important cellular functions such as mitochondrial biogenesis, muscle oxidative capacity, mitochondrial content, oxidative enzyme activities, muscle protein synthesis rates, mitochondrial protein gene transcripts, and mitochondrial DNA copy number. In addition, exercise training improves metabolic function. Age-related decreases in glucose tolerance and insulin sensitivity appear to be preventable with exercise participation. Research demonstrates that 60-year-old master's athletes have similar glucose tolerance test responses as those of younger athletes. Exercise programs designed for older adults also reduce the risk and incidence of falls.

Despite these benefits, studies show that physical activity participation decreases with aging in both amount of physically active time and intensity of activities performed. In 2007 the American College of Sports Medicine (ACSM), in conjunction with the American Heart Association (AHA), published physical activity recommendations for older adults [12]. These recommendations include various modes of physical exercise: cardiovascular (walking or swimming), muscle strengthening (lifting weights or using weight machines), flexibility (stretching), and neuromotor (balance exercises such as yoga or tai chi). Currently few older adults meet these physical activity recommendations, especially for resistance exercise. The challenge for clinicians and researchers remains in the translation of what we now know about usual aging and exercise as a strategy to prevent or reverse these changes, into routine, daily activities of older adults, in every setting in which they live.

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Chapter 2
Benefits of Exercise for Older Adults

Melissa J. Benton

Key Points

- Exercise improves important outcomes for older adults, including functional status, longevity, and healthcare costs.
- Exercise can be used to prevent, treat, or palliate chronic conditions commonly experienced by older adults, including heart disease, diabetes, osteoarthritis, falls, and depression.
- The greatest benefits are seen in sedentary older adults who begin a moderate-level exercise program.

Case Part 1

Wanda is a 74-year-old woman who was recently seen in the emergency room for a fall after losing balance while carrying laundry downstairs. She injured her right knee and shoulder without fracturing. Wanda feels frustrated because every time she sees her doctor she gets a new pill, yet she increasingly feels like she has lost her "get up and go." She was diagnosed with type 2 diabetes approximately 10 years ago and despite attempts to diet, continues to gain some weight every year. Wanda does housework and cooking, but no other physical activities. She takes medications for hypertension, diabetes, depression, and osteoarthritis of her knees. Wanda wants to take fewer medications, stop gaining weight, and get her energy back. She asks her doctor, "isn't there anything else I can do, besides taking more pills?"

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Overall Health Benefits of Exercise

Regular exercise has many benefits for older adults, including prolonged lifespan, maintenance of health and physical independence, promotion of social interaction, and improvements in quality of life (Table 2.1). Healthcare providers should counsel older adults about the benefits of physical activities matched to each individual's level of ability, skill, and interest and should advise also that these benefits begin almost immediately after starting a regular exercise program. This chapter will review overall health and specific disease benefits for older adults that result from engaging in one or more components of exercise. Although evidence strongly supports benefits for a wide variety of adults, this chapter focuses on community-dwelling older adults with typical chronic diseases associated with aging. Other chapters discuss avoiding exercise risks (Chap. 3) and exercises for individuals with functional impairments (Chap. 8).

Table 2.1 Benefits of exercise in older adults

Overall	Increased longevity
Cardiovascular	Increased HDL-C levels
	Decreased LDL-C levels
	Decreased total cholesterol
	Decreased blood pressure
	Decreased resting heart rate
	Decreased risk of myocardial infarction
	Decreased risk of stroke
Metabolic	Increased insulin sensitivity
	Decreased blood glucose
Psychological	Improved quality of life
	Improved mood
	Increased socialization
	Decreased risk for or severity of depression
	Decreased pain
Physical function	Increased independence in activities of daily living
	Improved activity tolerance
	Increased walking speed and distance
	Increased stair climbing ability
	Improved balance
	Decreased risk of falls

Leading Causes of Death

In 2010 heart disease was the leading cause of death in adults 65 years and older, followed by cancer, chronic respiratory disease, cerebrovascular diseases, Alzheimer's disease, and diabetes [1]. Among older adults, chronic diseases account for more than two-thirds of all deaths. When lifestyle behaviors are taken into account, *physical inactivity* is considered to be the major contributing cause of death and increased healthcare costs [2]. There appears to be a dose–response relationship between exercise and health, with somewhat better outcomes related to greater duration or intensity of exercise. The greatest relative benefits are observed when sedentary or low-active older adults become moderately active. Substantial health benefits can be accrued with as little as 150 minutes a week of moderate-intensity aerobic exercise such as brisk walking (Box 2.1) [3].

Box 2.1: Physical Activity Guidelines for Older Adults [3]

- Any amount of physical activity provides some health benefits. Some physical activity is better than none, and older adults should avoid inactivity.
- For more health benefits, older adults should do a minimum of 150 min/week of moderate-effort endurance exercise performed in bouts of at least 10 min on at least 3 days spread throughout the week.
- When older adults cannot do 150 min of moderate-intensity endurance exercise a week because of chronic conditions, they should be as physically active as their abilities and conditions allow.
- Older adults should also do muscle-strengthening exercises that are moderate or high intensity and involve all major muscle groups on 2 or more days a week, for additional health benefits.
- Older adults should do exercises that maintain or improve balance.
- Older adults should match their level of exercise intensity and effort to their level of fitness.
- Older adults with chronic conditions should understand whether and how their conditions affect their ability to do regular physical activity safely.

Benefits of Exercise for Specific Diseases and Conditions

Cardiovascular Disease

Strong evidence supports the benefits of exercise for prevention and management of *cardiovascular disease*. There is an almost linear dose–response relationship between amount or intensity of physical activity and reductions in risk [4]. Cardiac rehabilitation programs that provide upper and lower body endurance-type

exercises (treadmill walking, cycling, and arm ergometry) reduce cardiac mortality and improve depressive symptoms and quality of life. Daily endurance exercise such as brisk walking at 3–4 miles an hour for 20–30 min is protective against onset of cardiovascular disease, mortality during hospitalization for acute myocardial infarction (MI), and long-term cardiovascular-related mortality [5]. After MI, a 6-month mixed exercise program of cycling, weight lifting, and stretching exercises three times a week normalizes autonomic dysfunction, restores arterial baroreflex sensitivity, and decreases long-term mortality risk [6].

Vascular risk factors, such as low high-density lipoprotein (HDL-C) cholesterol levels, can be improved with regular exercise, which is associated with an estimated 7 % decrease in overall cardiovascular events and a 30–35 % reduction in risk for coronary artery disease. Duration is of greater effect than intensity, and endurance exercise (brisk walking or jogging) at least three times a week for more than 30 min is sufficient to improve lipid profiles [4]. Another type of exercise training, Tai Chi, has beneficial effects on blood lipids. A 30-min, low- to moderate-intensity program three times a week not only improves HDL-C, but can also decrease total cholesterol [7].

Systolic and diastolic blood pressure can be reduced with regular endurance exercise, although the greatest benefit is achieved within the first 6 months [8]. A dose–response relationship has been observed. Moderate- or high-intensity endurance exercise provides greater benefits than low intensity, and achieving or exceeding the 150 min/week recommendation results in slightly greater reductions in systolic blood pressure. In comparison, strength training at lower intensities seems to improve systolic and diastolic blood pressure to a greater extent than higher intensities, although strengthening exercise at any intensity is effective. Although evidence in older adults is limited, isometric strength training using a handheld dynamometer appears effective for blood pressure control as well [9]. Participation in a Tai Chi exercise program 2–3 times per week can reduce systolic and diastolic blood pressure in hypertensive older adults, and improvements may exceed those observed with more traditional endurance exercise programs.

Chronic heart failure can also be effectively managed with exercise. Either hospital- or home-based endurance training, alone or combined with strength training, reduces hospitalizations and all-cause mortality and improves functional capacity in older adults with NYHA class II–III heart failure [10]. An alternate training modality, high-intensity interval training (cycling or treadmill running) that interspersed short high-intensity bouts with recovery periods, is not only safe and as effective as moderate exercise protocols, but may be better tolerated by older adults with heart failure, due to their need for shorter exercise duration. Finally, in more severely impaired patients (NYHA class III–IV) who are unable to initially tolerate traditional endurance training, inspiratory muscle training using a portable resistive breathing device at home may provide an alternative. An inspiratory muscle training program at least two times per week for heart failure patients can improve dyspnea and exercise tolerance to an equal or greater extent than endurance or strength exercises alone [11].

Atrial fibrillation, a common cardiac arrhythmia, increases the risk of stroke. A regular walking program that meets the 150 min/week recommendation is strongly associated with decreased risk for development of atrial fibrillation in normal-weight (BMI 18.5–24.9 kg/m^2) older men and women and has a gender-specific protective effect in obese (BMI $\geq$ 30 kg/m^2) men [12]. Among older adults with permanent atrial fibrillation, resting heart rate can be reduced by 7–13 bpm within two to four months through a variety of exercise programs. These programs include brisk walking at a moderate pace (able to talk while walking), other endurance exercises (stair climbing, cycling, running, arm ergometry, rowing, or interval training), or strength training [13].

Stroke is associated with hypertension and poor cardiovascular health, as well as atrial fibrillation. After stroke occurrence, mobility (walking speed and tolerance) and balance can be improved with a regular endurance exercise program using a cycle or treadmill for at least 3 days/week [14].

Cancer

For older adults, the evidence supporting exercise for prevention and management of cancer varies. Among postmenopausal women, there is an inverse relationship between exercise *before diagnosis* and *breast cancer*, with risk of disease onset reduced by 20–80 %. This risk reduction does not appear to be dose-dependent and low-intensity physical activity appears to confer protection similar to moderate- to high-intensity exercise. In contrast, *after diagnosis* with breast cancer, there is a more dose-dependent relationship, with moderate- to high-intensity exercise decreasing risk of cancer-related mortality and all-cause mortality more than low-intensity physical activity. Endurance exercise, such as brisk walking, appears to fulfill the criteria for moderate intensity, with a cut point of approximately three hours per week being sufficient to lower mortality risk both pre- and post-diagnosis [15].

Regular exercise plays a role in prevention of *gastrointestinal cancers*, although women may accrue greater benefits than men. Moderate-intensity endurance exercise, such as cycling, is associated with a lowered risk of gastroesophageal cancer among older adults. However, frequency of physical activity appears to be of greater importance than intensity, and five days a week appears to be optimal. For colorectal cancer, exercise either before or after diagnosis can reduce mortality. Among older adults, decreased mortality is associated with greater frequency, duration, or intensity of endurance exercises such as walking, bicycling, or swimming. Those who are not physically active prior to diagnosis can still accrue the same benefit by becoming as active after diagnosis as those who have been continually active [15].

There is limited evidence regarding exercise and reduced risk for diagnosis of *prostate cancer* in older men. Moderate to vigorous endurance exercises such as brisk walking, jogging, running, or biking may provide a modest reduction in risk. This benefit appears to be specific to exercise during young and middle age; and thus, when exercise programs are begun in late life, they confer no protective effect.

Strength training alone or in combination with endurance training provides benefits to older adults with cancer during and after treatment. For example, during radiation treatment for prostate cancer, strength training alone three days a week improves strength but does not increase muscle mass. During chemotherapy for breast cancer, strength training 2 days a week with weight machines, dumbbells, and elastic bands, combined with endurance exercise (treadmill walking), can increase muscle mass and strength. Furthermore, the benefits of exercise are greater when training is commenced immediately rather than delayed.

Chronic Respiratory Disease

Among older adults, respiratory diseases such as chronic obstructive pulmonary disease (COPD) and asthma are common and associated with poor health outcomes and increased mortality risk. Pulmonary rehabilitation programs that include endurance and strengthening exercises are effective for management of chronic respiratory disease.

Strong evidence supports exercise interventions for the management of COPD. In both stable and unstable COPD patients, participation in a pulmonary rehabilitation program reduces hospitalization and mortality risk and improves dyspnea and quality of life [16]. Exercise programs are effective in a hospital, clinic, or home setting with a minimum of 30 min of any combination of endurance (walking, cycling, treadmill, stair climbing) and strengthening (weight lifting) exercises at least 2 times per week. Interval training with repeated short bouts of high-intensity exercise (cycling or treadmill running) alternating with recovery periods is also an effective training strategy to decrease dyspnea and increase exercise tolerance in older adults with COPD.

There is some evidence that upper extremity training with either an arm ergometer or free weights (dumbbells) at least 3 times per week may improve dyspnea although these improvements may not be clinically significant. In comparison, 2–3 days/week of either whole body- or lower extremity-specific strength training can improve respiratory function (forced vital capacity) [17]. Thus, it appears prudent to include both upper and lower body exercise training for optimal improvements in older adults with COPD. Although not superior to traditional land-based exercises, water-based training may be a feasible alternative for some older adults, with similar benefits observed in improved walking ability and quality of life [18]. Example exercises are illustrated in Video 4.2, Water Exercises.

Finally, for older COPD patients who are too deconditioned to initiate an exercise program, a regular program of breathing exercises using pursed lip breathing (breathing out slowly with the lips in a whistling position), diaphragmatic breathing (deep breathing focusing on the abdomen), or yoga breathing (timed breathing with a focus on exhalation) may improve exercise tolerance and facilitate progression to endurance and strengthening exercises.

Although evidence is limited, regular exercise appears safe and effective for management of *asthma* in older adults. Brisk walking at 60–75 % of predicted

maximal heart rate three times a week for 30 min can improve exercise tolerance without deterioration in asthma control. More intense and longer duration exercise is also well tolerated. A mixed training program of walking and circuit training (cycling, step-ups, wall squats) for 90 min three times a week can improve quality of life and exercise tolerance.

In contrast, exercise is often not encouraged in older adults with *pulmonary arterial hypertension*. However, research indicates that a supervised exercise program of longer duration and lower intensity can be safe and effective. A 60- or 90-min daily walking program, alone or with interval training (cycling), combined with low-intensity upper body strength training (dumbbells), is usually well tolerated and can improve exercise tolerance, walking distance, and quality of life. A similar program, undertaken by older adults with thromboembolic pulmonary hypertension, can also safely improve exercise tolerance, distance walked, and quality of life.

Dementia

Endurance exercise (40 min of brisk walking three times a week) appears to have a protective effect against the risk of occurrence of Alzheimer's disease. The same risk factors that promote cardiovascular disease are implicated in neurodegenerative disease and declines in cognitive function. Regular endurance exercise that promotes cardiovascular health also promotes cognitive health and reduces the risk for Alzheimer's and vascular dementia [19]. This relationship may be due to improved circulation and cerebral blood flow.

Evidence suggests that endurance exercise has positive effects on brain volume with greater levels of fitness maintaining and possibly increasing gray matter volume in healthy older adults. There is a dose–response relationship between physical activity and cognitive function, with greater doses (intensity or duration) of exercise resulting in greater protective effects against cognitive decline [20]. Greater muscle strength is positively associated with better cognitive function with aging; thus, strengthening exercises may also reduce the risk of dementia.

Supervised exercise can also be effective for management of older adults with mild to severe dementia in either home or institutional settings [21]. Training programs at least four times a week that include endurance exercise (at least 30-min walking at self-selected pace) alone or in combination with low-intensity strength exercise (squats, knee bends, chair stands, toe rises, or body weight push against wall) can enhance independence in activities of daily living, cognitive function, and depression. Exercise bands (TheraBands) provide a less frequent (three times a week) but higher-intensity strengthening program that can improve walking speed, balance, and activities of daily living. Participation in a structured group exercise program enhanced with music improves cognitive function (Mini-Mental State Exam) for older adults with moderate to severe dementia; however, these improvements may not be clinically important.

Diabetes Type 2

A minimum of 150 min/week of physical activity can reduce incidence of type 2 diabetes in older adults by more than 50 %, likely related to improvements in insulin sensitivity, which can be observed for up to a week following a single bout of 30 min of endurance exercise with or without strength exercise. After onset of diabetes, 60 min of endurance or strength training three times a week improves endothelial function and increases arterial blood flow in older adults [22]. Exercise training also decreases LDL-C and increases HDL-C levels, with greater improvements in HDL-C associated with longer exercise duration.

Exercise may also be used effectively for long-term management of glucose levels in older adults with type 2 diabetes. Any combination of moderate- to high-intensity endurance or strength exercise, at least three times per week for approximately 60 min, reduces hemoglobin A1C levels. Increasing frequency (number of days per week) of endurance exercise may enhance glucose control, although increasing the frequency of strength exercise has not produced additional benefits. Increasing the intensity of strength training may promote greater reductions in HbA1c through greater increases in muscle mass.

Neuropathy, a common complication of diabetes, increases risk for injury during exercise. In older adults with existing neuropathy, a strength training program at least twice a week can safely improve strength and balance and decrease fall risk. Endurance exercises do not appear necessary for improvements to occur.

Depression

Although there is less evidence that regular exercise can prevent the onset of depression, strong evidence supports the benefits of exercise in treating depression among older adults. Longitudinal studies among older adults indicate that participation in regular physical activity may be protective against depression. Lower levels of exercise, such as moderate to brisk walking at least 30 min a day, are sufficient, although there is some indication that a dose-dependent effect exists and that a greater weekly dose (longer duration, greater frequency, or higher intensity) may provide greater protection [23].

For treatment purposes, among older adults over the age of 70, initiation of a regular 30-min exercise program at least 3 days/week can decrease the severity of depressive symptoms [24]. Endurance exercises that include outdoor walking, indoor (treadmill) walking, or cycling are effective, although supervision may be a necessary component of the program. Strength training programs, which include either traditional gym-based programs at moderate to high intensities or lower-intensity home-based programs using ankle weights and weighted vests, treat depression as well as improve functional ability and overall quality of life. A dose–response relationship has been observed, with greater frequency associated with greater improvements. Structured group classes that combine endurance and

strength exercises are effective for symptom reduction and may provide additional benefits such as socialization.

Exercise also improves perceptions of overall well-being in older adults. Supervised group walking programs appear to be most effective, especially for older women. Light to moderate intensity, with a minimum of 45 min per session and two sessions per week, appears effective. Walking outdoors improves mood and decreases depression among older adults to a greater extent than walking indoors. Exercising outdoors may also enhance motivation or intent to repeat the activity and lead to greater adherence over time.

Osteoarthritis

The prevalence of osteoarthritis increases with age with more than one-third of older adults affected. Degenerative changes resulting from osteoarthritis are the most common cause of disability reported by older adults. Evidence for benefit from regular exercise, for symptom management, is strongest for knee osteoarthritis. Any physical activity reduces pain and maintains function compared to inactivity. Water-based endurance (walking, jogging, jumping, and cycling) or strength (squats, calf raises, knee flexion/extension, and hip abduction/adduction) training in a heated pool improves function and mobility (walking distance). Example exercises are illustrated in Video 4.2, Water Exercises.

Land-based exercise programs that include any combination of endurance (walking, Tai Chi), strength (exercise bands or weight machines), and flexibility (stretching) exercises are also effective for older adults with osteoarthritis. Frequency seems to have the greatest influence on outcomes, with three or more sessions per week needed for effective pain relief, although significant pain reduction may not be evident for up to 8 weeks after initiation of training. In comparison, Tai Chi exercises at least twice a week improve pain, stiffness, and function, but a 12-week training program may be necessary to achieve meaningful results. Walking programs reduce pain, promote strength, and maintain flexibility in sessions of at least 10 min of continuous brisk walking, preceded and followed by 3-minute warm-up and cool-down periods [25].

Sarcopenia, Functional Capacity, and Falls

Sarcopenia, or loss of muscle with aging, is characterized by atrophy of skeletal muscles and accompanied by loss of strength. Women are at higher risk than men due to lower overall muscle mass, and prevalence among elderly women can be up to two times greater than for men. The prevalence of sarcopenia is much greater in nursing home residents than in the community: as many as one-third of adults in long-term care are affected (see also Chap. 10).

It is important to consider gains in both muscle and function when exercise programs are initiated to prevent or reverse sarcopenia. The impact of sarcopenia is primarily observed in loss of strength and functional capacity of the lower body, because muscle fibers that promote muscular strength are selectively lost in favor of endurance muscle fibers that appear to proliferate with age. As a result, older adults can perform activities such as walking that require muscular endurance, but have profound difficulty with strength-related activities such as standing up from a chair or climbing stairs.

Exercise appears effective for management of sarcopenia in even the oldest old. Muscle strength in the upper and lower body can be increased with training even one day per week, although frequencies of two to three days per week are recommended. For severely deconditioned older adults, a single set of low-intensity strength exercises three times a week for the major muscle groups (chest, back, legs, arms) will increase upper and lower body strength, with higher intensities resulting in greater strength gains. Generally, multiple sets of 8–10 exercises on two or three days of the week are needed to increase muscle mass. A regular strength training program can improve strength and balance with subsequent improvements in walking speed, standing independently, and climbing stairs.

Fall risk also decreases with exercise. A multicomponent program that combines strength, endurance, and balance training appears most beneficial for reduction of frequency and severity of fall injuries [26]. Individual (home-based) and group exercise programs are equally effective. Studies consistently show that Tai Chi, in particular, decreases the frequency of falls in community-dwelling older adults, as well as the severity of fall-related injuries. For older adults, social benefits associated with fall reduction include continued community engagement and role maintenance in the family.

Case Part 2

As Wanda's main goals are to minimize medications and improve her lack of energy, her doctor suggests that endurance or aerobic exercise, such as walking, may be a good place to start. Wanda agrees to "start low and go slow." With a regular endurance exercise program, Wanda may feel and sleep better and require fewer or no medications to control her hypertension and diabetes. Exercise may also promote weight loss. Her knee pain from osteoarthritis is currently under control with occasional acetaminophen and should improve with exercise and weight loss. However, Wanda would also benefit from resistance or muscle-strengthening exercises to promote muscle gain and prevent muscle loss over time and balance exercises to decrease her risk for falling.

Wanda decides to join the local YMCA through the SilverSneakers program, to attend senior group sessions with strengthening, balance, and aerobic components. Water aerobics, treadmills, and recumbent cycles are also available at the Y to supplement her walking program, especially in bad weather. Her goal is to reach 150 min of activity per week at 6 weeks and 210 min/week at 15 weeks.

Maintenance of Health Benefits

Long-term benefits of exercise are sustained only with regular adherence (Table 2.2). Cardiovascular function, lung function, insulin sensitivity, strength, and pain relief are maintained over time when regular exercise is continued throughout the lifespan. Clinicians should encourage active older adults to continue regular exercise and inactive older adults to begin a program of their choice.

Table 2.2 Benefits of exercise for specific diseases and conditions

Disease or condition	Exercise component	Benefits
Cardiac and vascular		
Coronary artery disease	Endurance	*Prevention*
		Improves cardiac blood flow
	Tai Chi endurance	*Prevention*
		Improves blood lipids
	Endurance	*Treatment*
		Decreases mortality
		Improves cardiac function
		Improves blood lipids
Hypertension	Endurance, strengthening, and Tai Chi	*Treatment*
		Reduces systolic and diastolic blood pressure
Chronic heart failure	Endurance and strengthening	*Treatment*
		Decreases hospitalizations
		Decreases mortality
		Decreases inflammation
	Inspiratory muscle training	*Treatment*
		Decreases dyspnea
		Increases activity tolerance
Peripheral vascular disease	Endurance and strengthening	*Treatment*
		Increases blood flow
Atrial fibrillation	Endurance	*Prevention*
		Reduces incidence in normal-weight men and women and obese men
	Endurance and strengthening	*Treatment*
		Decreases resting heart rate
Stroke	Endurance	*Prevention*
		Decreases risk for atrial fibrillation
		Treatment
		Increases mobility (walking)
		Improves balance

(continued)

Table 2.2 (continued)

Disease or condition	Exercise component	Benefits
Dyslipidemia	Endurance and strengthening	*Treatment*
		Increases HDL-C
		Decreases LDL-C
	Tai Chi	Increases HDL-C
		Decreases total cholesterol
Respiratory		
COPD	Endurance and strengthening	*Treatment*
		Decreases dyspnea
		Reduces hospitalizations
		Decreases mortality
		Improves quality of life
Pulmonary arterial hypertension	Endurance and strengthening	*Treatment*
		Increases activity tolerance
		Increases mobility (walking)
		Improves quality of life
Endocrine		
Diabetes mellitus	Endurance	*Prevention*
		Improves insulin sensitivity
		Promotes weight loss
	Endurance and strengthening	*Treatment*
		Decreases blood glucose
		Increases blood flow
		Decreases mortality
Psychosocial		
Dementia	Endurance and strengthening	*Prevention*
		Improves cerebral blood flow
		May increase brain and gray matter volume
		Treatment
		Increases function (activities of daily living)
		Increases mobility (walking)
		Improves balance
		May slow cognitive decline
Major depression	Endurance	*Prevention*
		Improves mood
	Endurance and strengthening	*Treatment*
		Improves mood
		Decreases symptom severity Increases socialization
		Improves quality of life

(continued)

Table 2.2 (continued)

Disease or condition	Exercise component	Benefits
Insomnia	Strengthening and Tai Chi	*Treatment*
		Improves sleep quality
Musculoskeletal		
Osteoarthritis	Endurance and strengthening	*Treatment*
		Decreases pain
		Increases mobility (walking)
	Tai Chi	*Treatment*
		Decreases pain and stiffness
	Flexibility	*Treatment*
		Maintains joint range of motion
		Decreases pain
Fall risk	Strengthening (legs)	*Prevention*
		Maintains strength and muscle mass
		Improves balance
	Balance, strengthening, endurance, and Tai Chi	*Treatment*
		Reduces number of falls and injurious falls
Osteoporosis	Strengthening (high intensity only) and endurance (high intensity only)	*Prevention*
		Reduces risk of osteoporosis of the hip and spine
		Treatment
		Improves bone density of the hip and spine
Obesity	Endurance	*Treatment*
		Maintenance of weight after loss; weight loss in conjunction with diet

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Resources

Exercise is Medicine. Exercise is Medicine® aims to make physical activity a standard in the healthcare system through integration of clinical healthcare provider services with evidence-based community programs, and to provide a clinical decision support system so that clinicians can provide physical activity counseling. http://www.exerciseismedicine.org/.

Go4Life. Go4Life® is an exercise and physical activity campaign from the National Institute on Aging that is designed to help older adults fit exercise and physical activity into their daily life. http://go4life.nia.nih.gov/.

Physical Activity Guidelines for Americans. The Physical Activity Guidelines provide science-based guidance to maintain or improve health through regular physical activity. http://www.health.gov/paguidelines/guidelines/.

Silver Sneakers. Silver Sneakers Fitness® is a Medicare eligible program that helps older adults take greater control of their health by encouraging physical activity and providing benefits such as gym memberships. https://www.silversneakers.com/.

Chapter 3
Risks of Exercise for Older Adults

Liza Stathokostas and Gareth Jones

Key Points

- The benefits of exercise greatly outweigh the risks related to being physically inactive.
- The majority of older adults can safely take up light to moderate exercise, such as walking, with medical clearance suggested before starting vigorous exercise.
- An older adult at high risk for or diagnosed with heart disease, or whose weight is categorized as obese, should consult with a health care professional prior to becoming more physically active.
- Older adults are not at an increased risk for musculoskeletal injuries.
- Tips to avoid injury include: begin slowly with low-intensity exercises, warm up with low-intensity exercises at the start of an exercise bout, be aware of your surroundings, and choose a safe environment.
- Older adults should take precautions or avoid exercising outdoors in very warm or very cold weather.
- Prescreening and exercise consultation to identify and provide modifications for age-related issues allows older adults to safely participate in exercise.

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Introduction

Case 1, Part 1
Shirley (75 years) and Maria (78 years) are neighbors. Shirley and Maria often sit on their front porches and watch activities in the park across the street. Shirley experienced a heart attack two years ago and has since moved from the area where she attended supervised rehabilitative exercises for 6 months. Shirley is cautious about physical activity and her family reminds her to "take it easy" and "not to strain herself." Maria is healthy but has noticed that she breathes more heavily now with daily chores. Maria thinks this is part of the aging process and that she is too old to safely exercise, like the walking group in the park. Both ladies fear they may fall and hurt themselves if they were to start exercising.

For older adults, the many well-established benefits greatly outweigh the risks of being physically inactive. The perceived risks associated with exercise—structured, repetitive, and goal-oriented physical activity—act as a barrier among adults over the age of 65 years, who are the most inactive segment of the population. In addition, a lack of training, skill, and comfort experienced by health professionals creates a barrier toward the promotion and support of exercise among older adults. As health professionals remain the primary source for healthy lifestyle behavior information for older adults, the goal of this chapter is to inform health professionals in advising safe, effective exercise to older adults.

Screening for Risk, Medical Clearance, and Promoting Safety

When an older adult is starting physical activities categorized as aerobic or resistance training or is transitioning from low- to higher-intensity activities, medical clearance by a health professional is not required in the absence of major health problems. However, with age, the prevalence of chronic health conditions increases. Thus exercise recommendations from the older person's usual health care provider may be prudent. Medical review is also appropriate when an older adult plans to participate in physical activities that are a significant change from their current practice or has a chronic condition that increases the risks of exercise. Walking more or being more active in everyday activities does not warrant prior medical clearance.

To reduce risks associated with exercise, the first step is to assess a patient's health "readiness" to engage in exercise. A practical tool that can be used by health care providers, older adults, and exercise program managers is the Exercise and Screening for You (EASY) tool [1]. The EASY tool can help older adults determine if a visit to the health care provider may be needed before embarking on a new exercise routine. The tool also matches activities to particular health conditions or situations. Another resource, for all ages, is the Physical Activity Readiness

Box 3.1: Common Myths About Exercising in Older Adults

- It is dangerous for older adults to exercise.
- It is too late for sedentary older adults to benefit if starting exercise now.
- Difficulty walking or doing other activities is just part of getting older.
- To get real benefits from exercise, it must be vigorous, like running or playing basketball.
- Older people will injure their joints or fall if they try to exercise.
- Older adults need special tests, such as a cardiac stress test, before starting to exercise.

Questionnaire for Everyone (PAR-Q+), a single-page form to determine whether the individual should seek further advice from a medical professional or certified exercise physiologist before becoming more physically active (http://www.csep.ca/CMFiles/publications/parq/PARQplusSept2011version_ALL.pdf), with subsequent pages of this form used by a medical or exercise professional to determine the level of risk that a patient has relative to their underlying health conditions. The PAR-Q+ form may be downloaded from the Canadian Society for Exercise Physiology website at www.csep.ca.

In addition to self-report screens, exercise professionals or facility directors should obtain history regarding medical conditions, previous physical activities and exercise pursuits, and symptoms which may suggest underlying conditions such as shortness of breath, chest pain upon exertion, muscle weakness, joint pain, or easy fatigability.

Following medical screening for risks, there is no standardized method to increase physical activity. A prudent approach is to begin with a low to moderate intensity of short-duration activity, 6–10 min in length. These short bouts can be slowly increased to meet the duration and intensity goals of the patient, as in younger populations. Administering a fitness or functional test to identify fitness and functional deficits can establish a more targeted exercise prescription (see Video 4.1). This tailored prescription can utilize remaining physical assets, such as upper body strength, to offset other deficits, for example, poor balance, which may predispose an individual to injuries or falls. Following fitness and functional assessments, an exercise prescription that includes appropriate progression, reasonable and effective goals, consideration for the patient's unique circumstances, and a plan for follow-up can be implemented (see Chap. 6).

Furthermore, it can be very beneficial to share symptoms that are often associated with exercise. This is particularly important for older adults who are not accustomed to physical exertion and who are likely to experience symptoms such as shortness of breath or muscle soreness upon exercising. When older adults are informed of what they might expect, this can reduce fears associated with unaccustomed sensations and allow them to differentiate typical exercise symptoms from potential medical issues.

Case 1, Part 2: Follow-Up with Maria
On a recent visit to her doctor, Maria mentions that she often feels out of breath doing everyday activities and wonders if this means she is going to have a heart attack. Maria's doctor explains that these sensations are not usually due to getting older or the precursor to having a cardiac event. Maria's doctor tells her that as we get older we often do less activity and thereby lose our physical fitness. Then we fatigue more easily and get out of breath with daily activities. Therefore it is important for her to get more physically active. Maria's doctor explains that common feelings or "side effects" to exercise can be shortness of breath or muscle soreness, but these symptoms will subside as she gets more fit. With exercise, she will find that she can do her daily chores with greater ease.

Cardiovascular Risks Associated with Exercise

Anyone who exercises incurs some risk for an adverse event. The level of risk correlates with an individual's physical condition, presence of disease or disability, and the inherent danger of the physical activity, which is independent of one's age. However, the aging heart is more vulnerable to disease and heart rhythm disorders. Coronary artery disease (CAD), cerebrovascular disease (CVD), and peripheral arterial disease (PAD) are associated with stiffening and narrowing of the arteries, which restrict normal blood flow throughout the body. Reduced blood flow to the heart will cause chest pain (angina), to the lower legs will cause cramping, and to the brain will cause disorientation or light-headedness with exercise. These conditions can limit the duration and intensity with which an older adult can safely exercise.

The absolute risk of an exercise-related cardiovascular event is extremely low (0.01 %) in relatively healthy individuals at any age [2]. This risk is increased for individuals with diagnosed or occult cardiac disease. For these individuals, engaging in vigorous activity may acutely or transiently increase the risk of sudden cardiac death and acute myocardial infarction. In individuals under age 40 years, exercise-related cardiovascular events are largely a result of congenital cardiovascular abnormalities. In patients over 40 years of age, CAD is the predominant cause of adverse cardiovascular events, due to its higher prevalence with advancing age.

Vigorous exercise increases the risk of a cardiovascular event during or soon after exertion in young subjects, those with inherited cardiovascular disease, and adults with occult or diagnosed coronary heart disease. In general, the risk of any vigorous physical activity is an interaction between the exercise and the individual's physical fitness, because identical physical tasks evoke lower cardiac demands in physically fit subjects than in unfit persons. One physical activity that has been repeatedly associated with increased risk of cardiovascular events is snow shovelling.

The risk of this activity appears to be related to the demands of the activity, which include the cold weather environment, coupled with individuals who are unaccustomed to vigorous physical exertion and have underlying heart problems. Thus it is important to advise against rapid uptake of strenuous activities in previously sedentary adults, of any age.

Studies of exercise in supervised environments, like cardiac rehabilitation, find that the risks, while not zero, are very small. A large number of studies have demonstrated that the benefits of exercise outweigh the risks in older adults with chronic conditions, including cardiac, respiratory, diabetes mellitus, arthritis, and dementia. With proper counseling, all older adults should be able to be physically active.

A strategy to reduce exercise-related cardiovascular events begins with cardiovascular screening, to identify and exclude high-risk subjects from participating in vigorous exercise activities. Individuals at elevated risk for cardiac events—those with known CAD, symptoms that suggest underlying CAD, diabetes mellitus and other vascular risk factors, or end-stage kidney disease—should be referred to their primary care clinician for evaluation before beginning moderate-intensity exercise. Other individuals can participate in an exercise program that is tailored to their current fitness and health conditions.

Case 1, Part 3: Follow-Up with Shirley
The heart attack that Shirley experienced two years previously was caused by coronary atherosclerosis. Before starting an exercise program, Shirley's current doctor recommends a low-level exercise test to assess her risk status; her risk is assessed as low. Therefore Shirley can exercise on her own as opposed to under supervision, which is recommended for those who are at moderate to high risk. Shirley has been taught to monitor for red flag symptoms such as dizziness and chest pain and has been provided with a personalized, graded, moderate-intensity exercise plan. She plans on joining the walking group across from her home with her neighbor Maria.

It is estimated that one third of older Americans have high blood pressure and another third have pre-hypertension. High blood pressure contributes to increased incidence of all-cause and cardiovascular disease (CVD) mortality. Both resting and exercise blood pressures increase with age. This elevates the heart's work rate and oxygen demand requirements at any given exercise intensity, especially higher intensities. The large arteries stiffen, which increases blood flow resistance throughout the body.

However, exercise remains a cornerstone therapy for primary prevention, treatment, and control of hypertension [3]. Mild to moderate cases of increased blood pressure benefit from exercise. Individuals with severe uncontrolled hypertension (180/110 mmHg) should first see their physician for improved blood pressure control prior to commencing an exercise regimen. Exercise at resting blood

pressures above 200 mmHg systolic and 110 mmHg diastolic is not recommended. During exercise, blood pressure should not exceed 220 and 105 mmHg.

Conversely, the combination of antihypertensive medication and exercise can lead to postexercise hypotension. Caution should be used for frail elderly individuals (80 years of age or older) with low diastolic blood pressure (less than 60 mmHg) as postexercise hypotension will increase fall risk. For individuals with labile hypertension or moderate to high cardiovascular risk, postexercise monitoring of blood pressure is also prudent to detect hypotension. For these individuals, it is good practice to assess postexercise blood pressure and heart rate readings at 1, 3, and 5 min after a cooldown period to ensure the older adult's cardiovascular system has recovered to appropriate postexercise recovery levels (HR <100 bpm; systolic BP<145; diastolic BP<95) or to the values assessed in the individual at rest, prior to the exercise session.

In addition to cardiovascular disease, the aging heart may also be affected by abnormal heart arrhythmias (tachycardia, bradycardia, and fibrillation). The most common type is atrial fibrillation (AF), which can produce a rapid, irregular heart rate that may lead to hypotension, infarction, and death. Approximately 6 % of those over 65 years of age have AF [4]. Pharmaceutical and surgical interventions can allow the older adult with AF or other arrhythmias to participate in exercise safely. However, it is key that older adults with heart arrhythmias include a longer warm-up and cooldown period to allow the body to reach exercise capacity safely and return to normal resting (homeostatic) state. This is accomplished by gradually reducing intensity before the older adult completes their exercise regime.

Musculoskeletal Risks Associated with Exercise

Case 2, Part 1
Charles is an 80-year-old man who plays cards in the same seniors program as Shirley and Maria. Charles has osteoarthritis of his knee and osteoporosis. Charles overheard Shirley and Maria talking about getting more physically active. He understands the importance of being active but does not know if exercise is too risky for his bones and joints.

Older adults report fear of injury as a common barrier to exercise. Indeed it is a general misperception among fitness and health professionals that older adults should take it easy, can easily hurt themselves, and need special supervision when exercising. Typical musculoskeletal changes with aging include reduced skeletal muscle mass and decreased bone mass, integrity, and strength. Age-related changes that are hypothesized to increase the risk of injury include: increased amount and density of collagen in tendons which can lead to stiffness or laxity, degeneration of tendons due to chronic inflammation and irritation (tendinosis), osteoporosis which

makes bones more vulnerable to trauma and stressors, and sarcopenia with decreased muscle strength and power. The historical perception that older adults are at increased risk for injury from exercise exertion may also be propagated by the term "boomeritis," which refers to the musculoskeletal ailments (tendon, muscle, ligament tears, and stress fractures) frequently reported in the aging athlete population.

Participation in exercise or any recreational physical activity carries some risk of injury at any age. However, the risk for acute musculoskeletal or overuse injuries is relatively low [5]. Although research on the risk of musculoskeletal injury in the older adult population is limited, evidence to date indicates no increased risk in older persons. For example, individuals who attend community-based, older adult fitness programs have the same, relatively low injury risk as the rest of the general population [6]. There is some indication that older men are at greater risk for resistance training injuries, but this appears to be more a factor of proper technique than age. Therefore, older adults should not be deterred from participating in any activity, but rather receive instruction on proper technique or other safety issues regarding the activity chosen.

The injury that older adults report as their biggest fear and which often prevents them from exercising is falling. As with overall injuries, falls can occur to anyone, at any age. Falls are mostly associated with specific activities. One factor that may predispose older adults to falling is that they may not be able to recognize or react to a fall as quickly as when younger. Poor balance, reduced lower extremity strength, changes in gait, and a previous fall are common conditions that contribute to older adults' higher risk of falling in general. Minor, accumulating deficits in postural control—loss of coordination, slower postural reflexes, delay in detection of loss of balance, and disorganization in central processing—also enhance the risk of falls.

Due to the real potential for serious consequences of a fall, it is not surprising that older adults are hesitant to try a new or challenging activity. However, many of the risk factors associated with falls are also reduced with exercise. Exercise that targets specific risk factors, such as poor lower leg strength, can reduce the risk of suffering an injurious fall. Older adults without functional problems should be encouraged to include activities in their exercise regime that challenge their balance and lower body strength. Those with functional or mobility issues should target their physical deficits with fall-prevention exercise programs to reduce their risk of falling and experiencing an injury such as fracture.

Osteoarthritis and osteoporosis are two common skeletal conditions that increase in prevalence with age. Contrary to popular belief, lifelong moderate exercise does not lead to osteoarthritis in older age. Increased body weight, previous injury to a joint, and an occupation or repeated activity that causes very high joint loading are risk factors for developing osteoarthritis, which also has genetic associations. However, arthritis, particularly in the knee joint, is very prevalent in older adults. Osteoarthritis may produce substantial pain and functional decline. Exercise can maintain and increase muscle mass around the joint, optimize body weight, improve joint motion, and relieve pain and stiffness. Exercise can be undertaken without the risk of exacerbating symptoms or worsening disease progression [7] (see Video 4.2 for water-based exercises).

Osteoporosis causes bones to become porous and thin which leads to decreased bone strength and increased risk of fracture. Low-trauma fractures in individuals with osteoporosis can result from movements associated with simple activities of daily living, a fall, or even certain types of exercise movements. Hip and vertebral are common types of fractures; these can gravely impact one's health and quality of life. There is evidence from both observational and randomized controlled trials that exercise may increase the risk of fractures under certain conditions, such as walking during slippery weather or performing twisting movements too quickly during transitions between positions [8]. An individual who has thoracic spine osteoporosis, particularly thoracic kyphosis, may experience a fracture while performing twisting movements of the trunk, flexed postures or repeated flexion of the trunk.

Yet studies show that bone-building exercises are an essential component of treatment programs to increase bone mass and prevent fractures. Guidelines recommend specific exercises in the prevention and treatment of osteoporosis [9]. Recognition of osteopenia and osteoporosis is important in order to counsel the individual regarding activities of daily living and exercise activities. Fall risk reduction becomes even more critical in older adults with osteopenia and osteoporosis. For patients with prior fragility fractures or ongoing pain from osteoporosis, it may be helpful to consult an exercise specialist or physical therapist with advanced training in osteoporosis and exercise.

Other Chronic Diseases and Risks Related to Exercise

While type II diabetes is not considered a result of primary aging, the incidence increases with age. Exercise for individuals with type II diabetes is encouraged, but with some precautions [10]. Safe exercise for individuals with type II diabetes starts with the identification of any diabetes-related health complications. Older adults must be vigilant in monitoring blood glucose levels to avoid the risk of becoming hypoglycemic. Exercise is contraindicated if an individual has recurring hypoglycemic events. Occasionally, medication adjustments for exercise may be necessary for individuals using insulin or insulin secretagogues to avoid hypoglycemia.

In older adults with PAD, which increases adverse consequences of injury to the extremities, monitoring is advised. In particular, monitoring and counseling regarding proper foot care is important.

As medications may interact with the exercise response, it is helpful to know all drugs taken by an older adult starting exercise. Several groups, such as the American College of Sports Medicine and American Geriatrics Society, maintain resources that describe medication-exercise interactions of concern in older adults. For medications which are likely to affect the exercise response, close monitoring of blood pressure, heart rate, and perceived exertion during and after exercise is prudent.

Higher obesity rates are being observed in the aging population, and exercise remains a cornerstone of weight reduction [11]. In older overweight adults, weight loss is associated with a high risk of adverse events, thought in part related to a

greater loss of muscle mass as compared with weight loss in younger individuals. Exercise appears to mitigate the harmful effects of weight loss in older adults and thus is strongly recommended. After issues related to increased cardiovascular and metabolic risks have been assessed, there are some precautions that should be addressed when prescribing exercise for this population. Obese exercisers may require accommodation for arthritic conditions, such as modifications for weight-bearing activities. Because of this increased orthopedic risk, intensity may need to be sacrificed for safety and progression should be gradual. Obese older individuals are also at increased risk for hyperthermia; therefore the exercise environment and clothing should be carefully considered.

Environmental factors may pose a risk for exercising older adults. With increased age, we experience greater levels of thermal strain when exposed to hot or cold temperatures. This increases the risk of heat-related illnesses such as heat stroke, heat exhaustion, and heat cramps. Older adults should refrain from strenuous outdoor physical activities on hot and humid days. Conversely, older adults also may have reduced capacity for thermoregulation in cold environments and lose body heat faster than younger individuals. In addition, illnesses and medications taken by older adults can affect body heat and put older adults at risk for hypothermia. If older adults are exercising outdoors, it is suggested they be aware of the outside temperature and wind chill value, be dressed in layers so that clothing can be removed or added as needed, and be aware of the signs of hypothermia and frostbite.

As we age, we also have a lower perception of thirst with an increased risk for dehydration. The sensation of thirst cannot be used a sole reliable indicator for fluid ingestion. Older adults may need to be reminded to drink fluids, especially during exercise.

Case 2, Part 2: Follow-Up with Charles

On his next physician visit, Charles asks to have his fracture risk assessed and for help starting an exercise program. Charles has osteoporosis in his lumbar spine and osteopenia in his femoral head but has not experienced a fracture. His knee pain occurs primarily at night and is relieved with applied heat. Charles is not at high risk of falling based on office mobility tests: the timed up and go, 3 chair rises, and tandem stance.

After considering his physical exam, medical and activity background, and goals, Charles' physician recommends that he see a physical therapist to get started exercising. Charles is encouraged to join a multicomponent exercise program, which includes exercises to maintain his balance. The physical therapist teaches Charles about proper posture and on how to move safely, particularly when performing bending or twisting movements, as well as stretching and strengthening activities for his lower extremities and knee protection strategies.

Other environmental aspects of safe exercise participation include taking into account sensory changes that commonly occur with aging. While not all older adults will have vision and hearing impairments, the prevalence of these impairments increases greatly with age. Age-related changes in vision include decreased focusing, more difficulty seeing red and green colors, increased sensitivity to glare with decreased night vision, decreased contrast sensitivity, and reduced depth perception. Aging is associated with a decreased ability to visually adapt to the physical environment, which should be considered in assessing the exercise environment for older adults.

Hearing may decline with age. Presbycusis, a symmetric mixed sensorineural hearing loss, is the most common condition. High frequencies are lost first, such that high-pitched voices and consonants are more difficult to discern. Careful enunciation and a lowered voice can improve communication. Reinforcement of messages through visual cues, for example, when giving instructions in a group fitness class, may aid comprehension for participants with hearing loss.

Physiologic changes can also make balance increasingly difficult to maintain as we get older. In particular, the vestibular system that sends signals critical to maintaining an upright position is affected by aging. Activities which require quick changes in the position of the head should be avoided to reduce balance loss or dizziness, which could lead to falls and injury.

Cases: Follow-Up

Three months after Shirley and Maria joined the walking group from the park, they also joined Charles at his group fitness session, held at a local community center. The group meets in a room designed to have low glare lighting and nonslip floors. The room also has a handrail along one wall and a water fountain in the corner. The fitness instructor meets with each new participant to be aware of any health or mobility issues. Since Shirley has recently started wearing a hearing aid, the fitness instructor places Shirley at the front of the group so that she can watch and hear instructions easily. Charles exercises next to the wall and handrail, and the fitness instructor assistant is available to show alternative exercises for Charles and others who require modifications. The assistant always checks in with Shirley to monitor her intensity and ensure she does not skip the warm-up and cooldown. Maria now does her daily activities without heavy breathing and feels 10 years younger. She enjoys the fitness class so much she is considering becoming a fitness leader herself!

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Resources

American Geriatrics Society Beers Criteria Pocket Card, for medication-exercise interactions, http://www.americangeriatrics.org/files/documents/beers/PrintableBeersPocketCard.pdf.

American Geriatrics Society Prevention of Falls in Older Persons guideline, http://www.americangeriatrics.org/health_care_professionals/clinical_practice/clinical_guidelines_recommendations/prevention_of_falls_summary_of_recommendations.

American Heart Association information on exercise in older persons, exercise after cardiac events, and other topics, http://www.heart.org/HEARTORG/GettingHealthy/PhysicalActivity/FitnessBasics/Physical-Activity-in-Older-Americans_UCM_308039_Article.jsp.

American Society of Physical Therapy pocket guide on fall risk reduction, http://www.apta.org/uploadedFiles/APTAorg/Practice_and_Patient_Care/Patient_Care/Physical_Fitness/Members_Only/PocketGuide_Falls.pdf.

Exercise and Screening for You (EASY) screening tool, http://easyforyou.info/index.asp.

National Institute on Aging focus on exercise Go 4 Life program, and other resources for safe exercising, http://www.nia.nih.gov/health/featured/exercise.

The Physical Activity Readiness Questionnaire for Everyone Tool (PAR-Q+), http://www.csep.ca/CMFiles/publications/parq/PARQplusSept2011version_ALL.pdf.

Chapter 4
Types of Exercise: Flexibility, Strength, Endurance, Balance

Lynn B. Panton and Ashley L. Artese

Key Points

- Different exercise components—flexibility, strength, endurance, and balance—provide different benefits to older adults.
- Prior to starting exercise, an assessment of current function and fitness is helpful.
- "Start low and go slow" is the mantra for older adults beginning exercise programs.
- Although a multicomponent exercise program is optimal, it may overwhelm some beginning exercisers, who can start with one component and add others over time.

Introduction

A well-rounded exercise program consists of flexibility, strength, endurance, and balance training. These four components contribute to healthy aging and the maintenance of functional capacity, strength, independence, and quality of life. *Flexibility training* can help maintain or improve range of motion in the joint, which may prevent injury, reduce joint pain, and improve posture. Flexibility training consists of *dynamic stretches* that involve actively moving through the joint's range of motion or *static stretches* that are held for a certain length of time. *Strength training*,

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also known as weight or resistance training, requires the contraction of a muscle against a weight or type of resistance to build strength and endurance of the muscle. It can be achieved through the use of machines, free weights, resistance bands, body weight, or water resistance. Strength training helps maintain muscle strength, lean muscle mass, and bone density, which allow older adults to perform key activities of daily living. *Endurance training*, also known as aerobic training, involves the continuous movement of major muscle groups such as the legs or arms to maintain an elevated heart rate for an extended period of time. Common examples of endurance exercise for older adults include walking, cycling, stair climbing, dancing, and swimming. Endurance training helps maintain the health of the heart and lungs and reduces the occurrence of many chronic diseases, such as heart disease and diabetes. Since fall risk increases with age, *balance training* is an important fall prevention intervention. Balance training involves exercises that challenge an individual's ability to stabilize his or her body and maintain posture. This training uses unstable surfaces, narrowing bases of support, weight shifts, or the removal of upper body assistance to improve balance.

Starting Exercise

Prior to beginning a new exercise program or substantially increasing the intensity level of current exercise, older adults should visit their primary care provider to identify health risks or safety concerns; the majority of older adults will require no further evaluation (see Chap. 3). For older adults who are increasing their usual physical activities, such as walking, clinician evaluation is not needed. However, all older adults can benefit from physical assessment, an evaluation of the older adult's fitness level and functional ability, to determine an appropriate starting point for an exercise program. Physical assessments such as a walk test, chair stand, arm curl, sit-and-reach, one-legged stand, or tandem stand test are useful to assess fitness levels for flexibility, strength, endurance, and balance (see Table 4.1 and Video 4.1) [1]. In addition, questionnaires relating to lifestyle, physical activities, fears, and physical activity readiness can assess current physical activity levels, apprehensions, and attitudes toward exercise.

When prescribing exercise for older adults, it is essential, for both safety and adherence, to begin slowly at low intensities and gradually progress. While a well-rounded program would consist of all four components of exercise, this may overwhelm many older adults. Especially in sedentary or disabled persons, it may be more feasible to begin with one or two components of fitness and slowly incorporate additional ones as the older adult progresses. For older adults who are already active and have a higher level of fitness, a moderate intensity program consisting of two or more fitness components, matched to the individual's fitness level and goals, is recommended.

For those at very low function or bedridden, flexibility exercises should be recommended first, to improve joint range of motion and stiffness. For some

Table 4.1 Assessing fitness at the start of exercise

Test	Assesses	Description
Walk test	Endurance	Walk for a period of 6 min and measure distance covered. If a large area is not available, a 4 or 6 m walk can be completed at a normal walking pace and the time recorded.
Timed up and go	Agility	The older adult stands up from a chair, walks 8 ft, turns around a cone, returns to the chair, and sits down.
Chair stand	Muscular strength and endurance	With arms folded across the chest, from a seated position, the number of chair stands is recorded in 30 s. Note if the person requires the use of hands. Alternatively, the time required to do three chair stands without the use of arms is recorded.
Arm curl	Muscular strength and endurance	Using the dominant arm in the seated position, count the number of curl-ups that are completed in 30 s, with 5 lb weight for women and 8 lb weight for men.
Chair sit-and-reach	Lower body flexibility	Sit on the edge of a chair with one leg extended, heel on the floor with foot flexed toward the body. The opposite foot is placed flat on the floor with knee bent at 90°. One hand is placed on top of the other with the middle fingers aligned. Bending at the hip, the person reaches forward to touch toes of the flexed foot. The reach is held for 2 s, and a ruler is used to measure the distance between the fingertips and toes. A negative score is recorded if the fingers and toes did not overlap, while distance past the toes is recorded as a positive score. A score of zero is recorded if the fingertips just touch the toes. Each leg can be measured twice and the best score recorded.
Back scratch	Upper body flexibility	Stand with one hand positioned behind the head and over the shoulders with fingers pointing down and palm touching the back. The other hand is then placed behind the back with the palm facing outward and the fingers pointing up. Distance is measured with a ruler to the middle fingertips. A positive score is recorded if the fingers overlapped, and a negative score is recorded if the fingers did not touch. A score of zero is recorded if the fingertips touch. The best score of two trials for each side is recorded.
One-legged stand	Balance	While standing next to a sturdy surface or wall, the older adult lifts one leg and a timer is started. Record until balance is lost by lifted foot touching down or hand touching wall or object. The maximum amount of time for the balance is reached at 1 min.
Tandem stand test	Balance	Feet are placed one in front of the other and balance is held for up to 1 minute or the longest possible time until feet come apart or hands are used for support.

deconditioned older adults, stretching will increase heart rate and serve as an endurance activity when starting an exercise program. Eventually, strength training can be integrated through exercises with resistances that are appropriate for the individual. This may include exercises performed while lying down, seated in a chair, standing, in the pool, or using resistance machines. As strength improves, endurance exercises may be added. Finally, exercises to promote balance can be included, to optimize functional independence and lower fall risks.

Flexibility Training

Flexibility training allows older adults to maintain or improve their ability to perform activities of daily living such as combing hair, reaching for objects on a shelf or the floor, getting dressed, or putting on shoes. Flexibility training, especially exercises focusing on the hip extensors, has also been shown to improve several gait parameters—speed, stride length, and cadence—which may result in increased mobility and reduced fall risk [2]. In addition, stretching helps to prevent injuries, such as muscle strain, as well as reduces pain in the knee, hip, lower back, and neck.

For improvements in flexibility, the American College of Sports Medicine (ACSM) recommends performing static stretches for all major muscle groups at least 2 days per week, with a goal of 5 days per week [3]. Each stretch should be held without bouncing for 30–60 s and repeated two to four times. Flexibility exercises are best performed after endurance or strength training to ensure that muscles are warm; this allows the individual to gain the most benefit from stretching and also reduces the risk for injury. For weak or bedridden patients that are starting out with flexibility training alone, they should gradually move the muscle through the range of motion for a slow dynamic movement or gently move into and hold the static stretch.

Flexibility exercises can be performed while lying down, seated, or standing using props such as a chair, the wall, or a band for assistance as needed (see Table 4.2 and Figs. 4.1–4.18). Several exercises to use when starting a stretching program are the seated hamstrings stretch and standing calf stretch for the lower body, the supine lower back stretch for the back, and the shoulder stretch and the upper back stretch for the upper body (Figs. 4.1, 4.5, 4.13, 4.15, and 4.16).

Table 4.2 Instructions for stretching

Stretch after endurance or strength exercises or make sure muscles are properly warmed up to avoid injury
Gradually move into the stretch. Avoid bouncing movements
Stretches should be held in a position where mild discomfort is felt, but not pain
Maintain slow and steady breathing; if possible, breathe out when moving into the stretch
For floor stretches, if the older adult is fearful of getting on the floor or does not have the strength to stand back up, suggest a seated or standing stretch for the same muscle group or encourage the use of a couch or bed. Ensure that the surface is large enough to avoid a fall

Supine Hamstrings Stretch

1. Lie down with the lower back pressed into the floor, kness bent at a 90° angle, and feet flat on the floor.
2. Extend the right leg towards the ceiling. Place the hands behind the thigh, calf, or ankle and gently pull the leg towards the body until the stretch is felt in the hamstrings.
3. Flex the foot to increase the stretch in the hamstrings and calf muscles.
4. Repeat on the other side.

Modifications/Props:

1. Place a band or towel near the ball of the foot and gently pull the leg forward with the band until the stretch is felt.
2. Place extended leg against the wall (heel rested on the wall) and hold.

Fig. 4.1 Lower body stretches. Supine hamstrings stretch

Seated Hamstrings Stretch

1. Start seated on the floor or bed with both legs extended with heels touching the floor and feet flexed.
2. Bend the left knee and place the sole of the foot against the right inner thigh.
3. Square the shoulders to the extended leg and exhale while moving forward at the hips, reaching both hands toward the right ankle or foot.
4. Repeat on the other side.

***Modifications/Props:**

- For those with extremely tight hamstrings, the hips can be elevated by sitting on a pillow or folded blanket while performing this stretch.
- Place a band around the extended foot and gently pull the upper body forward.

Fig. 4.2 Lower body stretches. Seated hamstrings stretch

Chair Hamstrings Stretch

1. Start seated in a chair with knees bent at a 90° angle and both feet placed flat on the floor.
2. Extend the right leg straight and place the right heel on the floor.
3. Slowly hinge forward at the hips, reaching both hands equally towards the right foot.
4. Repeat on the other side.

***Modifications/Props**

- For those who may feel pain in the lower back when leaning forward, this exercise can be modified to maintain back support against the chair. Place a band or a towel under the foot of the extended leg and gently pull on the band to lift the right leg off the floor for the stretch.

Fig. 4.3 Lower body stretches. Chair hamstrings stretch

Standing Quadriceps Stretch

1. Stand with feet flat on the floor and knees slightly bent. Place hand on a chair or the wall for support.
2. Bend the right knee and lift the right heel towards the left gluteal muscles.
3. Reach the left hand behind the body and take hold of the right ankle.
4. Keep knees next to each other with the bent knee pointing down towards the floor, not out to the side.
5. Repeat on the other side.

***Modifications/Props:**

- If the patient has difficulty holding the ankle, the elevated foot can be placed on a chair instead.

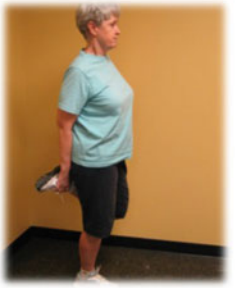

Fig. 4.4 Lower body stretches. Standing quadriceps stretch

Standing Calf Stretch

1. Stand facing a wall with feet about hip or shoulder-width apart, and place the hands against the wall at about eye level.
2. Place the right leg one or two feet behind the left leg.
3. Draw both heels down towards the floor and slowly bend the front knee until a stretch is felt in the right calf muscles. Do not let the front knee pass the toes.
4. Repeat on the other side.

Fig. 4.5 Lower body stretches. Standing calf stretch

Supine Hip Rotator Stretch

1. Start out lying with the lower back pressed into the floor, knees bent at a 90° angle, and feet flat on the floor.
2. Place the right ankle on the left thigh near the left knee.
3. Gently push on the right leg to open the hip until you feel a stretch in the right hip and thigh.
4. Repeat on the other side.

Modifications/Props:

- To further stretch the gluteal muscles: with the right ankle crossed over the left thigh, reach the hands between the legs and take hold of the left thigh. Slowly pull the left knee towards the chest to feel a stretch in the right gluteal muscles.

Fig. 4.6 Lower body stretches. Supine hip rotator stretch

Chair Hip Rotator Stretch

1. Start out seated in a chair with knees bent at a 90° angle and both feet flat on the floor.
2. Bend the right knee and place the right ankle on the left thigh near the left knee.
3. Gently push the right thigh and knee towards the floor until a stretch is felt in the right hip and thigh.
4. Repeat on the other side.

Fig. 4.7 Lower body stretches. Chair hip rotator stretch

Seated Gluteal Stretch

1. Start out seated on the floor or bed with legs extended.
2. Bend the right knee and place the right foot on the outside of the left thigh.
3. Slowly start to twist the upper body to the right side, keeping the upper body upright.
4. The left arm can wrap around the right leg or push against the outside of the right leg for a deeper stretch.
5. Repeat on the other side.

Fig. 4.8 Lower body stretches. Seated gluteal stretch

Seated Butterfly Groin Stretch

1. Sit on the floor with the back straight, shoulders down, abdominals tight, soles of the feet together in front of body, and knees bent to the sides.
2. Pull heel towards body while simultaneously relaxing the knees towards the floor.

Fig. 4.9 Lower body stretches. Seated butterfly groin stretch

Standing Groin Stretch

1. Start in a standing position with hands on hips or upper thighs.
2. Lean to the side and bend the right knee while keeping the left leg straight.
3. Press the hips back as you lunge and keep both feet pointing forward.
4. Hold and then repeat on the opposite side.

Fig. 4.10 Lower body stretches. Standing groin stretch

Chest and Biceps Stretch

1. Stand or sit up tall and place the arms behind the back with thumbs facing down. Clasp hands together if possible.
2. Once the arms are extended behind, gently pull arms upward until a stretch is felt in the chest and biceps.

Fig. 4.11 Upper body stretches. Chest and biceps stretch

Triceps Stretch

1. Lift both arms above the head and bend elbows so that forearms are behind the head (but not resting on it).
2. Try to point the right elbow to the sky.
3. Gently grasp the left elbow with the right hand.
4. Allow the left hand to drop towards the middle of the shoulder blades.
5. Feel the stretch on the outside of the upper left arm.
6. Gently pull the left elbow towards the right shoulder to deepen the stretch.
7. Repeat with opposite arm.

Fig. 4.12 Upper body stretches. Triceps stretch

Shoulder Stretch

1. Start in a seated or standing position.
2. Place the right arm across the chest.
3. Support the right arm by placing the left hand against the right forearm to feel a stretch in the right shoulder.
4. Repeat on the other side.

Fig. 4.13 Upper body stretches. Shoulder stretch

Neck Stretch

1. Start in a seated or standing position.
2. Slowly lower the chin towards the chest until a stretch is felt in the muscles in the back of the neck.
3. Return to starting position and then lower the right ear towards the right shoulder and hold.
4. Repeat on the other side.

Fig. 4.14 Upper body stretches. Neck stretch

Upper Back Stretch

1. Start in a seated or standing position.
2. Extend the arms out in front.
3. Place one hand in front of the other with the palms facing towards or away from the body.
4. Press both hands away from the body, allowing the upper back to be slightly rounded.

Fig. 4.15 Upper body stretches. Upper back stretch

Supine Lower Back Stretch

1. Start out lying on the floor with the lower back pressed into the floor.
2. Bend the knees and slowly draw the knees toward the chest by reaching the hands behind the hamstrings.

Modifications/Props:

- This can be done by pulling one knee at a time towards the chest.

Fig. 4.16 (Lower back/abdominal stretches. Supine lower back stretch

Seated Lower Back Stretch

1. Start out seated in a sturdy chair that has four legs (Do not use a rocking chair or recliner)
2. Slowly lean forward and allow the arms to move towards the floor.

Fig. 4.17 Lower back/abdominal stretches. Seated lower back stretch

Abdominal Stretch

1. Start out lying face down on the floor or bed.
2. Place the forearms on the floor with the elbows directly underneath the shoulders.
3. Slowly push the upper body up off of the mat and hold.

Fig. 4.18 Lower back/abdominal stretches. Abdominal stretch

Strength Training

Older adults that regularly participate in a strength training program can improve muscle strength, function, bone density, and body composition as well as reduce their fall risk. Strength training can also improve symptoms of many conditions: arthritis, osteoporosis, diabetes, and depression [4]. ACSM recommends that older adults participate in strength training activities for 2–3 days per week [3]. Start out slowly with a program consisting of four exercises for the lower body and six exercises for the upper body that target most of the major muscle groups, for one set of 10–15 lifts for each exercise. The number of sets can gradually be increased to two.

Exercises employ different types of equipment including machines, free weights, resistance bands, and stability balls. However, equipment does not have to be purchased. Milk jugs filled with water or sand, soup cans, or books can also be used for resistance. For those who are bedridden or confined to a chair, exercises can be performed while lying down or seated. For individuals that have more mobility, machines can provide support and promote safety and proper lifting technique while the older adult is learning new exercises. Once the individual feels comfortable with machines, movements can be incorporated into the training program to promote balance, use of stabilizing muscles, and multi-joint movements that are more specific to everyday activities such as bending down or lifting an object to place on a shelf. Table 4.3 describes important safety cues for strength training, and Figs. 4.19–4.30 demonstrate strength exercises. Five water-based strength exercises (chest flyes, lateral raises, triceps curls, arm extensions, abdominal kicks) are demonstrated in Video 4.2.

Regardless of the mode of strength training, start the individual off slowly with four exercises for the lower body and up to six exercises for the upper body, which includes the lower back and abdominal muscles. To maximize gains in strength and muscle mass, use a resistance or weight that can be lifted 10 times for each exercise, performed with moderate effort. Older adults can judge their level of effort by using either the original or modified Borg rating of perceived exertion (RPE) scales. The original scale self-rates effort from 6—very, very light—to 20—maximal effort. The modified RPE scale self-rates effort from 0 to 10 (see Table 4.4). Moderate effort on these scales would be rated as 12 to 14 or 3 to 5, respectively. As strength increases, older adults are usually able to tolerate a higher level of effort.

Table 4.3 Instructions for strength training

When seated in a machine or chair, or lying down on a mat, the small of the back should be pressed firmly against the seat or mat surface
When seated, knees should be bent at a 90° angle with feet flat on the floor
Perform movements slowly, allowing 2–3 s for the lifting phase and 3–4 s for the lowering phase
Do not hold breath. If possible, breathe out during the lifting phase and breathe in during the lowering phase
Be sure to gently hold the weight. Avoid squeezing or tightly gripping weights
Make sure the neck and spine are aligned when lifting
For individuals with balance problems, exercises should be performed while seated in a chair or lying on a firm surface

Chest Press

1. Start out lying with the lower back pressed into the mat, knees bent at a 90° angle, and feet flat on the floor.
2. Hold a weight in each hand and extend the arms out to the side so that elbows are in line with the chest and bent at a 90° angle.
3. Exhale and slowly extend the arms to press the weights forward until the weights meet above the chest.
4. Inhale and return to starting position.

Fig. 4.19 Upper body strength training exercises. Chest press

Upright Row

1. Start out standing with feet hip-width apart, holding a weight in each hand.
2. Extend the arms straight so that the weights are in front of the thighs with the palms facing towards the leg.
3. Exhale and slowly lift the weights towards the chest by bending the elbows out to the sides.
4. Hold for a second when the weights reach the chest and then inhale as weights are returned to starting position.

Fig. 4.20 Upper body strength training exercises. Upright row

Front Shoulder Raise

1. Start out standing or seated in a chair with the back supported and feet flat on the floor.
2. Hold a weight in each hand with arms by the sides with the palms facing back.
3. Exhale and slowly raise the arms out to the front, keeping the elbow extended and the palms facing down.
4. Stop when the arms reach shoulder level and then slowly lower the weights back down.

Fig. 4.21 Upper body strength training exercises. Front shoulder raises

Biceps Curl

1. Start standing or seated in a chair with the back supported and feet flat on the floor.
2. Hold a weight in each hand and extend the arms straight by the sides of the body,palms facing forward.
3. With the elbows pressed firmly against the side, exhale and slowly bend\ the elbows, bringing the forearms closer to the upper arms.
4. Hold for a second and then inhale to return to starting position.

Fig. 4.22 Upper body strength training exercises. Biceps curl

Standing Triceps Extension

1. Start out standing behind a chair with one foot in front of the other. Slowly bend forward at the hips to about a 45° angle and place the left hand on the chair for support.
2. Hold a weight in the right hand and bend the elbow, sending it back behind the body with the right arm close to the side of the body.
3. Slowly extend the elbow, bringing the weight behind the body while exhaling.
4. Hold for a second, and then return to starting position.

Fig. 4.23 Upper body strength training exercises. Standing triceps extension

Seated Leg Extensions

1. Start seated in a chair with the back supported and feet flat on the floor.
2. Exhale and slowly lift the right foot off the floor and extend the right leg out in front, making sure the right knee stays slightly bent on the extension.
3. Hold for one second. Inhale and return to starting position.
4. Repeat for the desired amount of repetitions before switching to the other leg.
5. Ankle weights can be added for increased resistance.

Fig. 4.24 Lower body strength training exercises. Seated leg extensions

Standing Hamstrings Curl

1. Stand behind a chair with feet flat on the floor, shoulder-width apart.
2. Slowly shift the weight onto the left leg. Exhale and flex the right knee to lift the right heel up towards the gluteal muscles. Hold when the knee reaches a 90° bend.
3. Inhale and slowly return to starting position.
4. Repeat for the desired amount of repetitions before switching to the other leg.
5. Ankle weights can be added for increased resistance.

Fig. 4.25 Lower body strength training exercises. Standing hamstrings curl

Standing Calf Raises

1. Stand behind a chair or near the wall with feet hip-width apart and both hands holding onto the back of the chair or wall for support.
2. Exhale and slowly raise the heels off of the floor, being sure to maintain an upright body position.
3. Inhale and lower the heels back to the floor. Repeat for desired amount of repetitions.
4. Ankle weights can be added to increase resistance.

Fig. 4.26 Lower body strength training exercises. Standing calf raises

Chair Squats

1. Start seated in the middle of a chair with legs about hip-width apart and feet flat on the floor placed about 5-8 inches in front of the chair.
2. Arms can be extended out in front, crossed over the chest, or placed on the chair handles if arm assistance is needed for the exercise.
3. Slowly exhale and stand up, making sure the knees do not fully extend at the top of the movement.
4. Once reaching a full standing position, inhale and slowly lower the body down to a seated position on the chair, making sure not to allow knees to come past toes during the movement.
5. Hold for a second and repeat.

Fig. 4.27 Lower body strength training exercises. Chair squats

Supine Hip Lifts

1. Lie on the back with arms by the sides and palms facing down. Knees should be bent at a 90° angle with feet flat on the floor.
2. Exhale and slowly raise the pelvis off the floor so that the lower back and buttoks are lifted.
3. Hold this position for 1-2 seconds.
4. Inhale and return to starting position and repeat.

Modifications/Props:

- To increase difficulty, this exercise can be performed on a single leg with the other leg lifted.

Fig. 4.28 Lower body strength training exercises. Supine hip lifts

Abdominal Crunch

1. Lie on the back with feet flat and knees bent. Make sure the small of the back is placed firmly against the mat.
2. Place the hands behind the head for support and slowly lift the head and shoulders off the floor, exhaling while contracting the abdominal muscles. Be sure to keep some space between the chin and the chest.
3. Try to imagine a string attached to the middle of chest (the sternum) pulling the upper body towards the ceiling without altering the head and neck position.
4. Hold for one second and then slowly return to starting position while inhaling.

Fig. 4.29 Lower back/abdominal exercises. Abdominal crunch

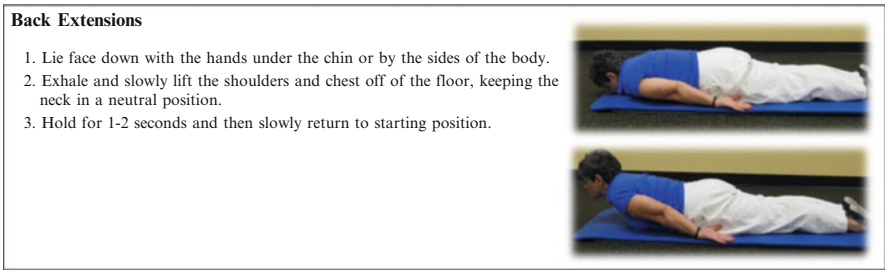

Fig. 4.30 Lower back/abdominal exercises. Back extensions

Table 4.4 Borg rating of perceived exertion scales

Original scale	Effort description	Modified scale	Effort description
6	No exertion	0	Rest
7	Extremely light (7.5)		
8			
9	Very light (9)		
10			
11	Light (11)	1	Really easy
12		2	Easy
13	Somewhat hard (13)	3	Moderate
14		4	Sort of hard
15	Hard (15)	5	Hard
16		6	Hard
17	Very hard (17)	7	Really hard
18		8	Really hard
19	Extremely hard (19)	9	Really, really hard
20	Maximal exertion	10	Maximal effort

Adapted from Centers for Disease Control and Prevention, Physical Activity page, http://www.cdc.gov/physicalactivity/everyone/measuring/exertion.html, accessed 7 Dec 2014

Encourage the older adult to perform the strength program at least 2–3 days per week, with 1 day of rest between exercise sessions. Gradually progress every 3–4 weeks by modifying one of the following: frequency or exercise during the week, number of times the weight is lifted, or number of sets. In addition, exercises can be replaced with more challenging intensity options or new exercises. Before strength training, the older adult needs to warm up by slowly walking, cycling, or marching in place to increase blood flow and increase body temperature.

Exercises recommended for starting a program of strengthening include chair squats and standing calf raises for the lower body; abdominal crunch and back extensions for the abdominal and back muscles, respectively; and the biceps curl, standing triceps extension, and front shoulder raise for the upper body (Figs. 4.21–4.30).

Endurance Training

Endurance training is crucial for improving the function of the heart, lungs, and vascular system. Endurance training also aids weight management and decreases the risk of many chronic diseases. In addition, older adults with increased cardiovascular fitness can perform more difficult physical tasks and exercise at higher intensities than those who do not undertake regular endurance activities.

The Center for Disease Control and Prevention recommends an accumulation of 30 min of moderate intensity endurance exercise on most days of the week [5]. For greater health and fitness benefits, 60 min is recommended. Moderate exercise is defined as activity that is equivalent to 3–6 metabolic equivalents (METs), which means that energy expenditure is 3–6 times greater than resting energy expenditure. This intensity causes an individual to be slightly out of breath or break a sweat, but still have the ability to carry on a conversation while exercising. The recommended duration may be too strenuous and difficult to achieve to an older adult who is just starting an exercise program. These individuals should start out slowly with low-impact exercise, such as walking, for a short duration, and gradually progress. Shorter bouts of endurance exercise can be completed throughout the day to reach the recommended total of 30 min.

Endurance exercise is generally associated with the use of equipment such as treadmills, elliptical machines, stair climbers, or cycles. However, the greatest advantage of endurance exercise is that it does not have to involve expensive equipment and it can be performed anywhere at any time. Encourage older adults to start an activity that they will find comfortable and will enjoy. Walking can be a great way to start, but other options include line dancing, group exercise classes, swimming, water aerobics, and performing simple aerobic exercise moves at home. Home maneuvers which can be used for cardiovascular conditioning are shown in Video 4.3. Walking is often the most feasible form of endurance training, since special skills are not needed. An older adult can walk anywhere (inside or outside) with just a good pair of shoes. Other options include more active lifestyle activities or habits such as gardening, cleaning, taking the stairs instead of the elevator, or parking the car further away from a building entrance. Table 4.5 provides suggestions for starting a walking program. Demonstrations of 8 pool-based endurance activities (pool walking, knee lifts, lateral walks, high knee jog, jumping jacks, scissors, knee tucks, bicycle with noodle) are shown in Video 4.2.

Table 4.5 Starting a walking program

Start out slowly and progress by increasing the time by 5 min or increasing the speed or step count, if a pedometer is being used, by 10 % every 1–2 weeks
Monitor intensity with a Rating of Perceived Exertion Scale. For example, on a scale of 1–10, moderate activity should feel like a 3–5. Although breathing is increased, the older adult can talk
Consider using a pedometer, which tracks the number of steps. One can set weekly step goals, with the ultimate target being 10,000 steps per day for healthy older adults
Wear shoes that offer support and are appropriate for the type of activity

Balance Training

Conditions commonly experienced by older adults, such as arthritis, muscle weakness, gait deficit, osteoporosis, and vision impairment, can lead to loss of balance and stability problems which in turn can lead to an increased risk for falls, fractures, injuries, and functional loss [6]. Therefore, improvement in balance will not only reduce the risk for falls and injuries, but may also increase the older adults' confidence in their ability to perform activities of daily living.

Balance exercises consist of positions or movements that challenge the individual to maintain posture and stability over a base of support. The ACSM recommends performing exercises that narrow the base of support, disrupt the center of gravity, stress postural muscles, or reduce sensory input [7]. While there is no consensus for the frequency, intensity, and duration of these exercises, older adults may easily add several of these exercises to a strength training program, 2–3 days per week. Encourage the older adult to hold each balance position for 10–15 s or for a length of time that is both challenging and safe for the individual to perform. Exercises can be completed near a wall, a counter top, or a sturdy table or chair for assistance, especially for those who are just starting out or at high risk for falling. For more advanced balance training, exercises can be completed with the eyes closed or using balance pads, balance discs, small core balls, BOSU® balls, and stability balls.

Simple balance exercises can be incorporated into an individual's daily activities with exercises that include standing on one foot while doing dishes or brushing teeth. Balance exercises should be performed in sturdy shoes or bare feet. Having a secure object, such as table or counter, next to the older adult is important in case there is a loss of balance. Exercises should be chosen based on the older adult's needs and abilities. To ensure safety, older adults should clear their environments of obstacles when performing balance training. If the older adult has poor balance or is nervous about trying the exercises, then he or she should have another person available for assistance. A cell or portable phone should always be near in case the older adult falls and needs help. Water exercises (noodle balance, single-leg balance) may also be helpful as demonstrated in Video 4.2. Figures 4.31, 4.32, 4.33, 4.34, 4.35, and 4.36 illustrate balance exercises, and Tables 4.6 and 4.7 provide sample balance exercises.

Single Leg Balance

1. Start in a standing position with the wall or a chair in front or to the side of body.
2. Gently place the hands against the wall or hold onto the edge of the chair.
3. Slowly lift the right foot off of the floor and place it to the front, side, or behind the body and hold for approximately 10-15 seconds.
4. Slowly place the foot back on the floor and lift the opposite leg.

Progression

- Release the hands from the chair or wall.
- Slowly move the arms up over the head and then back down while balancing.
- Close the eyes while performing this exercise.

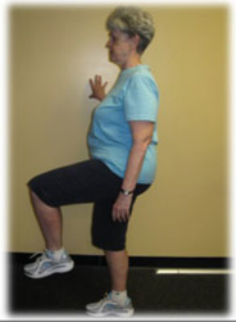

Fig. 4.31 Balance exercises. Single-leg balance

Tandem Standing

1. Start in a standing position with the wall or chair for support if needed.
2. Place the right foot directly in front of the other with the right heel touching the left toes and hold this position for 10-15 seconds.
3. Repeat on the other side.

Progression

- Release the hands from the arm or chair and cross them over the chest.
- Slowly move the arms above the head and then down or press a light medicine ball or weight above the head while holding this position.
- Close the eyes.

Fig. 4.32 Balance exercises. Tandem standing

Knee Raises

1. Start out standing near a wall or chair for support if needed.
2. Slowly lift the right foot off the floor and raise the knee up until the hip is at a 90° angle.
3. Hold for 1-2 seconds and then slowly lower the foot down towards the floor until the foot is about an inch from touching the ground.
4. Without letting the right foot touch the floor, lift the right knee again and hold for 1-2 seconds again.
5. Repeat this 10 times on the right, trying to keep the right foot off of the floor throughout the exercise. Then repeat 10 times on the other side.

Progression

- This same exercise can be performed by raising the leg out to the side or extending the leg behind, not touching the floor between repetitions.

Fig. 4.33 Balance exercises. Knee raises

Stability Ball Sit

1. Sit on top of a stability ball with the body centered on the ball and feet flat on the floor, hip-width apart.
2. Use the hands for support if needed by placing one hand on a chair or the wall.
3. Hold this seated position for 15-30 seconds or as long as possible.

Progression

- Add a leg lift by slowly lifting one foot off of the floor. Hold for 1-2 seconds and return to starting position.

Fig. 4.34 Balance exercises. Stability ball sit

Spinal Balance

1. Start in a prone position, with the knees and hands on the floor.
2. Make sure the knees are directly under the hips and the wrists are under the shoulders.
3. Maintain a neutral spine and slowly lift the right arm and left leg off the floor, extending the arm out in front and leg behind.
4. Hold for 1-2 seconds and then place the hand and foot back on the mat.
5. Repeat on the other side, lifting the left arm and right leg off of the floor. Hold and return to starting position. Repeat several times on each side.

Fig. 4.35 More advanced balance exercises. Spinal balance

Balance Disc and BOSU® Ball Options

1. Stand with both feet on the top of balance discs or a BOSU® ball and balance for 10-15 seconds.
2. Stand with both feet on the balance discs or BOSU® and lift one foot off of the floor.
3. Perform step-ups on the BOSU® by stepping the right foot onto the top of the ball and then the left foot up, so both feet are on the top. Then, step the right foot onto the floor followed by the left.

Fig. 4.36 More advanced balance exercises. Balance discs or BOSU® options

Table 4.6 Balance exercises with movement

Alternate knee lifts while walking across the floor
Perform a tandem walk across the floor by placing each foot directly in front of the other in a toe-heel position
Place small blocks or cones on the floor, with approximately a foot and a half between each one. Slowly move forward across the floor, stepping over each block
With the blocks set up the same way as above, move sideways across the floor stepping over each block

Table 4.7 Incorporating balance and coordination into everyday life

Practice standing on one leg while performing daily tasks such as cleaning the dishes, combing hair, brushing teeth, or standing in line at the store
When moving across a room, walk in a narrower stance (heel to toe) or walk sideways
Try to stand up out of a chair without using hands
Hold small objects out away from the body (while keeping the elbows slightly bent) while walking

Additional Exercises

Structured exercise programs and classes designed specifically for older adults, such as Tai Chi, gentle or chair yoga, water aerobics, line dancing, Zumba Gold®, and the SilverSneakers Fitness® programs, can motivate and encourage older adults to exercise through a fun, supportive, and social environment. In addition, these classes are usually led by certified instructors who provide form and safety cues to ensure that the class participants are performing the exercises correctly, as well as including appropriate warm-up and cool down periods. Many of these programs incorporate all four components of exercise during classes. The local YMCA, senior center, or other fitness facilities often offer specific programs for older adults and at reduced rates. Pet therapy exercise classes may also be available in some locations (Video 4.4). Older adults should be encouraged to try these programs while keeping in mind the stipulation to “start low and go slow.”

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Chapter 5
Motivational Interviewing for Older Adults

Kenneth Brummel-Smith

Key Points

- Motivational interviewing is a technique used to explore ambivalence about a behavior, such as physical activity.
- Motivational interviewing uses open-ended questions, affirmations, reflections, and summarizations to help an older person self-analyze their behavior.
- Motivational interviewing leads to modest improvements in physical activity in people with chronic health conditions.
- There may be benefits to incorporating motivational interviewing into clinical practice.
- The effects of motivational interviewing may be greater if the clinician adheres to the core components of motivational interviewing.

Introduction

As mentioned throughout this book, the majority of older persons do not engage in any regular physical activity program, although most are aware of exercise benefits. Health care providers are frequently frustrated when trying "to get the patient" to start exercising. Even the United States Preventive Services Task Force (USPSTF) rates making physical activity recommendations to the general population of older

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Table 5.1 Ambivalent persons have big "buts"

• I know I need to lose weight, *but* I hate exercising
• I'd like to start walking, *but* I just don't have any time
• I used to love swimming, *but* all those young women in their bathing suits make me feel self-conscious

persons as a grade C—uncertain—value, which indicates that recommendations alone may not result in measureable benefits [1]. Perhaps this dilemma results from not using a proper technique for assisting patients to change behavior.

In the last 30 years, a new model for helping individuals make behavioral changes has emerged. Motivational interviewing is a client-centered counseling style for helping older adults explore and resolve ambivalence about behavior change [2]. There is a growing body of literature documenting the effectiveness of motivational interviewing [3–6]. Understanding an older adult's ambivalence is the key to helping the older person make decisions about changing an existing behavior.

Everyone has motivations for their behaviors. The older adult who does not exercise is either very motivated to do something other than exercise or very motivated to not exercise. However, virtually everyone (even most of those in the "precontemplative" stage of change) is also ambivalent about not exercising. By focusing on and helping the individual to resolve this ambivalence, motivational interviewing increases the likelihood that the person will change a behavior.

Why would an older adult be motivated to maintain an unhealthy behavior? There are *always* disadvantages to change. Some healthy behaviors are seen as unpleasant, hard, or distasteful. Many people *enjoy* the status quo. They may feel it is their time to "rest" and that exercise is for younger persons. Others worry that they will not have the time to exercise or that they may be hurt if they start an exercise program. Some have limited resources to afford a gym or buy equipment or may live in areas where outdoor walking is unsafe. The older adult who says "I'd like to start walking more, but I'm just too busy right now" is ambivalent. Listen carefully for the *but* in that statement that tells you the patient is ambivalent (Table 5.1). Exploring ambivalence is demonstrated in Video 5.1

The Spirit of Motivational Interviewing

The "spirit" of motivational interviewing is different than the standard way most clinicians engage in discussions about behavior change. Motivational interviewing is collaborative rather than prescriptive. This technique recognizes that only in partnership with older adults can joint decision-making occur. It seeks to evoke from the person her own source of motivation, rather than telling the person something she must do. This strategy recognizes that we can never motivate someone else—motivation comes from within. Motivational interviewing honors autonomy.

It recognizes that people generally resist when they are told to do something and feel respected when their viewpoints are elicited. Some detachment is required when employing motivational interviewing. Some health care providers, particularly physicians, are more comfortable giving orders to be followed by patients.

Motivation has traditionally been viewed as an internal personality trait. People who don't exercise are lazy, noncompliant, or unmotivated. If motivation was an intrinsic personality trait, it would be difficult to change. The motivational interviewing approach views motivation as transactional: it depends on the relationship between two or more people. Motivation is temporary and changes over time. Trying to make someone change when she has no interest or fears change is like getting into a wrestling match. Motivational interviewing is more like a dance. In this type of dancing, it is the older adult who does most of the leading.

Practitioners in medical encounters use three main types of communication styles: *directing*, *following*, *and guiding*. Directing the patient to do something is perhaps the most common form of communication used by health care providers. The physician takes charge, at least for the moment: "I'm going to start you on this medication for your blood pressure." The expected role of the patient is to be compliant. In reality, this communication style is not very effective in most situations. The unequal power relationship may work well in a dire emergency, but it does little to facilitate behavior change. Providing knowledge alone rarely translates into changed behaviors. Often the prescriptive model elicits a wrestling match—the "yes, but" response from the older person.

The *following style* requires the clinician to suspend his own agenda and listen, very carefully, to the older adult's agenda. It is also the foundation of the patient-centered approach. In following the patient's lead, the clinician attempts to understand the patient's perspective. What are the older person's goals? How do those goals conflict with current behavior? What are the worries and concerns about change? Simple techniques such as nodding the head and saying "Uh-huh" and "Go on" allow the older adult to provide glimpses into the ambivalence he feels.

One can unwittingly set up roadblocks to listening. One has to avoid disagreeing, challenging, arguing, or shaming the person for what she has said. This will most certainly curtail the individual's comfort with discussing the difficulties of making a change. Similarly, too quickly agreeing with the person, expressing approval, or reassuring her may inhibit full disclosure. Silence while waiting a few seconds for the person to continue are the simplest methods to use.

Guiding is perhaps the least utilized skill in traditional medical provider-patient interactions. A guide does not choose the outcome but can help with the journey. A key component of guiding is exploring options. For instance, in a person newly diagnosed with heart failure, an important step is to clarify the person's goals of care. Here the listening skill predominates. The older adult may reply that avoiding hospitalization and not taking too many medications are his goals. The proper response using motivational interviewing would be to ask, "Are you interested in learning about the ways to prevent hospitalizations and lessen the need for medications?" The door is now open to discuss physical activity, stress reduction, diet modifications, and other options.

The Process of Change

Change in behavior starts with ambivalence. If someone is completely committed to a certain course of behavior, there is nothing that the clinician can do. Often such committed persons are labeled as "resistant," "noncompliant," or "unmotivated." If an older adult is resisting the clinician's recommendations, it is a good sign that the current approach is not working and a change in course is needed. Doing *more* of what doesn't work, does not work. In most cases, however, the person is not totally committed to the present course. In this situation the first step is a deeper exploration of the person's ambivalence. There are four useful techniques for engaging in discussions of motivation: using open-ended questions, affirming what the patient says, providing reflections to link ideas, and summarizing (Table 5.2).

One can start by asking the older adult to describe the values or benefits she receives from her present behavior. For instance, if you were discussing smoking behavior, you might ask, "What do you like about smoking?" (Open-ended question) This may seem counter-intuitive because we don't want to appear to be sanctioning "unhealthy behaviors." The question does not connote approval of the behavior, but rather shows respect for the person as a decision-maker. It is important not to cut off the person's listing of positive outcomes of his present behavior. Asking "What else?" or "I'm interested in hearing other important reasons you've had that prevented you going to the gym" shows the person that you are genuinely interested in what is really important to her. If the person was to say that she is so busy doing volunteer work that she can't afford the time to exercise, one can use an affirmation to show that you respect her choice: "So, you really are very busy and successful in your volunteer work."

Open, nonjudgmental listening opens the door for the patient to engage in *change talk* (see Table 5.3). Motivational interviewing looks for themes in change talk. These themes can be remembered using the acronym, DARN—desire, ability, reasons, and need. Desire refers to a person's wish to change. Often the patient uses phrases like "I want…," I would like to…," or "I want to…" when engaging in change talk. Ability is more active and connotes that the patient can or should be able

Table 5.2 OARS techniques

O	Open-ended questions
A	Affirmations
R	Reflections
S	Summarizing

Table 5.3 Change talk

• "I don't know, I might be able to do it."
• "I wish I could."
• "I'll try to do it."
• "I'll help if I can."
• "I'll think about it."

Table 5.4 Using DARN to ask questions

***D**esire*	What do you want, like, wish, and hope for?
***A**bility*	What is possible? What can or could you do? What are you able to do first?
***R**easons*	Why would you make this change? What would be bad about it?
***N**eed*	How important is this change? Why do you need to do it?

to do something. Reasons stated usually point to specific outcomes: to be able to play with grandchildren, to lose weight, etc. Change talk about needs often refers to how important the change is to the person. DARN can also be used to frame questions for greater clarification (see Table 5.4). Examples of these are found in Video 5.2

The purpose of change talk is to develop discrepancy in the person's mind. People consider change when they become uncomfortable with the status quo. If the older adult views what is happening now in a relatively negative light compared to how he wants things to be, he will begin to examine conflicting motivations. The strategy is to enable the person to become aware of his deeper goals and values. A person may appreciate time gained to work on email by forgoing a 30-minute walk, but he may also more deeply value the benefit of weight loss. Ultimately it is the older adult, not the clinician, who should voice the arguments for change.

It is possible to elicit change talk, particularly in older adults who are contemplating a change in behavior. If you are the one bringing up exercise, it is always wise to ask permission, "Can I ask you some questions about exercise?" If the response is "no," then it is best to forgo further discussion. You may add, "If you change your mind, I'd be interested to hear your thoughts about it." This shows respect for the person and keeps the agenda focused on issues he/she wants to address. If the person responds positively, and you know that the person does not engage in any regular physical activity, then begin with an open-ended question, "If you were to begin a regular activity program, what would you hope to see happen?" The use of a reflection can clarify the difficult choice the patient is making when faced with changing a behavior, "So, you've given a lot of thought to getting more physical activity, but you're also concerned how it might affect your health."

A commonly used technique in motivational interviewing is the use of *rulers* to gage the importance of the change or the degree of confidence. For instance, after hearing change talk you can ask, "So, on a scale of 0, not important at all, to 10, very important, where would you put yourself regarding starting a walking program?" (Fig. 5.1) Clearly, someone scoring himself towards not being important is likely to be poorly motivated to change. Similarly, people with very low confidence that they will be able to start an exercise program may need much more interviewing about their competing motivations. Confidence can also be judged by using a "confidence scale" in the interview (Fig. 5.2). Regardless of where they score themselves, it is key to understand why they chose that number. A secondary question to ask is, "Why did you not give yourself a 3 instead of a 5 for importance?" This will help the individual identify personal reasons for change. Similarly, asking the person who says his confidence level is a 6 why he didn't choose an 8 will enable her to explore perceived barriers to change. This is illustrated in Video 5.3

Fig. 5.1 Importance ruler

Fig. 5.2 Confidence ruler

Periodically summarizing what the person has said is another important technique used in motivational interviewing. Summarizations serve multiple purposes: showing that you have been listening, helping the patient to continue talking and possibly use change talk, and opening the door for gentle probing and clarification. By summarizing what has been said, the older adult also has the opportunity to correct any misunderstandings. That enables the individual to have a more equal status in the discussion. One can provide a simple summarization by repeating what was said. This is particularly important when change talk has occurred. For instance, when an older adult states she wants to start exercising because her mother had diabetes, never exercised, and had an amputation, you might say, "So, you don't want to end up like your mother who lost a leg to diabetes." Summarizing allows you to highlight or emphasize statements and to change direction.

Summarizations can also be used to draw different aspects of discussion together. For example, a patient may know that exercise would be good for him, but he is concerned that he may develop pain with a program such as walking. You might say, "So you feel that getting regular exercise would be helpful in helping control your high blood pressure, but you're afraid that starting to exercise could aggravate your arthritis." Summarizations are particularly helpful when a discussion has revealed various options, but the path ahead has not been decided. For example, "We've talked about your interest in starting a walking program and that it's pretty important to you and that your confidence is not high that you'll be able to stick with it. Where do we go from here?" This allows the older adult to be the one to initiate a plan, rather than the plan coming from the clinician. An example conversation is shown in Video 5.4.

Informing the older adult is part of motivational interviewing as well, although it is much less directive than traditional medical interviewing. Perhaps the most significant difference is the importance of asking permission before providing information.

This allows the clinician to play the role of the guide, rather than the drill sergeant. Imagine hiring a guide by saying, "Take me somewhere." The usual approach is to tell the guide where you want to go—"I'd like to climb Mt. Shasta." The guide then usually asks questions about what route or what experiences you want to get out of the journey. Asking permission honors the individual's autonomy and promotes more active involvement. The clinician and the older adult can then enter into a collaborative process, which lowers resistance to change. How to "roll with resistance" is demonstrated in Video 5.5.

There are many ways of asking permission. A simple question is, "Would you like to know what you could do for your diabetes?" After providing evidence-based options, you can follow the list with, "Would you like to hear more about any of these?" If a physical activity program is the choice, a follow-up question might be, "Would you like to hear about the benefits and risks of starting an exercise program?" Beware of overwhelming the person with information. The goal is not to "cover the material" but rather to help the older adult discover her conflicting motivations and gain more clarity about the direction she wants to follow.

Putting It Together

The most important aspect of motivational interviewing is the clinician's commitment to active listening. Listening is what distinguishes this type of interviewing most from traditional approaches to behavior change. Active listening suspends all judgment. It seeks to resist the "righting reflex"—the common approach of trying to fix the person. It recognizes that if the clinician advocates for change, the individual will likely increase his resistance to change. Instead, the clinician must listen, very carefully, for the reasons why the older adult might think he wants to change. How important is change? Why would he want to do it? What are his worries about it? It is only by nonjudgmental listening that the individual's dormant motivation will come forth.

Through listening, the clinician is sometimes rewarded with DARN talk—what the person desires, how able she feels to change, the reasons why change might be worth pursuing, or the need that is driving the motivation. If this buried treasure is heard, the clinician can explore these areas. Sometimes rulers—how confident, how important is it to move towards a change in behavior—can then be used. These questions help to deepen the individual's desire and awareness of the need to change. Through these techniques ambivalence can be elicited and clarified. Working with the patient at all stages is illustrated in Videos 5.6 and 5.7

Finally, after the reasons for change have been explored, the clinician may have the opportunity to inform the patient, with the patient's permission. Informing in motivational interviewing adheres to the concept that no one knows best, for we all know differently. No one can motivate another person. The real goal in motivational interviewing is to help older adults discover their own motivations and then support them in learning more about them.

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Resources

Motivational Interviewing Network of Trainers: excellence in motivational interviewing [Internet]. c2013. Available from: www.motivationalinterviewing.org—a website with references, videos, and links to training opportunities. Experienced motivational interviewers can be seen discussing the spirit of motivational interviewing and the way it works can be seen in the video on this page. (cited 2014 December 21)

Another useful link on this website is "Motivational Interviewing Resources" (http://www.motivationalinterviewing.org/motivational-interviewing-resources).

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Chapter 6
Writing an Exercise Prescription for Older Adults

Debra J. Rose

Key Points

- Prescribing exercise for older adults is both a science and an art.
- Three senior-specific principles—functional relevance, challenge, and tailoring or adaptation—should guide the development of an exercise prescription.
- The exercise prescription for older adults should be multicomponent and include aerobic endurance, muscle strengthening, flexibility, and balance training.
- Adjustments to the environment, communication techniques, and number of different exercises can safely engage older adults with sensory losses or cognitive impairment in exercise programs.

Introduction

Professionals in the health and fitness field are well aware of the importance of integrating physical activity into every individual's daily life. According to the American College of Sports Medicine, American Heart Association, and other groups, the scientific evidence is indisputable and the benefits of exercise are greater than the potential risks for most older adults [1]. Studies show that older adults who engage in physical activity or exercise on a regular basis derive numerous health- and performance-related benefits. Not only does a certain level of fitness protect the older adult from a number of chronic diseases, but it also improves the performance of daily life tasks and recreational activities and enhances emotional well-being, cognitive function, and perceived quality of life [2, 3]. In addition, the annual direct

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medical costs of physically inactive older adults, with no physical limitations, are significantly higher than those of their physically active peers [4].

Currently, a minority of older adults meet Centers for Disease Control recommendations for physical activity [4]. The lack of prior training or experience in prescribing effective exercise programs, on the part of clinicians, creates a critical, ongoing barrier to improving the numbers of physically active older adults. This chapter will provide the essential information to develop a tailored exercise prescription for older adults.

The Science and Art of Exercise Prescription

In 2009, the American College of Sports Medicine (ACSM) published a position stand related to physical activity and older adults based on emerging research evidence to limit the development and progression of chronic disease and disability [5]. In particular, *aerobic*, *muscle-strengthening*, and *flexibility* activities were considered core components of an exercise prescription for older persons. In 2011, a subsequent ACSM position stand added *neuromotor exercise* training to the list of core components [1]. Also referred to as *functional fitness training*, this component of the exercise prescription incorporates balance and gait, coordination, and agility training.

Although the ACSM position stands provide guidance when designing the exercise prescription for older adults, how best to tailor the exercise program to each older adult remains unknown. This is largely because the onset and rate of decline across different physiological systems varies considerably within the older adult population and between the sexes. As a result, adaptive responses to exercise will vary widely. Therefore, developing the exercise prescription for an older adult requires careful review of each older adult's medical history, pre-exercise screening and assessment, and history of prior physical activities. While this knowledge will guide the selection of exercises in the initial exercise prescription, ongoing monitoring of the individual's response to exercise to adjust the prescription forms the "art" of exercise counseling.

Case 1
Cynthia is a 75-year-old woman who lives alone in the community. Since her retirement several years ago, she has continued to be socially active and in good health, but does not regularly participate in physical activity. Recently she noticed that she gets tired when walking and has difficulty unloading her grocery bags from the car. She is also worried about feeling unstable when walking in the neighborhood. After obtaining this history during her annual wellness visit, Cynthia's primary care physician recommends that she join an exercise class at her local "Y," where she has enjoyed assisting with crafts fairs and blood drives.

(continued)

At the Y, Cynthia completes the senior fitness test, six tests designed to evaluate lower and upper body strength, flexibility, aerobic endurance, and balance and agility. In comparison to established national performance standards, Cynthia is in the below average category for aerobic endurance and upper body strength and in the low average category for lower and upper body flexibility and lower body strength. Her score on the balance and agility test is also in the low average category.

Cynthia's test results indicate that she would benefit most from a well-rounded exercise program, with particular emphasis on improving her aerobic endurance and upper body strength. Lower body strength activities combined with balance and agility will also be important for safe walking in her neighborhood.

In order to effectively tailor the exercise prescription for older adults, it is necessary to assess the multiple dimensions of fitness. Fortunately, there are functional fitness assessments available that are suitable and safe to use with older adults. One such assessment is the senior fitness test (SFT), which has undergone rigorous psychometric testing since first published in 1999 [6]. The SFT utilizes common functional tasks to assess important physical fitness parameters such as lower and upper body strength, flexibility, aerobic endurance, and balance and agility. Because each of the SFT items simulates a daily activity, participants who complete the test usually find the experience meaningful and motivating (see Table 4.1 and Video 4.1).

Principles for Designing Exercise Programs

When designing exercise prescriptions for older adults, two general exercise principles and three senior-specific principles need to be considered. The two general exercise principles are *progressive overload*—exposing a tissue or organ to a load that the individual is not normally accustomed to improve its function—and *specificity*—exercise training effects are specific to the type of exercise and muscles involved. The three senior-specific principles include *functional relevance*, *challenge*, and *adaptation* or *tailoring* [7]. Functional relevance encourages the selection of exercise activities that simulate movements associated with daily activities: transferring, climbing stairs, negotiating curbs, and walking on altered surfaces. Demonstrating the functional relevance of an exercise helps the older adult client make a meaningful connection between the exercise and requirements of daily life. This enhances motivation to continue exercising.

Also, selected activities/exercises must *challenge* the older adult but not exceed the individual's functional capabilities in terms of strength, aerobic endurance, or balance.

The level of challenge can be manipulated by changing the demands of the task—from seated to standing, with or without support—or demands of the environment, such as from even to uneven surfaces. For example, an older adult might begin exercising on a recumbent bike but progress to walking on a treadmill as his or her aerobic endurance and balance improve. However, it is important to remember that the inclusion of exercises that challenge an older adult sufficiently to produce positive effects must be balanced against those that increase the risk of an injury or adverse response to exercise.

The third senior-specific principle to consider is *tailoring* or *adaptation*. This principle recognizes that older adults, even those who are physically independent, at times may have symptoms or medical conditions that can fluctuate or require medications to control. Elevated pain levels or adverse side effects associated with certain medications may reduce the ability to exercise at the same level of intensity or duration as prescribed. Adapting the exercise prescription by temporarily lowering the intensity or duration of exercise is important to minimize adverse responses and maximize enjoyment. While this principle is at odds with the progressive overload principle, it recognizes the high degree of variability often observed in older adults' physical abilities and the fluctuations that occur in their physical and psychological health. Similarly, it is important to teach older adults how to monitor their own level of exertion and make adjustments when appropriate.

Designing Multicomponent Exercise Programs

Exercise prescriptions designed for older adults ideally should include all four key components: aerobic endurance training, resistance training, flexibility, and balance and agility. Although adjustment for the goals and preferences of the older adult is required, the focus remains on incorporating as many of the four components as possible into the exercise prescription.

Aerobic endurance exercises increase the heart rate, over a sustained period, by the use of large muscle groups at lower effort levels (see also Chap. 4 and Video 4.3). Because the respiratory rate increases along with the heart rate, older adults usually can monitor their level of effort. The preferred method of measuring the effort or intensity of exercise is Borg's rating of perceived exertion (RPE) scale (see Table 4.4) [8]. This scale does not rely on the cardiovascular response alone, but also takes into account the central (breathing and heart rate) and peripheral (muscle fatigue) responses to exercise. Moreover, a relationship between RPE and VO_2Max has been established, independent of age. For example, exercising at an intensity of 13–15 on the RPE scale is approximately equivalent to exercising at 70–80 % of VO_2Max, whereas an RPE between 11 and 13 equates to a VO_2Max ranging between 49 and 70 % [9].

When working with healthy older adults, it is recommended that the RPE be maintained between 11 and 13 (moderate to somewhat hard on the 6–20 Borg scale), but for sedentary or frail older adults, it should not exceed a range of 9–11 (very light to light). Older adults exercising at home can be reminded to monitor their ability to talk during

physical activity: if they can talk and sing, the level is likely moderate. If they can talk but not sing, the level is more vigorous. If breathing interferes with talking, the exercise level has gone beyond aerobic and the older adult should slow down.

In contrast, resistance training, or muscle strengthening, increases the strength of a few muscle groups at a time, by using high effort levels over short periods (see also Chap. 4). Many aerobic exercises, such as walking or swimming, can increase both endurance and strength to some degree. On the other hand, flexibility exercises require a separate prescription element: stretching exercises to enhance or maintain joint range of motion and to reduce pain. Finally, balance and agility exercises challenge an older person's balance to improve their ability to avoid a fall when changing positions or negotiating uneven surfaces.

Principles for Aerobic Endurance Training

When designing the aerobic endurance component of the exercise prescription, the two general exercise principles introduced earlier—specificity and progressive overload—must be addressed, as well as the variables of frequency, intensity, time, and type of exercise or FITT [10]. How each of these four variables is manipulated will determine the volume of exercise prescribed at different time points. To improve a client's aerobic capacity, it is important to select exercises that are aerobic in nature and can be performed at an appropriate intensity to achieve a training effect. For example, walking on a treadmill or outdoors can be easily adjusted from an intensity rated as light to somewhat hard by altering walking speed or degree of incline or decline. For maximum effectiveness, clinicians should select exercises for each individual that are based on the results of the initial pre-exercise screening and follow-up functional assessments, to target fitness parameters that need improvement.

For aerobic exercise, *interval conditioning* is highly effective and may reduce the time required to improve fitness. Rather than continuous activity at the same level, interval conditioning involves periods of higher levels of activity followed by recovery periods. The concept is straightforward and easily understood by most older adults. Interval conditioning uses the aerobic (with oxygen) and anaerobic (without oxygen) energy systems to a greater or lesser degree during alternating periods of higher-intensity exercise and periods of active, lower-intensity, recovery exercise (Table 6.1). Although the ultimate goal is to combine both continuous, steady-state exercise and interval-conditioning approaches, it is recommended that interval conditioning be the approach of choice during early stages because it is more flexible and produces rapid, specific aerobic endurance gains that positively influence the performance of daily activities. As the level of aerobic endurance improves, however, the older adult should be encouraged to increase the duration of their workout and exercise at a constant, submaximal intensity for a period of at least six or more uninterrupted minutes.

Table 6.1 Interval-conditioning training continuum for older adults

	Spontaneous conditioning	Fitness conditioning		Performance conditioning	
Goal	"Get me started"	"Train me"		"Challenge me!"	
	Getting skilled up: feeling fitter	Getting trained up: getting fitter		Getting even fitter: maintaining the training gains and beyond	
	Fitter moments	Fit for life		Fit for sport or performance	
	"I want to reduce breathlessness enough to get to the store and back without stopping and without feeling so exhausted that I have to rest for the whole day to recover."	"I want to be able to increase my walking time to 30 min, increase my pace, and include some uphill walking."		"I want to enter (or improve my time in) the super veteran category in my local triathlon."	
Fitness level	Deconditioned	Moderate to high		High	
Intensity	Instructor programmed, participant controlled	Instructor programmed, participant controlled		Set by instructor	
	RPE guidelines 9–11	RPE guidelines:		RPE guidelines:	
		Effort interval RPE 11–13	Recovery interval RPE 9–11	Effort interval RPE 13–15	Recovery interval RPE 9–11
		Progress to: RPE 13–15	Remains: RPE 9–11	Progress to: RPE 15–17	Remains: RPE 9–11
	METS guidelines 2–4	METS guidelines 4–6		METS guidelines 6–10	
		Progress to: 6–8		Progress to: 10–12	

Time			
Work/rest: effort/recovery ratio	Instructor programmed, participant controlled	Set by instructor	Set by instructor
	Aerobic effort 1 min: recovery 1 min	Aerobic effort 1 min: recovery 1 min	Aerobic effort 1 min: recovery 1 min
		Anaerobic effort 1 min: recovery 3 min	Anaerobic effort 1 min: recovery 3 min
Duration	Instructor programmed, participant controlled	Set by instructor	Set by instructor
	Effort interval: 10 s to 5 min	Aerobic: 3–5 min	Aerobic: 3–5 min
	Recovery interval: 10 s to 5 min	Anaerobic: 80–90 and progress to 90–270 s	Anaerobic: 80–90 and progress to 90–270 s
		Recovery: 3–5 min	Recovery: 3–5 min
Frequency	Participant controls number of work-to-rest cycles based on fitness level and length of aerobic endurance component (15 or 30 min)	Number of times each work-to-rest cycle is performed depends on fitness level and type	Number of work-to-rest cycles depends on fitness level and length of aerobic endurance component
Type	Walking, stationary cycling, and stair climbing and descending	Walking, jogging, cycling, rowing, swimming, exercising to music, and circuit training	Timed or race walks, runs, swims, triathlons, mini-marathons
Approach	Individualized "easy-does-it"	Comfortably challenged	Improved sports performance, going beyond improved fitness, only for better-conditioned clients
	No or minimal structure	More structured	Highly structured
	"Speed up a little for the next 30 s and you are breathing a little harder but are not breathless, then ease off a little and recover."	"Work a little harder than you usually do."	

Note: All interval-conditioning programs must be tailored to the older person's health and functional needs, physical fitness levels, personal goals, and interests
Adapted from Dinan et al. [10] and Brooks [11]

Table 6.2 FITT exercise variables for aerobic component

Variable	Example	Increase order	Increase example
Frequency	3 times/week	Second	5 times/week
Intensity	Slow, comfortable pace, able to talk easily	Third	Swing arms above waist
			Later, speed up the pace
Time	6-min duration	First	10-min duration
Type of exercise	Walking outside or treadmill inside, exercises in pool, recumbent bicycle, swimming		

When designing the aerobic component of the exercise prescription, progressive overload is accomplished by the systematic application of the FITT variables (Table 6.2). Begin by increasing only one exercise variable at a time. First, increase the time over which the exercise is performed, such as 1-minute increments as tolerated, before increasing the intensity at which the exercise is to be performed. Increasing exercise intensity can be accomplished by encouraging participants to move the arms in a more challenging way, such as above the waist level, or by increasing the level of resistance, such as walking with a weighted vest, pole walking, or light hand weights. The variable of intensity should also be increased prior to increasing the speed of the movement. Usually 2 weeks should be allowed for adaptation after each key increase.

Principles for Resistance Training

Although the general principles for developing the resistance-training component of any exercise program are similar, irrespective of age, there are special considerations that apply to the older adult population. First, tailoring the resistance-training component based on the older adult's current functional abilities and medical status is critical. Second, older adults, particularly those who have led a sedentary lifestyle or have little exposure to resistance exercise, must be taught the correct movement technique, breathing, and posture associated with each selected exercise. Third, in order to prevent injury or overtraining issues, the progression of each selected exercise should be monitored.

When designing and tailoring the resistance-training component of the multicomponent exercise program for older adults, the principles of progressive overload and specificity apply once again. In addition, the specific functional goals for each older adult can guide the manipulation of key training variables: load/resistance, number of repetitions and sets, recovery time, and movement speed. Functional goals include muscle strength (muscle's ability to maximally exert force against resistance in one effort), endurance (muscle's ability to continue to exert force with repetitions), or power (muscle's ability to perform a certain amount of work over

time). While the traditional view has been to develop muscle strength and endurance prior to muscle power training when working with older adults, more recent evidence suggests that improving an older adult's muscle power should be done in conjunction with muscle strengthening because it is more closely associated with the performance of daily activities [12]. Multi-joint and single-joint exercises are recommended for all fitness levels: novice, intermediate, or advanced. Training opposing muscle groups (e.g., abdominals and lumbar extensors, quadriceps and hamstrings) is also important to prevent muscular imbalances.

The selected load/resistance is usually represented as a percentage of the individual's one repetition maximum (1 RM) or the maximum amount of weight that can be lifted while maintaining an acceptable movement technique. If the goal is to improve muscle strength, it is recommended that older adults lift loads between 60 and 80 % of 1 RM for 8–12 repetitions. In contrast, lifting light-to-moderate loads of 30–60 % of 1 RM for 12–15 repetitions or higher is recommended for improving muscular endurance. Finally, lifting light-to-moderate loads (30–60 % 1 RM) over a lower number of repetitions (6–10) but at a higher velocity is recommended if the goal is to improve muscle power.

While these constitute general guidelines, the given level of resistance also must be tailored to the specific needs of the older adult. These include the individual's previous experience with resistance-training techniques; the potential for adaptation based on age, gender, and health status; the goals of the program and older adult; and the type of resistance-training protocol: machine-based circuit training, free weights, or home-based exercises using resistance bands or own body weight.

Resistance training is performed in sets. For example, lifting a weight ten times with no rest between lifts constitutes one set of ten repetitions. As the number of sets increases, so does the level of muscle fatigue and the amount of recovery time required. The volume of exercise prescribed should begin at a low level and be increased as training continues. While performing a single set of repetitions is sufficient to overload the muscles for those older adults just beginning to engage in resistance training, multiple sets of repetitions are recommended once the older adult is able to tolerate a greater volume of exercise. The current recommendation is that three sets of repetitions should be the maximum number performed by older adults.

The interaction between the number of repetitions or sets completed during a resistance-training session and the amount of recovery provided between sets of the same exercise or between different exercises will determine the metabolic (energy) demand of an exercise session. The length of a recovery period should be based on these considerations: frequency of resistance training (number of days per week), intensity of the exercise performed (light, moderate, heavy), fitness level of the individual, resistance-training goals (strength, endurance, power), and the metabolic (energy) demands associated with the resistance exercise. For example, as the intensity of training increases, such as with heavier loads or shorter rest periods, so too do the metabolic demands as a result of requiring a greater contribution of energy from the anaerobic energy system. As the load, or resistance, is increased, so too should the length of the recovery period. This is needed because, by increasing the muscle load, the overall training intensity has also been increased.

Training frequency refers to the number of training sessions completed in a given period of time, usually a week. The frequency with which an individual performs resistance exercises needs to progressively increase during the early phases of a training program as the body becomes more tolerant to the stress placed on the working muscle groups. For older adults with some resistance-training experience, it is recommended that total-body workouts be performed two to three times per week, with at least 1 day of recovery between workouts that stress the same muscle group. In contrast, for those older adults with very little experience, at least 2–3 days of rest should be scheduled between sessions in which the same muscle groups are exercised (Box 6.1).

Box 6.1
For beginners, 2–3 days of recovery should be scheduled between resistance-training sessions that stress the same muscle groups, while only 1 day of recovery needs to be scheduled for more experienced individuals.

After a sufficient period of adaptation or for individuals who are already quite fit, more functional forms of resistance training can be incorporated into the multicomponent exercise prescription. This training more closely simulates the types of muscle actions performed on a daily basis, such as bending, turning, and reaching. Several exercises, for example, pilates, and equipment, such as stability balls, can be used for a logical training progression.

In addition, there are other program variables that can affect the nature of the overload experienced and, therefore, the training response in individual older adults. These variables include type of equipment used (free weights, body weight, or machines), single versus multiple joint exercises (bicep curl versus squat), type of muscle action (isometric, concentric, or eccentric), and exercise order (large versus small muscle groups). For older adults who have little resistance-training experience and are willing to leave home, it is recommended that resistance exercises first be performed in a center on machines until the correct movement and breathing techniques have been learned.

The most common types of muscle actions used during resistance training are concentric (muscle shortens during contraction) or eccentric (muscle lengthens during contraction). Including isometric (no change in muscle length during contraction) exercises can be beneficial for older adults as a means of promoting low-back health and improved stabilization of the spinal musculature, which is important for postural alignment and stability.

The resistance-training session usually begins with exercises that involve multiple joint actions and larger muscle groups, such as leg press and seated row, so that a higher level of resistance can be achieved and muscle fatigue is minimized. Later in the session, the focus can shift to the performance of exercises requiring single-joint actions and smaller muscle groups, such as bicep curls and tricep extensions.

Table 6.3 Safety considerations for older adults during resistance exercise [13]

Ensure that the muscles to be exercised are warmed up for at least 10 min prior to the resistance-training component
Begin with low resistance levels and gradually add repetitions, sets, and intensity
Encourage movement through a full but pain-free range of motion
Discontinue any resistance exercise that causes pain: lower the resistance or find an alternative exercise for the targeted muscle group that can be performed without pain
Instruct the older adult in correct breathing techniques: exhalation during the effort phase and inhalation during the relaxation phase
Teach the older adult client how to perform a resistance exercise without hyperextending or locking the joints
Allow at least a 48-hour rest interval between resistance-training sessions that require the same muscle groups

(See Figs. 4.19–4.30 for illustrations of strength training.) To ensure the safety of the older adult when performing resistance exercises, several safety precautions should be followed (Table 6.3).

Principles for Flexibility Training

Research evidence demonstrates that older adults with range-of-motion (ROM) deficits can improve their flexibility by stretching on a regular basis. Improvements in ROM can be achieved by performing a variety of different exercises including traditional ROM exercises, dance, tai chi, and aquatic exercise. The most important requirement is that the joint be moved through a complete range of motion or to the point of slight discomfort.

Different types of stretching techniques are beneficial when applied correctly and at the right time during an exercise session. These different techniques can be divided into two main categories: static and dynamic stretching**.** Static stretching generally focuses on a particular muscle group and involves moving the joint through a single movement plane until a given end point is reached. The joint is then held in that position for a period of time, usually 30–60 s. Static stretches are very safe to perform once the muscles and joints have been warmed up and present little likelihood of injury if performed correctly. In contrast to a static stretch, dynamic stretching moves a joint through a given range of motion, but the stretch is not held for any period of time. Instead, the goal of this stretching technique is to increase progressively joint ROM with each subsequent movement repetition, but without bouncing or forcing the stretch.

As yet, research has not determined which type of flexibility training, static vs. dynamic, as well as optimum frequency, is most beneficial for older adults. However, there is general consensus that the more dynamic forms of stretching, such as rhythmic movements, are preferred when the muscles and joints need to be warmed up,

Table 6.4 Principles for flexibility exercises

Select flexibility exercises on the basis of which joints have obvious range limitations and which muscles are stiff
Emphasize correct body alignment
Perform dynamic stretches during the warm-up to facilitate warming up the body and muscles
Do not perform static stretches until the body is at its warmest, and muscles and joints are receptive to stretch
Move slowly into a static stretch position
Stretch to a point of slight discomfort, but not pain
Do not jerk, bounce, or force a stretch to avoid injury
Hold a static stretch for 30–60 s
Inhale before the start of the stretch, exhale during the stretch, and breathe evenly while holding the stretch at its end position

whereas static stretching is best when the muscles and joints are warm. [14] Both static and dynamic stretching techniques are effective and should be included in the exercise prescription. A single static stretch is more comfortable than multiple repetitions of a dynamic stretch for a person who has significant joint disease and pain, particularly in the early stages of an exercise program. On the other hand, for someone with poor body awareness, repeating limb movements multiple times may be appropriate (Table 6.4).

It is important that older adults are encouraged to move at their own pace to avoid injury. If certain flexibility exercises cause pain, an alternative exercise should be selected that stretches the target muscle or joint and can be performed without pain. Special precautions may be needed when selecting flexibility exercises for older adults with medical conditions such as osteoporosis, rheumatoid and osteoarthritis, and stroke. For some older adults at very low levels of fitness, stretching alone can provide aerobic exercise as well as relieve joint stiffness and pain and thus may be a critical starting point for a multicomponent exercise program. (See Figs. 4.1–4.18 for illustrations of static stretching exercises.)

Principles for Balance and Agility Training

Good balance and agility are essential to the successful performance of most activities of daily living as well as many recreational pursuits. Irrespective of past physical fitness, certain age-associated changes inevitably occur in body systems that contribute to balance and mobility. While some of these changes have no observable effect on how well balance- and mobility-related tasks are performed, other changes adversely affect multiple dimensions of balance and mobility. For example, changes that affect multiple systems simultaneously (sensory, cognitive, and motor) or are exacerbated by existing medical conditions (diabetes or arthritis) can affect not only the strategy older adults use to perform a certain balance task but whether they choose to perform it at all.

Including activities that promote balance, coordination, and agility will improve older adults' abilities to participate in recreational pursuits and lower their risk of falling. The primary goal when planning balance and agility activities for older adults is to challenge but not exceed their functional capabilities. This is accomplished by systematically introducing more complex balance and agility tasks that can be performed in a variety of practice environments. These environments should simulate those encountered in daily life, such as changing levels, negotiating obstacles, and moving at different speeds. Tasks or environmental demands should be manipulated based on the older adult's existing abilities. The current recommendation is that balance exercises should be performed two to three times weekly for benefit.

Also, the exercises selected will depend upon whether the focus is improving the older person's motor vs. sensory systems. If the goal is to enhance the motor system, it is most appropriate to alter the task demands of a particular balance and mobility activity. One way to manipulate the task demand is to perform a balance activity in an altered base of support position, such as a tandem or one-legged stance, or while moving instead of standing quietly. However, if the goal is to augment the sensory systems that contribute to good balance and mobility—visual, somatosensory, or vestibular—then manipulating the environment in which the task is performed should be prioritized. Having the older adult perform balance activities with reduced or no vision (darkened room or eyes closed) while standing on a yielding or moving surface is a way to manipulate the environment. If a second cognitive or manual task is added while the older adult is performing a balance activity, this will increase the level of challenge and require that attention now be divided between multiple tasks (Table 6.5).

Table 6.5 Manipulating task and environmental demands to improve balance

	Easy	More difficult	Most difficult
Task demand			
Arm position	In contact with seated surface or external support if standing	Resting on thigh if seated or at sides of body if standing	Folded across chest
Base of support	Feet together	Feet in tandem stance[a]	Single-leg stance
Pacing of exercise	Self-paced (own speed)		Externally paced
Length of movement sequence	Single activity	Three to four sequential movements	Six to eight sequential movements
Additional task	Cognitive (e.g., counting backward)	Self-paced manual task (e.g., reaching)	Externally paced manual task (e.g., catching)
Environmental demand			
Lighting	Dim room lights	Dark glasses	Closed eyes
Support surface (seated)	Balance disk on chair	Stability ball (with holder)	Stability ball (no holder)
Support surface (standing)	Thin foam (1–2 in.)	Dense foam (2–4 in.)	Balance disk

[a]Tandem stance: placing feet in heel-toe position when standing
Balance challenge can be further increased by combining two or more task or environmental demands
Adapted from Rose [15]

Exercises that improve perceptual-motor skills should be included in the balance component of the exercise prescription. Examples include walking with different gait patterns or variable walking speeds, negotiating obstacle courses, performing tai chi movements that require multi-limb coordination and control, and engaging in proprioceptive activities, such as performing exercises on compliant or moving surfaces or without vision. (See Figs. 4.31–4.36 for illustrations of balance exercises and Tables 4.6 and 4.7 for descriptions of balance exercise performed during movement and everyday life.)

Case 1 Continued
Cynthia joins the Y's Powerful Aging program that includes seated or standing aerobic exercise, 3 days per week. She also starts a program of resistance training with a group of older women under the supervision of a Y trainer. She starts with a single set of ten repetitions at a load corresponding to 60 % of 1 RM, 2 days per week. She is careful to do these repetitions slowly to avoid injury and maintain the correct movements and breathing techniques demonstrated by the trainer. She uses the machines for some exercises (chest, legs) and free weights for her arms (bicep curls, tricep extensions).

After these exercises have become easier to do, she adds an additional set of repetitions performed at a higher level of resistance (70 % of 1 RM).

Cynthia begins all of her exercise sessions with dynamic stretches and ends with static stretches; she has learned these at the Powerful Aging class and they are also posted in the gym. The Powerful Aging program includes balance exercises that start with easier activities using a chair and advance at the participant's own pace.

Over time, Cynthia is able to participate in the full hour of the Powerful Aging aerobic program, at an increased pace.

Lifestyle Changes for the Exercise Prescription

Improvements in all parameters of fitness can also be accomplished by making simple lifestyle changes. In addition to participating in an exercise class, two or three times per week, older adults should perform daily physical activities to improve health and function. The benefits of exercising for 60 minutes during the day are quickly undermined if the remainder of the day is spent continuously sitting on the couch. In fact, just standing burns three times as many calories as sitting because the muscles are activated.

Activity levels can be appreciably elevated by encouraging older adults to get up every 20 min and move around, perhaps during each commercial break while watching the TV or after each chapter when reading. Talking on the phone, while standing or moving around, is also an easy way to expend more energy. Other activities that can be incorporated into one's daily activity include going for short but frequent walks, taking the stairs rather than the elevator, parking the car further away from the store when going shopping, or getting up to change the TV channels instead of using the remote control.

Wearing an activity monitor can be an effective tool for increasing physical activity levels. Too often we are unaware of how long we spend not moving during the day. These monitors can be useful by making us aware of how sedentary we are and also motivating us through setting daily step goals. It is important to convey to older adults that every minute that is spent moving will lower their risk of disability and premature morbidity.

Special Circumstances: Older Adults with Sensory or Cognitive Loss

While the actual exercise prescription changes little when working with older adults experiencing sensory losses, including vision, somatosensory, or hearing impairments, some precautions are needed for a safe exercise environment. For visual loss, ensuring that the exercise area is well lighted and free of exercise equipment that may create a tripping hazard is important. Any written exercise instructions given to the client or listed on a workout card should be in a larger font. In the case of more severe vision loss, additional supervision may be needed to ensure the correct number of repetitions and sets are performed and equipment is set up correctly.

For older adults experiencing sensory loss in the feet, it is important to have manual support available to prevent a loss of balance, particularly when engaging in the balance and agility component of a program. In some cases, the exercise prescription may need to be modified, such as by removing eyes-closed activities when the individual is exercising in unsupervised environments.

Hearing impairments also require accommodation, particularly in group-based exercise settings. For example, when giving instructions, it is important for the instructor to speak clearly and slowly and face the older adult so communication can be enhanced by lipreading and gestures. Reduced kinesthetic awareness, also seen in older adults with hearing impairments, can make these individuals more prone to losing balance. Seated activities may be substituted for some standing or moving activities if postural instability is a concern.

When working with older adults with cognitive impairment, the exercise prescription is modified to minimize the likelihood of injury due to a loss of balance or engaging in risky behaviors. The severity of the cognitive impairment determines the level of supervision needed during each exercise session. In group-based settings, more severely impaired clients will need to be accompanied and supervised by a caregiver at all times. The need to review important exercise instructions or demonstrate certain exercises that have been forgotten between sessions will reduce the amount of time spent exercising during each session and slow progress. Providing the opportunity for more repetition of fewer exercises can minimize frustration or confusion when working with older adults with cognitive impairment. Patience and consistency are the key instructional elements needed when working with clients with altered cognition. Finally, providing frequent verbal encouragement and ongoing support is helpful to keep the older person interested and participating in the exercise program.

Summary

Given the high degree of variability that exists among the older adult population, every exercise prescription will need to be individually tailored based on functional ability, previous experience with physical activity, and personal goals (Table 6.6). The process should begin with screening and physical assessment of the core fitness components (aerobic endurance, muscular strength, flexibility, and balance) so that a comprehensive, well-rounded exercise program can be developed. The general principles of progressive overload and specificity must be addressed when designing the exercise program, as well as the senior-specific principles of functional relevance,

Table 6.6 Sample exercise prescription

℞ for: *Cynthia* date:			
My goals are *to walk around my neighborhood without feeling exhausted or unstable, to be able to go to the grocery store, bring my groceries into the house, and not have to rest for 2 h*			
	Week 1	**Week 3**	**Week 5**
Aerobic endurance			
Frequency	Three times weekly, class program	Four times weekly (at home walking program 1 day/week)	Five times weekly (at home walking program 2 days/week)
Intensity	Light to moderate effort, RPE of 9–10	Moderate to hard effort, RPE of 11–12	Moderate to hard effort, RPE of 12–13
Time	10 min (5, 1-min work and 1-min recovery cycles)	15 min (5, 1.5-min work and 1.5-min active recovery cycles)	20 min (5, 2-min work and 2-min active recovery cycles)
Type	Class program or recumbent cycling	Class or treadmill walking/ home walking	Class or treadmill walking/home walking
Resistance	Single set	Single set	Two sets
	10 repetitions	12 repetitions	8 repetitions
	60 % of 1 RM	60 % of 1 RM	One 60 % 1 RM
			One 70 % 1 RM
	Two times weekly	Two times weekly	Two times weekly
Flexibility	Stretching in class: dynamic stretches during warm-up and static stretches during cooldown	Stretching in class: before (5 min) and after (5 min) aerobic component, also once weekly at home (10 min)	Stretching in class: before (5 min) and after (5 min) aerobic component, also twice weekly at home (10 min)
Balance	Seated trunk leans and altered base of support activities	Balance part of class, standing, with weight shifts and transfer exercises using chair for support	Balance part of class, with moving activities: starts and stops, directional changes
Lifestyle	Get up every 20 min and move around for 1–2 min	Add: park a little farther away from the grocery store	Add: walk with the neighbor, walking her dog
Monitor *joint pains, too short of breath to speak, other pains, or light-headedness: STOP*			

RPE Borg's rating of perceived exertion scale
1RM one repetition maximum or the maximum amount of weight that can be lifted while maintaining an acceptable movement technique

challenge, and adaptation. Through careful manipulation of component-specific exercise variables and ongoing monitoring of the older adult's exercise responses, the prescription can be readily adapted to address fluctuations in physical or psychological health. While general recommendations can guide the design of the exercise prescription for an older adult, evidence regarding how to advance each exercise component and over what period of time is lacking. For these reasons, designing the exercise prescription for the older adult remains both a science and an art.

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Chapter 7
Cultural Considerations for Exercise in Older Adults

Rosaly Correa-de-Araujo

Key Points

- Awareness of cultural history, values, and beliefs allows tailoring of exercise recommendations to diverse older adults.
- Language and low literacy present barriers to understanding an exercise prescription.
- A culturally sensitive approach can elicit an older adult's preferences and concerns about potential inhibitors and motivators to physical activity.
- Community-based participation, with strong emphasis on social supports and family values, is an effective approach for all racial and ethnic groups.
- "Fitness deserts" limit the ability of many older adults from minority cultures to exercise safely.

Introduction

Physical activity is an essential element of many prevention, treatment, and rehabilitation interventions designed for older adults. Behaviors, particularly lifestyle choices, have strong links to beliefs and values which are in turn influenced by cultural background. Environment and cultural background interact with intrapersonal

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factors, such as personality, to influence lifestyle choices including engagement in physical activity.

Despite the known benefits of physical activity, the Healthy People 2020 study in 2011 found that only a little over one-third of adults 65 years or older, with reduced physical or cognitive function, engaged in any leisure-time physical activity [1]. This engagement varied across racial and ethnic groups, with older Hispanics/Latinos and African Americans having even lower rates. Given the high prevalence of chronic conditions among older adults, especially racial and ethnic minorities, these low rates for physical activity are a significant public health concern. Physical activity interventions geared to older adults with various racial and ethnic backgrounds are increasing in number, but fewer interventions are directed toward Asian Americans, African American and Hispanic/Latino men, and rural American Indians and Alaska Natives.

Factors beyond race and ethnicity also contribute to differences in physical activity participation. These factors include the built environment (availability, safety, and quality of nearby parks or recreational centers), gender, views on exercise as a social norm, and differential needs for peer support. Language barriers and overall value placed on personal health and well-being serve as additional factors affecting understanding of and engagement in physical activity.

Projections indicate that by 2050 the racial and ethnic composition of older adults will change profoundly, with older whites declining from 80 to 58 % of the population and increases in current minorities: Hispanics to 20 %, African Americans to 12 %, and Asians to 9 % of the older adult population [2]. Thus it is imperative to understand the factors influencing engagement in physical activity for all cultural groups. This chapter will provide health care professionals with clinically relevant information about the culture of physical activity among older adults of various racial and ethnic groups and recommendations for taking a culturally competent approach when prescribing or promoting physical activity for older adults.

The Culture of Physical Activity

Every person has a cultural identity and values that are rooted in experiences learned, shared, or created across his or her life. Cultural identity, values, and experiences ultimately shape a person's views. The intersection of gender, race and ethnicity, age, disability, socioeconomic status, education, geographic region, environment, language, music, art, history, religion, food, clothing, and other factors forms one's cultural identity. Great diversity exists among cultural groups such that generalizations about individuals should be made cautiously, if at all. In addition, acculturation, often measured by the length of time in the host country, may change practices over time, with important effects upon physical activity participation. Nonetheless, understanding cultural context can act as a starting point for health professionals counseling an older adult from a different racial or ethnic background about physical activity. Health care professionals can also employ motivational interviewing to help older adults from culturally different background commit to physical activity (see Chap. 5).

Perceptions and Attitudes Toward Physical Activity

A considerable amount of literature reports findings from focus groups conducted with racial and ethnic minorities, with some of these studies specifically targeting older adults (see Tables 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, and 7.7). This information can help clinicians craft culturally sensitive messages to promote physical activity, improve skills in eliciting information from older adults, and improve the design of physical activity programs. Keep in mind that acculturation is a continuous process and will change people's views and attitudes over time.

Relatively little is known about physical activity or program-based preferences across older ethnic minorities or immigrant groups: most of the published studies have analyzed immigrants to Canada. These studies of usual physical activity grouped by self-described ethnicity (e.g., Whites; South, Southeast, and West Asians; Blacks; Latin Americans; Aboriginal persons; and others) show that ethnic minority groups and immigrants tend to participate in routine forms of physical activity, such as walking, and less likely to engage in endurance, recreation, and sports activity. However, recent and established immigrants are more likely to have a physically active commute [12].

In the United States, studies of immigrant older adults of East Asian descent, Spanish speaking, and Native Americans find that walking is their preferred mode of physical activity, followed by stretching and tai chi in Cantonese groups and dance and socializing in Hispanic/Latino groups.

Table 7.1 African Americans' perceptions and attitudes toward physical activity

Value social aspect of programs and support from family and friends
Emphasize improving the health of the community, rather than individual
Value community-based, church-based, and faith-based exercise programs or group activities
Value settings that can offer child care and classes in the evening
Prefer African American physical activity instructors or group leaders
Value physical activity information presented in storytelling, interactive or demonstrative formats, and the use of cultural symbols
Believe individuality within activities should be maintained
Report walking as a common activity during earlier years, frequently performed to relieve stress, meditate, and be in contact with nature
Value easy access to parks and facilities like gyms, particularly in their neighborhoods
Limitation of public transportation makes access a challenge and may prevent participation
Cost of joining fitness clubs is a barrier to exercise
Unsafe neighborhoods are a disincentive to physical activity for older women and men
Identify some level of discomfort with exercising alongside adolescents and younger adults in the same facility
Some do not exercise due to hair-associated concerns
Lack of time due to family or church commitments can limit physical activity engagement
Fear of falling is a barrier to physical activity

Adapted from Belza et al. [3], Pekmezi and Jennings [4], and Siddiqi et al. [5]

Table 7.2 Hispanics/Latinos' perceptions and attitudes toward physical activity

Physical activity is generally seen as a luxury and receives little attention in their personal agendas
Physical activity is not part of the cultural norm
Women are not expected to exercise; husbands discourage wives from exercising
Being overweight is associated with wealth, beauty, and motherhood
Self-efficacy—the ability to successfully perform—is important and may affect starting and maintaining physical activity
Multiple roles and responsibilities within the family (children, caregiver) are a priority and restrict time and availability for physical activity
Value caring for others, putting family and friends before themselves
Value the social aspect of programs and the need for support from family and friends to exercise
Not having a friend with whom to engage in routine exercise is an important barrier
Value community-based exercise programs or group activities
Socializing is viewed as important to avoid depression
The desire to be healthy for the family and anticipated physical and psychological benefits are a facilitator to physical activity
Being outdoors motivates physical activity. Walking, gardening, singing, dancing, and other types of family-oriented activities are among the preferred physical activities. Celebrations and music are valued

Adapted from: Belza et al. [3], Ickes and Sharma [6], and Larsen et al. [7]

Table 7.3 American Indians and Alaska Natives' perceptions and attitudes toward physical activity

History of oppression, poverty, and low self-esteem are associated with lower motivation for self-care, including physical activity
The high prevalence of chronic conditions such as diabetes has increased awareness of need to be active
Fear of falling is a barrier to physical activity
Approach health through traditional ceremonies
Strong cultural and community connections, which serve as very important motivators to engage in physical activity
Consider activities as caregivers to be a physical activity
Limited by geographic isolation and lack of access to transportation
Uncomfortable in fitness facilities where no older adults of similar background and identity are present

Adapted from Belza et al. [3] and Teufel-Shone et al. [8]

Studies also have shown that Hispanics/Latinos prefer physical activity programs strongly associated with community and social supports. Family-based interventions and the use of community resources to engage participants are seen as positive influences to achieve sustained physical activity programs. In addition, among older Hispanic women, planned walking groups offer the opportunity to gain new friendships which increase the likelihood of participation. Sports activities (bowling, basketball, and baseball) and associated social activities (church activities, clubs, voluntary organizations, and parties) have been more frequently reported by African Americans as their preferred type of physical activities.

Table 7.4 Chinese and Korean perceptions and attitudes toward physical activity

Chinese (Cantonese speaking)
Exercise is perceived as an essential component of health maintenance and is more important than taking medications
Believe that engaging in physical activity is associated with numerous positive outcomes
Believe that exercise, through activities such as yard work and indoor alternatives for bad weather conditions, promotes emotional and social benefits
Enjoy and value an early morning routine of stretching, arm swinging, tai chi, or a combination of these physical activities
Value social and family obligations such that social (having visitors) and family (caregiving) obligations can interfere with an exercise routine
Poor weather, such as in heavy snow, brings additional concerns: fear of falling and injuries
Korean
Believe that exercise provides numerous health benefits
Believe that health care providers may not recommend physical activity because of age or health conditions
Express feelings of isolation from other Koreans, even when surrounded by other Asian American groups in community activities

Adapted from: Belza et al. [3], Ceria-Ulep et al. [9], Coronado et al. [10], and Horne and Tierney [11]

Table 7.5 Filipinos' perceptions and attitudes toward physical activity

Acknowledge important role of community, socialization, and sense of happiness in engaging in physical activity
Older Filipinos prefer to exercise with peers to avoid feeling out of place when physical activities predominantly involve younger people
Exercise is perceived as important to counteract high-fat diets in the United States
Walking, stretching, practicing tai chi, and household chores are their most common physical activities
Believe tai chi is the ideal physical activity for older Filipinos because there are no sudden movements
Obligations with family and work may interfere with participation in physical activities
Fear of falling is a barrier to physical activity
Environmental and neighborhood safety factors act as inhibitors to physical activity including drastic fears of rape, robbery, kidnapping, or being the target of a terrorist

Adapted from: Belza et al. [3], Ceria-Ulep et al. [9], Coronado et al. [10], and Horne and Tierney [11]

Among American Indians and Alaska Natives, preferred physical activity programs include those that take a family-based approach, focus on improving the community, and use native community leaders.

Differences in the composition of ethnic minorities, methodological approaches, and changes in physical activity patterns over the past decades make the findings of the studies summarized above somewhat difficult to interpret. Thus there is an ongoing need for health care investigators to design physical activity interventions or programs that are likely to succeed with diverse groups of older adults [13].

Table 7.6 Vietnamese and Cambodian perceptions and attitudes toward physical activity

Vietnamese
Older adults strongly emphasize the importance of consistent daily exercise routine
Older Vietnamese believe the use of medications can be avoided if regular physical activity is maintained
Being afraid of early premature death is a motivator to engage in physical activity
Believe personal determination and willpower are needed to remain active
Geographic isolation is a barrier to physical activity: those living far away from friends or parks, walking trails, or other areas appropriate to physical exercise are less able to be physically active
Cold weather is a more problematic weather condition than rain, as cold weather is associated with "breathing difficulties"
Using indoor exercise equipment, walking inside shopping malls, and doing housework are acceptable ways of exercising
Cambodian
Cambodians are generally of small stature and believe that short stature conveys health, which serves as a barrier to physical activity
Sweating is thought to be a benefit from physical activity, with some believing that if one sweats considerably, toxins are released from the body and diseases removed
Believe that physical activity benefits many conditions and brings health and longevity
Social (seeing others exercising, having a supportive friend) and community engagement are important enablers to physical activity

Adapted from: Belza et al. [3], Ceria-Ulep et al. [9], Coronado et al. [10], and Horne and Tierney [11]

Table 7.7 South Asian perceptions and attitudes toward physical activity (Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Maldives, and Sri Lanka)

Prefer single-sex exercise classes with same sex instructor and culturally sensitive activities
Display collectivist attitudes in that taking time for oneself, such as exercising, runs against acting for the family and the wider community
Inability to understand English or being illiterate in their own language leads some to depend on family members for information
Inability to communicate can be a barrier to exercise
Unaware of the value and principles of preventive care
Peer mentors facilitating exercise opportunities may encourage exercise
Some feel it is inappropriate for women to be physically active
Women may feel uncomfortable walking unaccompanied outdoors
May think that health is shaped by fate or a higher force and thus disease cannot be prevented through regular physical activity
Believe doctors fail to alert them about health benefits or provide related relevant information when health is already compromised, thus less able to engage in physical exercise
Having recommendations from the doctor to exercise, monitoring outcomes, setting goals, and getting social and family support are motivators to start and sustain physical activity

Adapted from: Belza et al. [3], Ceria-Ulep et al. [9], Coronado et al. [10], and Horne and Tierney [11]

Physical Activity Interventions in Minority Older Adults

The vast majority of studies of physical activity interventions have been conducted on well-educated whites with a predominance of women. When racial and ethnic minorities are included, findings are rarely stratified or reported by race and ethnicity. Interventional studies targeting minorities have included African Americans, American Indians and Alaska Natives, and Hispanics/Latinos; very few have focused on Asian Americans. These studies are often inadequate for specific subgroup analyses due to limitations with sample size or methodology.

Interventions in Older African Americans

The increasing number of physical activity intervention studies in African Americans has been accompanied by improvements in quality such as more randomized controlled trials, larger sample sizes, use of self-reported measures with more evidence of validity, and addition of more objective assessment tools. Nevertheless, attrition remains a problem: studies with follow-up beyond 6 months regularly report attrition rates above 40 % [4].

Successful settings used for exercise interventions have involved community centers, churches, commercial gyms, worksites, and health centers or hospitals. Church-promoted physical activity programs appear to be an important venue for physical activity (see also Chap. 11). Churches are an attractive setting because many already include health-related services and programs suited for group activities, such as child care and evening classes. Church involvements vary between close partnerships to serving as intervention sites only. Close partnerships may include researchers training church members to better organize and deliver intervention programs. Other interventions promote active participation of researchers, pastors, and church board representatives in the design and implementation of the exercise program. Studies involving churches generally report significant gains in activity behaviors. Strategies reported to increase physical activity rates at follow-up include speaking with church members and having the pastor's support. Inclusion of holistic, spiritual, or religious beliefs in physical activity interventions appears to be a useful cultural approach to improve African Americans' participation in exercise programs.

Other efforts to tailor interventions for African American older adults have primarily focused on surface issues: matching intervention materials and messages to observed characteristics of the group. Fewer studies have directly compared culturally sensitive physical activity interventions, such as using African Americans as physical activity instructors or group leaders. Overall, a community-based participatory design may be the best approach to initiating and sustaining exercise programs among African Americans [14].

Interventions in Older Hispanics/Latinos

The number of physical activity interventions specifically targeting Hispanic/Latino older adults remains small, particularly for Hispanic men. As the US Spanish-speaking older adult population contains an enormous variety of cultures, from South American, Central American, Caribbean, African, and European regions, it is difficult to generalize from studies that may have focused on one group, such as Mexican Americans, or may not have identified the particular ethnic group under study.

The vast majority of physical activity interventions targeted to Hispanics/Latinos have been delivered in the community—in centers, parks, playgrounds, grocery stores, and schools—followed by family- and home-based, faith-based, and clinical settings. Increased social support is a strategic component in the majority of interventions. Activities have included walking groups, aerobic and dance exercises, and other types of structured activities. Cultural sensitivity is generally achieved through educational materials, use of bilingual instructors, and self-management strategies such as individual goal setting and problem solving [6].

While community-based physical activity interventions for middle-aged Hispanics/Latinos have improved physical activity rates, little is known about older Hispanics/Latinos. Most experts consider the involvement of community health workers to be an important element of community empowerment, to improve drop-out rates and understanding of educational messages. For Hispanics/Latinos, having social supports such as a friend who exercises is a strong motivator of physical activity. Other strategies using social supports take advantage of natural interactions occurring within families, specifically between Latino mothers and daughters, to improve physical activity.

Individually tailored programs seem to increase the likelihood of consistent participation, particularly when utilizing music, dance, and aerobic movement. These types of exercise are also perceived as enjoyable, safe, and low-cost methods to promote physical activity. One recent report suggests that physical activity interventions targeting Hispanics/Latinos should use Hispanic/Latino physicians or *promotoras* to deliver physical activity messages [7]. The manner in which information is delivered may affect uptake of physical activity among Hispanics/Latinos. Messages focusing on the potential gains or benefits of physical activity result in greater intention to exercise as compared to messages addressing the health consequences associated with being inactive.

A promising, emerging educational technology employs an *embodied conversational agent* (ECA), an interactive, animated computer character, to simulate face-to-face counseling [15]. The ECA uses simple speech, hand gestures, facial expressions, and other nonverbal behaviors to maximize comprehension. This communication strategy could match cultural norms and language to any minority group. Clinical trials are underway to test computer-based activity advice for Hispanic/Latino older adults.

Interventions in Older Asian Americans

Like the Hispanic/Latino minority group, Asian Americans comprise an enormously diverse group which limits generalizations from research findings. Surveys show that older Asians, in general, are the racial and ethnic group least likely to have sufficient physical activity levels. Low educational achievement, immigrant status, and South Asian origin seem to be predictors of decreased physical activity among Asian Americans [16, 17].

Information is quite limited regarding successful interventions to promote physical activity in older Asian Americans. Most studies have focused on individuals with chronic conditions, particularly diabetes. One such study of Pacific Islanders with diabetes, primarily older women, found that local acceptance was critical to success [18]. This intervention included an orientation session to improve self-management skills, a "graduation ceremony" for participants, and meetings every 6 months. Meetings functioned as an opportunity for participants to share their experiences. The intervention was delivered in a community health center for older adult care, which offered participants the opportunity to join other healthy lifestyle activities already in place at the center.

In developed countries, people of South Asian origin (Indian, Pakistani, Bangladeshi, and Sri Lankan) have markedly higher and earlier mortality and morbidity from heart disease and diabetes. Because they are the least physically active population compared to the general population, obesity is a growing concern. Therefore studies examining the effectiveness of physical activity and dietary interventions in South Asians are a priority, but results to date are limited in number and overall quality of methodology.

Interventions in Older American Indians and Alaska Natives

It is well documented that increased levels of physical activity among American Indians and Alaska Natives protect against cardiovascular diseases, diabetes, and related complications. Consequently, the number of health promotion interventions targeting these populations has increased considerably, with numerous programs containing a physical activity component combined with healthy diet education, family outreach, and disease-specific information [8]. Many intervention studies focus on individuals with a single disease. Most of the interventions targeted to this population group are led by nontribal research organizations or by partnerships between tribes and research organizations.

A few initiatives have been administered exclusively by a tribe, through a community-based program designed to increase physical activity and promote wellness across all age groups. In these programs, the youth is usually the most frequently targeted subgroup. An intergenerational approach that encourages

families to hold physical activities together is employed. Family physical activity events at schools or community centers, the creation of home teams, or inviting family members to attend exercise classes together are the most common strategies utilized. Programs may also use older adults as role models. These types of programs stress the benefits of lifelong activity, share stories that emphasize the relationship between Indian culture and physical activity, and teach traditional games.

With tribal leadership support for exercise promotion, intervention components can be culturally sensitive and adapted to local attitudes toward appropriate exercise behavior. To maximize the use of community resources, community members can be trained to lead exercise classes. Numerous interventions designed with this community-based participatory approach have been successful in increasing physical activity among American Indians and Alaska Natives, across broad age groups [19]. Thus effective and sustainable physical activity interventions for American Indians and Alaska Natives appear to depend upon tribal leadership and training of tribal members to assume leadership roles. Tribal-led interventions can highlight the community's unique culture to enhance acceptance of the intervention.

Recommendations for Health Care Professionals

Culturally sensitive interventions have shown mixed results as to their advantage compared to standard interventions; however, most studies are also limited due to low number of targeted participants, short length of follow-up, and other methodological problems. Certain ethnic groups, such as Asian Americans and Hispanic/Latino men, and rural American Indians and Alaska Natives are understudied while also at markedly increased risk for functional loss and diseases associated with lack of exercise.

When designing an intervention to increase physical activity for any population group, family and social support appear to be critical across racial and ethnic groups. A large variety of group settings for exercise programs appear acceptable to older African Americans, Hispanics, and American Indians and Alaska Natives. In contrast, individually targeted interventions allow personalization of recommendations on particular health issues and result in increased physical activity levels in the short term. Yet individually delivered exercise interventions may not produce as sustained benefits as group-delivered programs.

Fitness Deserts

As with food deserts, or areas with limited access to fresh products, fitness deserts also pose challenges to a population's health. While wealthy neighborhoods usually have green spaces and private facilities for exercise, low-income neighborhoods may not provide safe access to parks, walking trails, fitness or recreation facilities, or

transportation. The issue of safety is a particular concern in urban areas due to narrow sidewalks, aggressive drivers, and the potential for violence. For older adults, the situation is often compounded by mobility disability and environmental challenges. Fitness deserts pose a real health challenge to millions of people in the United States, particularly for low-income, underserved populations and disabled, minority adults.

The benefits of outdoor physical activity go beyond physical health to include social interactions in shared spaces for improved mental health. Advocacy is needed for better planning to ensure community-scale urban design and land policies that provide safe, sustainable environments for physical activity.

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Chapter 8
Exercises for Adults in Nursing Home and Assisted Living Facilities

Barbara Resnick

Key Points

- Institutional older adults, in skilled nursing and rehabilitation settings, both short and long stay, benefit from participation in effective exercise programs.
- Exercise is safe although modifications are necessary, for institutionalized older adults.
- Effective strategies can be employed to motivate older adults with different conditions and diseases, in these settings.
- Transforming the philosophy of care to include exercise is possible in institutional settings.

Introduction

Despite known efficacy for improving function and health outcomes in older adults, in many if not most institutional settings, effective exercise programs are rare. Exercise, as defined by the American College of Sports Medicine, is planned, structured, and repetitive bodily movement done to improve or maintain one or more physical fitness components. For most adults in institutional settings, the intensity and types of exercise will need to be modified. For example, aerobic conditioning requires that the intensity of the activity should range between 40 and 85 % of

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aerobic capacity. For older adults in group settings, cardiorespiratory endurance often can be improved by conditioning at an intensity level as low as 40 % of aerobic capacity or as few as 3,000 steps per day. Moderate intensity aerobic exercise is experienced subjectively as little or no discomfort and little increase in breathing. For the average adult, moderate intensity aerobic activity occurs when walking 100 steps in a minute. For older adults in institutional settings with multiple comorbid conditions, moderate aerobic activity may occur while walking to the bathroom. Thus, exercise for older adults can be subjectively defined by the individual: if it feels like exercise, then it is exercise.

In long-term care facilities, specifically nursing homes and assisted living communities, it has been repeatedly shown that increasing residents' participation in any type of exercise, at even low levels of intensity, results in improved gait, balance, and mood and fewer disruptive behaviors. In addition, residents that optimize their function and physical activity are less likely to be transferred to the emergency room for episodes of care associated with non-fall-related problems, such as infections. Thus, there is substantial support to encourage older individuals in institutional settings to spend more time engaged in physical activity and less time in bed or sitting.

Despite the evidence supporting exercise in these settings [1, 2], a persistent cycle may occur: deconditioning—existing prior to hospitalization or as a consequence of hospitalization, decreased function, contractures, and wheelchair dependence. Often in these settings, exercise and rehabilitation efforts are left to nursing staff, certified nursing assistants, or direct care workers.

Case Part 1
Beryl is an 80-year-old woman admitted to a long-term care facility for skilled rehabilitation after admission for fever and delirium related to influenza infection. Previously, she lived alone in her own apartment with assistance for personal care activities from a private nursing assistant. At home, she was able to ambulate approximately 100 feet in the apartment; beyond that point, she would stop because of fatigue. Beryl has been treated for several years for Parkinson's disease, mild dementia, diabetes, hypertension, and depression. Beryl recovered slowly in the hospital; she first walked in her room with assistance on the fourth and final day. In the nursing facility, she received physical and occupational therapy for several weeks. She made slow progress, was fearful of standing, and resisted ambulating, and therapy was discontinued. Now, Beryl is in a wheelchair most of the day.

Exercise for Older Institutionalized Adults

The prevention of functional decline, which reduces caregiving needs and improves quality of life, is critical for residents in long-term care. Being able to transfer with no or minimal assistance can facilitate the residents' ability to independently move

Box 8.1. Chair Sit-to-Stand
Start in a regular chair, sitting with your buttocks on the edge of the chair and your feet flat on the floor.
Lean forward—nose over toes.
Push with your legs and push your buttocks up. At the same time push down on the chair arms with your arms as counter leverage.
To sit down, bend at your hips and reach back with your buttocks leading the way.
Sit down slowly—do not drop down or fall backwards.
Start this at first by using your arms to help push you up but work towards the goal of doing this without using your hands or arms.

about his or her room or within the setting. It may also allow a resident to get outside in a garden area or visit a restaurant or family event. Further, prevention of contractures that often occur from sitting for long periods of time will reduce future pain. Engaging in even limited exercise activities, such as doing sit-to-stand exercises (Box 8.1), can greatly facilitate maintenance of function.

Aerobic, or endurance, training promotes optimal cardiovascular status by maintaining lung function and cardiac output. Strength training offsets the loss in muscle mass and strength that are commonly seen with aging and aggravated by disuse. Additional benefits from exercise include improved bone health, postural stability, and flexibility and range of motion (critical for bathing and dressing) and reduced fall risk and pain from degenerative joint disease. Most important, exercise gives institutionalized older adults an overall sense of psychological health and well-being. Conversely, sedentary behavior and lack of activity promote deconditioning, contractures, pain, pressure ulcers, falls, and exacerbations of chronic illnesses.

Risks and Benefits of Exercise

Although studies show that the benefits of regular exercise for institutionalized older adults are greater than the risks, institutionalized older adults are more likely to have both cardiovascular and musculoskeletal conditions that warrant exercise modifications and enhanced awareness on the part of staff. Despite a higher prevalence of cardiovascular conditions, institutionalized older adults do not require additional screening before engaging in moderate levels of exercise, beyond the admission history, physical examination, and usual assessments. In fact, there is a greater risk of exacerbation and worsening of cardiovascular disease from *not* exercising. However, those at greatest risk for cardiovascular events are individuals who previously have been sedentary. To minimize the risk of cardiovascular events, it is essential that previously sedentary individuals, which will include many individuals in group settings, begin with low- rather than moderate-intensity exercise and increase slowly. As noted, a subjective appraisal of what is moderate activity can be

Table 8.1 Warning signs for nursing assistants, activity staff, families and residents to recognize during exercise

Pale, clammy, cool skin
Change in cognition, such as new confusion or disorientation
Nausea or vomiting
Shortness of breath that does not resolve in 30 min
Chest pain
Dizziness
Unusual fatigue
Change in balance or unsteadiness

used to establish exercise intensity for most older adults. The Borg Rating of Perceived Exertion (RPE) scale (see Table 4.4) is a practical and easy method. The individual is asked to rate, on a scale of 6 (very, very light exercise exertion) to 20 (very, very hard exercise exertion), how they perceive their exercise activity. For older adults with cognitive impairment, caregivers should ask how hard the older adult thinks they are working verbally rather than ask them to assign a number to the level of intensity. An RPE score on the Borg measure that falls between 12 and 16 correlates with reaching 60–80 % of the targeted heart rate or a moderate intensity of exercise.

Using good clinical judgment during exercise is critical for assuring safety among older institutionalized adults. Table 8.1 lists the signs and symptoms staff should recognize and teach residents to be aware of and report, as potential danger signs during exercise. When these warning signs occur, exercise should be stopped and follow-up by the individual's health care provider arranged.

The greatest risk that staff and residents fear in association with exercise is a fall. While there is no evidence to support this fear, staff tend to encourage sedentary activity over exercise. Thus, for institutionalized older adults, it is particularly important to teach staff how to incorporate exercise activities that do not increase fall risks. For example, safe exercise equipment that individuals are not likely to fall off or trip over should be available. Appropriate supervision will be needed for individuals who may have balance impairment. Staff will also need to monitor individuals with cognitive impairment who may have little awareness of their functional abilities or who must adhere to a specific weight-bearing status.

In comparison with cardiovascular events, musculoskeletal complaints and injuries are much more likely to occur in older institutionalized adults. In general, older adults experience fewer musculoskeletal complications when exercising than younger individuals, although deconditioning may predispose to increased risk. Fortunately, these complications are generally minor and often can be prevented. In order to decrease the risk of injury, "starting low and going slow" is highly recommended. Likewise, monitoring for symptoms such as joint or muscle pain is critical, particularly for individuals with known joint conditions. Working up to but not to the point of pain, followed by rest, is advised. The majority of older adults, even those with cognitive impairment, are aware of discomfort or pain and will usually stop at this point. Some individuals may push beyond pain and require monitoring

and counseling. Important parameters to monitor are evidence of pain; incorrect positioning, which can cause trauma; and working beyond one's capability, such as inability to talk while exercising.

Obese individuals and those with underlying arthritis, particularly in weight-bearing joints, will tolerate low-impact exercise such as pool-based exercises, stationary cycling, or walking better than high-impact activities. Starting with activities that do not cause pain or injury and building up slowly will facilitate adherence as well as prevent injuries. Exercise should be avoided in acutely inflamed or injured joints, until pain has substantially resolved.

Environmental Safety Consideration

The physical environment and appropriate exercise equipment are important aspects of safe exercising for institutionalized older adults. Age-appropriate equipment ensures that the individual is able to use the equipment correctly and safely. Table 8.2 provides an overview of considerations when selecting equipment for older adults. However, currently, few long-term care settings have appropriate equipment available. There are a growing number of continuing care retirement communities and larger long-term care settings that do have exercise rooms that house age-appropriate devices. In addition, more facilities are including pools that allow for low-impact activities. Institutional settings can more easily provide open, flat, and clutter-free hallways with rails, for individuals to walk safely. The distances of facility hallways are often greater than those of the resident's prior home and thus can be used to significantly augment the amount of physical activity done by older institutional adults.

Weather, temperature, lighting, furniture, and clear open space influence exercise safety. Older adults are less able to adapt to heat and thus at risk for heat stress. During exercise, large amounts of heat are generated by active muscles. When it is hot and humid outside or when the inside environment is kept excessively warm, the older individual is less able to dissipate this heat. Unfortunately, older adults are both at greater risk for heat exhaustion and less likely to note prodromal symptoms. These symptoms include progressive weakness, fatigue, frontal headache, hypotension, tachycardia, and changes in cognition. Treatment of heat exhaustion requires cessation of exercise and rehydration. Obese individuals with multiple chronic illnesses and on multiple medications are particularly at risk for heat-related injuries. To reduce this risk, staff in institutional settings should determine when outdoor activity is safe and ensure that older residents wear loose clothing and maintain adequate hydration before and after exercising. Staff should avoid scheduling exercise activities in excessively warm or humid outside or inside conditions.

Environments that promote physical activity can reduce functional decline and enable people to achieve their highest level of function and well-being [3]. Designated exercise space may be limited or inaccessible in institutional settings. Hallways, common areas, and outdoor walkways are often available, yet seldom

Table 8.2 Safe exercise equipment for older adults

Key features	
Strength training equipment	User-friendly with nonintimidating appearance and function
	Lowest possible load or impact is available
	Non-obstructed entry and exit suitable for individuals with functional challenges and disability
	Clear, large-print instructions with diagrams
	Adjustable to various body sizes
	Able to change resistance levels when in a seated position
	Resistance levels that start low (less than 5 pounds) and increase at low increments such as 1 pound or less
	Range of motion adjustments that accommodate joint dysfunction or limitations due to joint replacements
	Easy adjustments to level of resistance for older adults with arthritis or stroke
Treadmills	Display panels with large buttons and letters that are easy to read
	Simple adjustment features that are easy for older adults to understand (e.g., up and down arrows to increase speed)
	Low starting speeds (e.g., 0.5 miles per hour)
	Clear, large-print instructions with diagrams
	Shock-absorbing decks
	Emergency backup with belt clip so that the treadmill shuts off automatically if the individual falls or stops moving
	Low motor housing so it is possible to view the older individual while on the treadmill
	Handrails, for those with balance problems
Steppers, recumbent bikes	Open shroud entrance and exit
	Control panel that is easily accessible and easy to read
	Minimal preprogrammed workouts
	Clear, accessible adjustment features for seats and armrests that are within easy reach while seated
	Wide and comfortable seats with arm rests
	Swivel seats for easy entrance and exit

promoted for physical activity. Planning of institutional environments focuses on safety rather than facilitating exercise and function. Case studies and direct observations of residential communities for older adults indicate that visibility of exercise-related areas, walkable spaces, clear open pathways, chairs that are the appropriate height for safe transferring by residents, and interesting walking destinations enhance exercise participation. Simple, cost-efficient modifications can improve exercise spaces, such as improved lighting, signs that specifically promote active living, and physical activity stations provided throughout the facility. Outdoor improvements include ensuring that sidewalks and stairs are safe and accessible, providing greenery and interesting destinations, and assuring adequate shade and seating so residents will feel comfortable outdoors.

In addition to consideration of the objective physical environment, the degree of *person-environment fit* (P-E fit) is critical to evaluate, especially as function declines. Adaptation, or P-E fit, occurs when there is a match between the person and the environment. Evidence suggests that individuals with lower function are particularly influenced by the P-E fit as they have to spend more energy overcoming and adapting to environments and consequently are unable to optimally engage in physical activity. In these instances, physical activity can be improved by lowering environmental demands through interventions such as altering the height of a bed or a chair to facilitate transfers.

The height of a bed is critical for safety and to facilitate independent transfers. A bed that is too low is difficult to rise from. Conversely, a bed that is too high is difficult to get back on and lift the legs up on. The firmness of the mattress will also make a difference. An old mattress or one that "gives" under body weight is difficult to get onto and provides no support when pushing up to stand. Seat height should not be greater than 120 % of lower leg length (LLL) or less that 80 % of LLL as this can impede safe transfer and result in falls. Measurement of LLL is done from the kneecap to the ankle. Caregivers may resist changes in bed height, as the optimum height for caregivers who are helping with personal care or nursing activities and the best height to optimize transfer ability of the older adult are usually different. Height-adjustable beds and chairs are ideal in group settings. Height-adjustable beds are also useful if one height is needed for getting out of bed and another for getting into it.

Exercise Prescriptions for Institutionalized Adults

Individual Approaches

Health care providers are particularly challenged to determine what type and how much exercise to prescribe for older adults in institutional settings, where individual variation is the rule and deconditioning is rampant. While there are excellent resources for exercise activities for older adults, such as from the National Institute on Aging (see Resources), these exercise activities cannot generally be done independently by residents in long-term care settings. An effective method to engage older institutionalized adults in exercise activities is to incorporate exercise into daily life and activities, such as by adopting a *function-focused care* approach. Function-focused care is a philosophy of care that first evaluates the older adult's underlying capability with regard to function and physical activity [4]. Then a plan is created to maintain abilities and continually increase time spent in physical activities. This philosophy of care is in contrast to routine long-term care approaches in which daily tasks are done by caregivers to ensure the individual is safe, well groomed, and dressed. Examples of function-focused care interactions include verbal cues during bathing, so the older individual performs the tasks rather than the direct care worker bathing the individual, asking the resident to walk to the bathroom rather than use a urinal, and accompanying a resident to an exercise class.

Incorporating a function-focused care approach for an institutionalized older adult requires an individualized approach. Unfortunately, there is a tendency when working with older adults to assume that the person is unable to perform a given activity (bathing, dressing, transferring), that an exercise class will be too tiring or dangerous, or that it will be easier to move the individual to the dining room or bathroom using a wheelchair. Thus, caregivers tend to perform the activity as quickly as possible. This approach propagates deconditioning and disability. Conversely, individuals need to be evaluated to determine if they have an underlying capability to perform the task: independently, with the assistance of another individual, or at the lowest level with hand-over-hand assistance (the caregiver performs the activity but moves the individual's arms through the motions, as in eating). This determination will allow caregivers to establish appropriate exercise or physical activity goals.

The *physical capability assessment* form is a simple method to identify the basic abilities of an older institutionalized resident and a critical first step to developing exercise goals. The basic elements of the physical capability assessment are shown in Table 8.3 and consist of simple functional tasks: one-, two-, or three-step commands; upper and lower extremity range of motion; transfers and bear weight on lower extremities; and standing balance. Based on this assessment, and input from other members of the health care team, both functional and physical activity goals should be developed (Table 8.4). For example, if the individual has full range of motion and is able to follow at least a one-step command, he or she should be performing bathing and dressing with verbal cues as needed.

Table 8.3 Elements of the physical capability scale

Element	Test	Points
Range of motion	Upper extremity	
	Shoulder abduction	0–1
	Shoulder external	0–1
	Shoulder internal	0–1
	Lower extremity	
	Ankle flexion	0–1
	Ankle extension	0–1
	Knee	0–1
March while seated		0–1
Chair rise (chair sit-to-stand)	Stand from seated position	0–3
Follows commands	Single-step verbal	0–1
	Double-step verbal	0–1
	Triple-step verbal	0–1
	Single-step visual	0–1
	Double-step visual	0–1
	Triple-step visual	0–1
Total possible		16 (=highest function)

Adapted from Resnick et al. [5]

Table 8.4 Goal attainment scale guide
PATIENT NAME: _____
GOAL SETTER(S): _____
Goal-setting Date:_____ Follow-up date: _____
Goal Attainment Score (Range −2 to +2; Expected 0)

Level of predicted attainment	Goal 1	Goal 2	Goal 3	Goal 4
Much Less Than expected −2				
Somewhat Less Than expected −1				
Expected 0				
Somewhat More Than expected +1				
Much More Than expected +2				

Case Part 2
After Beryl was discharged from therapy, she remained at the nursing home, as she now needed 24-h personal assistance. Beryl scored 7 out of 16 on the physical capability assessment. She had decreased range of motion in her upper extremities bilaterally. In the lower extremities, she had full range of motion at the ankle and knee and was able to march in place when sitting. She could not independently come to stand. With the assistance of one individual and verbal cues, she could come to stand and stand for 1 min. She was able to follow a single one-step command both verbally and visually. With this information, a specific exercise program and goals were established for Beryl and incorporated into her care plan.

As Beryl could come to a stand with assistance, her first goal was to do three sit-to-stand exercises with every toilet transfer, or at least three times a day. This was increased to do five sit-to-stand exercises (Box 8.1), after she could tolerate three. The goal form was reevaluated monthly. With time, she was able to stand for longer periods and ambulate short distances. Her next goals were walking three times a day, for a distance of approximately 20 feet, and chair-based group exercise activities offered in the facility.

Group Activities

Despite the benefits to engaging institutionalized older adults in exercise, initiating and continuing daily exercise programs remain an enormous challenge. There are many ways to incorporate group exercise into institutional settings that are low cost and appropriate for all residents. Example activities may be viewed in Video 8.1.

Ten-minute spurts of exercise, done three times a day, can help residents and staff attain the minimum recommendations for physical activity, for all adults. Dance is a terrific way to incorporate group exercise. Set aside 10-min periods for putting on fun dance tunes consistent with the cultural preferences of your residents, and dance away to the music. Generally three to four songs will achieve the goal of 10 min. To increase interest, have a dance competition: whoever dances the longest wins. Those who are unable to stand can march their feet and swing their arms. Those that need supervision can dance with a staff member.

Walking can be another entertaining group activity. Help residents to set daily walking or self-propelling goals and map out 10-min walks within your site. Staff can set a specific destination, such as going for a cup of coffee or to see a garden beyond a window. Another activity is playing musical chairs. Put on some oldies music and have the residents walk or self-propel around a circle of chairs and sit when the music stops.

For residents who enjoyed caring for their homes, cleaning their rooms is an option. Give these residents the supplies and help them to start dusting and sweeping, clearing the dining room tables, or setting tables for the next meal. Incorporating an "it is never too late to play" philosophy, add horseshoes, croquet, flyswatter badminton, shuffleboard, and beanbag tosses to daily group activities within institutional settings.

For success, potential barriers to engaging residents in exercise activities must be recognized and addressed. These include comorbid conditions, fear of injury on the part of the resident as well as providers, lack of suitable space and equipment, and lack of knowledge about exercise options on the part of the staff, residents, and families. In addition, there may be cognitive and motivational challenges.

Cognitive and Behavioral Problems

As many as 90 % of older adults in long-term care facilities have some cognitive impairment with associated symptoms of aphasia, motor apraxia, perceptual impairments, and apathy. These conditions complicate attempts to encourage institutionalized older adults to engage in functional activities and exercise. Further, some individuals may have behavioral symptoms such as verbal or physical aggression or resistance to care. Challenged by agitated or uncooperative behaviors of cognitively impaired residents, caregivers may focus on maintaining behavioral stability rather than engaging them in functional and physical activities. This approach reinforces sedentary activity and a "just get it done" approach to personal care, in which the caregiver completes the functional task rather than supporting the resident to do so. Motivational "tricks of the trade" for caregivers are available on the Function Focused Care webpage (www.functionfocusedcare.org). This webpage houses six, 3-min video coaching sessions that demonstrate how to engage residents in exercise and functional activity in challenging situations. Written resources and ideas for exercise activities appropriate for institutionalized older adults are also available at this site. Additional examples include encouraging your residents to walk to the hair

salon; putting out small weights, foam balls, or elastic exercise bands in the dining room to spark residents or staff interest in spontaneous exercise; and developing a "function over fashion!" philosophy to your environments, by placing an exercycle, safe for older adults, in the dining area.

Motivation to Exercise

Along with cognitive and behavioral challenges, underlying motivation of the individual to exercise needs to be considered [6, 7]. Figure 8.1 provides an overview of the many factors that can positively influence motivation to engage in exercise. Helping older adults as well as their caregivers to believe in the benefits of exercise is an important first step. Encouraging activities in which the individual will be successful and that will not cause discomfort or injury is important. Physical discomfort associated with exercise should be eliminated through modifications of activities and pretreatments (e.g., heat, acetaminophen, stretching). For example, stretching exercises will decrease the discomfort associated with disuse and long periods of sitting. Example activities may be viewed in Video 8.2.

Social supports and encouragement provided by others are important sources of motivation for older institutionalized adults. This encouragement should come from health care providers, families, and others who interact with the resident. Ongoing verbal encouragement to exercise, walk, go to an exercise class, or simply perform transfers is important. Even when residents refuse, often related to lack of self-efficacy, encouragement to engage in exercise should continue. This can improve self-efficacy and underscore the importance of exercise, an activity as critical as taking one's medications, which receives substantial, repeated emphasis in institutional settings.

Fig. 8.1 Factors that influence motivation to exercise in older adults

While eliminating any unpleasant sensations associated with exercise is essential, it is equally important to ensure that exercise is a pleasant experience. New and varied types of activities can engage individuals in exercise. For example, a new dance program, an evening prom, and "a walk across America" are ways to stimulate interest and enjoyment. Introducing lively music to group sit-to-stand exercises before mealtimes can add pleasure to this task.

To motivate older adults to exercise, individualized goals that take into consideration underlying physical and cognitive capability and resident preferences are needed. Getting to know the individual and what types of exercise or work she did when younger will provide useful information to support motivation. For example, an older, retired nurse may be willing to walk the ward with you to make rounds. A retired television repair man or mailman may find interest in delivering televisions or the mail for you. Many older adults enjoy interacting with animals; a small study of assisted living residents demonstrated both increased gait speed and adherence to continued exercise when they were paired with a dog, from a local shelter, vs. a human walking companion. (See also Video 4.4, Pet Therapy Exercise Class.)

Case Part 3
After 6 months, Beryl was able to walk more than 100 feet at a time, without fatigue, and get out of a chair without assistance. She particularly enjoyed group sessions in the exercise room on a stationary bicycle, set at the lowest resistance, where the group was led on a different "trip" each day, and group relaxation/stretching sessions. She remarked "I feel stronger than before I had the flu!" She returned to her apartment with personal assistance several hours daily, a home exercise plan for good and bad weather days, and commitment to obtain annual influenza immunization.

Conclusion

The benefits of exercise for older institutionalized adults outweigh the associated risks. For each individual, the amount and intensity of exercise will vary and can be subjectively determined. What is perceived as a moderate level of aerobic activity by an institutionalized older adult will be very different than that perceived as moderate intensity for younger individuals or healthy older adults. Individualized assessments to evaluate the resident's physical and cognitive abilities are important first steps in developing a suitable exercise plan. In addition, motivational techniques must be considered to ensure that the individual will engage in activities.

Implementing an innovative approach that focuses on optimizing function and physical activity of older institutionalized adults rather than task completion is challenging. This approach requires a team and significant institutional commitment.

Without question, exercise is the best "medicine" for institutionalized older adults and thus requires equal attention. Establishing individualized exercise goals that are incorporated into daily life will promote attainment of the highest level of health and function for older institutionalized adults.

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Resources

Function Focused Care. www.functionfocusedcare.org.

National Institute of Aging, Exercise & Physical Activity. Your Everyday Guide from the National Institute on Aging. http://www.nia.nih.gov/health/publication/exercise-physical-activity/introduction.

Rate of Pereived Exertion, Borg scale. https://www.acsm.org/docs/current-comments/perceive-dexertion.pdf.

Chapter 9
Exercise for Hospitalized Older Adults

Gail M. Sullivan

Key Points

- Older adults are at high risk for deconditioning as a result of bed rest during hospitalization.
- Deconditioning results in loss of function and discharge to higher levels of care, such as a nursing home, even after short or elective hospital stays.
- Older adults can participate in walking, resistance exercises, and early rehabilitation programs without increasing adverse events during acute hospitalization.
- Geriatric acute hospital units using comprehensive geriatric assessment, multidisciplinary teams, and interventions targeted to preserving function and mobility have the strongest evidence for reducing decline.
- Older adults for whom exercise may present significant risk or for whom exercise is not possible may benefit from passive range of motion and changes in position.
- System-wide interventions, such as changing the default activity order to out of bed, are recommended by experts yet require more study.

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Introduction

Since the time of Hippocrates, clinicians have observed that prolonged immobility results in loss of muscle strength and function. These losses are particularly likely to occur in older adults, who also constitute a disproportionate number of hospital admissions. Many clinicians have trained in care systems in which it is assumed without question that most older adults admitted for elective or emergent reasons will require a subsequent rehabilitation or nursing home stay to regain their baseline function. Yet studies show that interventions can break this cycle of immobility, loss of strength, loss of function, and discharge to higher care settings.

Barriers to implementation of these interventions include: fear of harming the older adult, myth that exercise will interfere with healing, nursing and rehabilitation resources targeted to keeping the patient in bed or wheelchair, and staff lacking training. All of these are amenable to education. This chapter will discuss the consequences of immobility and interventions that are effective for older hospitalized adults.

Case Part 1
Lavern is an 82-year-old woman hospitalized after a few days' illness at home with fever, cough, and probable pneumonia. She is admitted to the general medical ward and treated with IV fluids, antibiotics, acetaminophen, and oxygen by nasal cannula. After 24 h, she is able to sit up in bed, talk a little, and eat 25–50 % of her meals. Without her oxygen, she maintains adequate saturation and her oxygen is discontinued. She has a 5 cm red area on her sacrum, new since admission, which the nurse rates as a stage 1 pressure ulcer.

Prior to admission, Lavern was living on her own, with help from her family for groceries and transportation. She did not engage in specific exercise but was able to walk 100 feet to get her mail every day without an assistive device.

The standard protocol for this unit is for all previously ambulatory patients to undergo brief functional assessment and walk 2 to 3 times daily with a trained escort or family member. Lavern's daughter requests that her mother remain in bed, use a bedpan or commode, and be allowed to rest to speed her recovery and avoid falls.

Prevalence and Consequences of Immobility in the Acute Hospital

In the USA, just under half of all adults admitted to the hospital are 65 years or older. Although individuals 65 years and older were 13 % of the US population in 2008, they generated 35 % of all hospital discharges [1]. These numbers become

Table 9.1 Consequences of immobility

System	Complication
Function	Decline in functional status from baseline
Musculoskeletal	Bone loss
	Muscle loss
	Contractures
	Decreased balance
	Fatigue, sense of exhaustion
Skin	Pressure ulcer
Cardiovascular	Orthostatic hypotension
	Decrease in cardiac output
	Deep vein thrombosis
Respiratory	Atelectasis
	Aspiration pneumonia
	Pulmonary embolus
Gastrointestinal	Constipation
Genitourinary	Urinary incontinence

more pronounced with older cohorts. For example, in 2008, adults 85 and older comprised 1.8 % of the population and 8.0 % of all discharges [1]. The proportion of individuals transferred to long-term care after hospitalization also rises greatly with older cohorts, with 44 % of those 85 years and older going to rehabilitation or nursing home sites of care rather than home after hospitalization [1]. Some of these transitions are due to shortening of hospital length of stays; in 2008, the average length of stay for older adults was 5.5 days, which is longer than the average length of stay for younger adults but shorter than hospital stays in the past [1]. However, functional loss, from immobility during hospitalization, also plays a role.

Immobility during hospitalization adversely affects many organ systems (Table 9.1), with a net result of overall functional loss. For older adults, deconditioning and functional loss begin by day 2 of hospitalization; thus prevention protocols must start at or soon after hospital admission [2, 3]. Studies reveal that declines from baseline function in mobility and self-care are common, whereas early orders for out-of-bed status, physical therapy, or bedside exercises are infrequent [4]. Although bed rest is usually ordered for older hospitalized patients, chart reviews find no medical reason for bed rest in a majority of instances [5].

For those with preexisting functional or cognitive impairments, hospitalization presents additional challenges to maintaining independence and returning home. Older adults using assistive devices such as canes or walkers are more likely to have functional decline during hospitalization than those who do not. It is possible that the need for a device, not readily available on medical or surgical floors, presents a significant barrier to mobility. In addition, nursing staff with less experience with

assistive devices may be hesitant to attempt transfers or walking with these patients and may delay orders for out-of-bed status until a physical therapist is available to work with the patient.

Older adults with dementia are more likely to experience substantial loss in instrumental of activities of daily living (IADL) and activities of daily living (ADL) during hospitalization. Regaining lost abilities is related to the severity of cognitive impairment. In addition, dementia is a major independent risk factor for acquiring delirium, or acute confusional state, during hospital admission. Delirium presents a critical obstacle to treating the index illness as well as maintaining mobility and function [6].

Studies of hospitalized older adults find that those who lose IADL and ADL function during a short hospitalization may not recover lost function even after 3 to 6 months of rehabilitation [4]. For some, continued functional decline is likely due to underlying medical conditions. For others, recovery is dependent upon rehabilitation efforts, which vary greatly. For individuals who are unable to tolerate 3 h/day of formal therapy, the home or skilled nursing facility are the usual sites for posthospital rehabilitation rather than a rehabilitation hospital. In the home or skilled nursing facility, older adults usually participate in a single exercise session from a few times weekly to daily. Particularly in institutional settings, staff may perform IADLs and ADLs for the older adult, to save time and reduce fall risk, which perpetuates continued decline in function (see Chap. 8).

Assessing Function in Hospitalized Older Adults

Fortunately, studies demonstrate that interventions can minimize hospital-associated functional decline [7]. A variety of approaches have shown benefit; most of these approaches start with an assessment of the older adult's preadmission function and risks for functional loss. Independent risk factors for hospital functional loss and nursing home placement include increasing age, low preadmission cognitive status, and low baseline IADL status; thus these factors should be part of an intake assessment for older adults.

Although several instruments are available to assess physical performance in hospitalized older adults, none is considered ideal for all individuals or settings. Because it does not require extensive training, equipment, or time, the *Elderly Mobility Scale* is particularly useful for measuring physical function in hospitalized ill older adults (Table 9.2) [8]. The scale has been examined in different settings and has good validity and reliability evidence. Key advantages of this scale are its simplicity and brevity: it requires 5–10 min to administer. Another instrument used in hospitals is the *Hierarchical Assessment of Balance and Mobility* (HABAM) scale, which rates balance (6 possible levels), transfers (8 levels), and mobility (14 levels) [9]. With this additional specificity, the HABAM instrument requires more time and training to use.

Table 9.2 Elderly mobility scale

Task	Score					Score range
	4	3	2	1	0	
Lying to sitting			Independent	Help of 1 person	Help of ≥2 persons	0–2
Sitting to lying			Independent	Help of 1 person	Help of ≥2 persons	0–2
Sitting to standing		Independent ≤3 seconds	Independent >3 seconds	Help of 1 person	Help of ≥2 persons	0–3
Standing		Stands without support and able to reach	Stands without support but needs support to reach	Stands but needs support	Stands with help of another person	0–3
Gait		Independent with or without cane	Independent with walker	Mobile with walking aid but unsafe	Needs physical help or constant supervision to walk	0–3
Timed walk (6 m)		<15 s	16–30 s	>30 s	Unable to walk 6 m	0–3
Functional reach (see Chap. 4)	>20 cm		10–20 cm		<10 cm	0–4
Total						0–20
Interpretation						
Score <10		Generally requires high level of assistance				
Score 10–14		Borderline, will need help at home				
Score >14		Generally able to return home				

Adapted from multiple sources including: Prosser L, Canby A. Further validation of EMS for measurement of mobility of hospitalised elderly people. Clinical Rehabilitation 1997;11(4):338–343; Yu MSU, Chan CCH, Tsim RKM. Usefulness of the Elderly Mobility Scale for classifying residential placements. Clinical Rehabilitation 2007; 21: 11141120; and http://www.csp.org.uk/sites/files/csp/secure/agile_outcome_measures_ems_v2. Accessed 12/12/14

Safety of Exercise in the Acute Hospital Setting

To date studies, including pooled data in meta-analyses, have shown no increase in adverse effects, such as falls, injuries, or infections, in older adults engaged in hospital exercise programs [10–12]. No increase in adverse consequences is seen even with high-intensity resistance exercises performed in bed when compared with passive range of motion [13]. In fact, some programs show decreased hospital length of stay and decreased fall risk in the active intervention groups.

Studies have typically excluded older adults with unstable medical conditions as well as those in the intensive care unit (ICU) or receiving palliative care. Some programs exclude older adults who were not ambulatory prior to admission or who have been admitted from a nursing home. Other individuals who need additional review prior to entering a standard hospital mobility program are listed in Table 9.3.

Table 9.3 Older adults to exclude from standard approaches

Head trauma
Spinal trauma
Significant lower extremity trauma
Hypotension
Symptomatic tachyarrhythmias
Active bleeding
Unstable respiratory system

Physical impairment, whether due to deconditioning or to acquiring the motor neuropathy syndrome known as *ICU-acquired weakness*, is common in adults who survive an ICU stay. Although few in number, randomized controlled studies of rehabilitation in the ICU setting demonstrate the feasibility and safety of physical therapy to improve immediate and long-term function [14, 15]. In this setting, range of motion and bed mobility exercises are often initiated first. For selected patients, sitting exercise, transfers from bed to chair, resistance exercises, and ambulation are employed. Programs have successfully integrated reduced use of heavy sedation with physical and occupational therapy starting within 72 h after intubation. Study results suggest benefits such as shorter ICU stays, earlier return to walking status, and greater likelihood of regaining baseline function.

Case Part 2
The physician, nurse, and physical therapist caring for Lavern meet briefly with Lavern and her daughter. They ask Lavern about her goals on leaving the hospital and about her daughter's concerns. Lavern strongly wishes to return home rather than go to a short-term rehabilitation facility or nursing home. Lavern's daughter is afraid that exercise right now may cause her mother to relapse and also risks a fall; she sees how shaky her mother is just sitting up in bed. The clinical team presents the risks of immobility in older hospitalized adults and strategies to prevent these consequences. Lavern slowly walks four feet to the bathroom with the physical therapist. Although fatigued, she is game to try again later.

Preventing Functional Decline with Geriatric Units and Teams

Traditionally hospitals have focused on treating the acute illness or surgical procedure rather than considering the hazards of hospitalization for older adults. Thus clinicians and staff focus on the principle reason for hospitalization—the pneumonia, fracture, myocardial infarction, or cholecystectomy—rather than overall function and independence, which primarily determines quality of life for older adults. Hospital administrators place considerable attention on the most efficient, rapid method to deliver care. Protocols may emphasize prevention of injuries, such as

falls, rather than avoiding discharge to higher levels of care. The easiest way to avoid a fall or injury is to not permit mobility; thus many hospital policies actually promote muscle loss, decreased mobility, and loss of function.

Hospital geriatric teams and geriatric geographic units that employ geriatric assessment and individualized patient treatment plans have been extensively studied since the 1980s. Many studies have used rigorous study designs, with more than 22 randomized controlled trials, but have variable target patient groups, assessment instruments, interventions, and outcomes. Despite this heterogeneity, several meta-analyses have found that hospital-based geriatric units and teams are associated with improved function, mortality rates, and likelihood of returning home and reduced likelihood of living in an institution [10, 12]. The number of older patients needed to treat (NNT) for the outcomes of survival and returning home ranges from 17 (home at 6 months after hospitalization) to 33 (home at 12 months after hospitalization) in comparison with usual medical care [10]. Benefits in reduced hospital costs are also seen; studies have not analyzed savings from fewer nursing home stays, which would further decrease costs.

In subgroup analyses comparing teams and geographic units, Ellis and colleagues found that the specialized geriatric units were more effective than mobile geriatric teams, which have variable outcomes [10]. Only 13 (follow-up at 6 months) or 20 (12 months) older adults need to be treated in a geographic geriatric unit to prevent one person from dying or living in an institution [10]. Also, benefits are seen whether admission to the geriatric unit is based solely on age, such as 75 years and older; particular conditions, such as delirium or falls; or perceived needs, such as functional impairment or risk for institutionalization. Thus comprehensive assessment delivered through a dedicated multidisciplinary team working in a geographically distinct unit improves an older adult's chance to survive hospitalization and return home.

One example of a specialized geriatrics unit is the *Acute Care of the Elderly* or ACE unit. These programs use geriatric assessment and multidisciplinary teams to deliver acute medical care while targeting interventions to maintain function. ACE units encourage patients to participate in ADLs and promote daily exercise, such as walking in hallways. Multidisciplinary teams conduct daily rounds that focus on function as well as medical concerns. Also, the environment of an ACE unit is designed to enhance mobility: handrails in unobstructed hallways, elevated toilets for easier transfer, and exercise space integrated into the unit.

Additional Hospital-Based Strategies

NICHE

Started in 1990, *Nurses Improving Care of Healthsystem Elders* (NICHE) is a national program to promote high-quality, evidence-based care of older adults. The project has developed and disseminated assessment tools, best practices, and

educational materials for nurses. The most common NICHE strategy for improving the care of hospitalized older adults is the resource nurse model. In this strategy, assigned unit-based nurses acquire expertise in geriatrics best practices and disseminate information and skills to other nurses on the unit. Although this practical model makes sense, it is a more dilute intervention than the mobile geriatrics team and geographic geriatrics unit, and studies to date have not demonstrated consistent functional benefits.

Hospital Environments

Typically, hospital hallways have not been designed for patient ambulation but rather to move beds, equipment, and people as efficiently as possible. Similarly, rooms have not been arranged to facilitate walking to the bathroom or to a chair. IV poles, urinary catheters, and other devices tether patients in place. Bedrails, bed heights left elevated, and a multitude of equipment clutter the average room and environs. Areas suitable for safe walking can be created by adding nonglare lighting, railings, markers for distances walked, and periodic seating for rest stops. In addition, appropriate assistive devices, such as adjustable canes or walkers, can be available on units and patients trained in their use early in the hospital stay, not just on the day of discharge. Patients also need gowns that do not gap open, such as opposing johnny gowns, and nonslip footwear to facilitate mobility.

Standardized Protocols or Order Sets

Orthopedics research has found that early mobilization programs—out of bed or walking on day of surgery—significantly reduces length of stay and improves joint function after hip or knee surgery, without increasing adverse outcomes and with retained patient satisfaction [16]. Borrowing in part from these studies, hospitals have initiated walking programs for older adults.

Walking for Wellness [17] and *Project Move* [18] are examples of hospital-based programs that provide an overall framework for all older patients. These programs automatically provide a shared initial assessment, patient education, and mobility plans used across a hospital. Some of these programs have demonstrated reduced complications from immobility as well as sustainability as a system-wide intervention. Trained escorts, family members, nurses, and physical therapists are used in these programs. Clarity, ease of operation, and consistency of implementation are essential elements of hospital-wide projects.

Another hospital-wide strategy is to eliminate “bed rest” as a default admission order. When bed rest is ordered as an add-on order, an explanation must be given by the ordering clinician. Analogous to restraint orders, bed rest orders can be allowed for only a short duration before expiration, such as 24 h, and must be reordered to be continued.

This strategy has also been used in some ICU settings, in which the computerized order entry system no longer lists bed rest as the default activity level but does list physical and occupational therapist consultation, in automatically generated admission orders.

Ongoing hospital-wide education regarding the importance of patients continuing to perform self-care activities, sitting out of bed, and early mobilization is also recommended by experts. See Tables 9.4 and 9.5 for descriptions of hospital-based exercise interventions and approaches.

Table 9.4 Hospital interventions for older adults

Type	Interventions	Outcomes
Geographic geriatrics unit	Comprehensive geriatric assessment Dedicated geriatrics team Daily discussion of function Protocols for geriatric conditions Enhanced environments	Reduced discharge to higher levels of care Better function Reduced mortality Better cognitive status at discharge Reduced costs, length of stay
Mobile geriatrics team	Comprehensive geriatric assessment Geriatrics consult team Recommendations focused on geriatric conditions and function	Variable
Unit-based nurse resource	Nurse with enhanced knowledge and experience in geriatrics best practices Educational materials such as assessments targeting common geriatrics conditions	Few studies: little differences
Early physical rehabilitation	Multidisciplinary programs with exercise component or usual care with exercise program Exercise 5 times/week, up to 2 times daily, with focus on strength, mobility, and balance	Variable: most studies show improved physical function tests and some show reduced discharge to nursing home No increase in injuries, falls, or adverse events Most patients adhere to program
Walking programs	*Walking for Wellness* [17]: trained escorts (from transportation staff) supervise patients' daily walking in hallways 2–3 times/day, patient brochures and short video, family education, walking aids such as canes and walkers, walking goals and walking record	High acceptance by patients High patient and family satisfaction Average 2 walks/day
	Project Move [18]: enhanced clarity of nurse and physical therapist roles, staff education, patient function included in nurse assessments and change-of-shift reports, stickers for patients "Ask Me if I Walked Today" and educational brochures for families, default order changed to "out of bed with progressive activity as tolerated," specific patient activity schedule	Physical therapy (PT) and occupational therapy (OT) perceived improved appropriateness of consults No increase in total PT or OT consults Decrease in pneumonia and pulmonary complications vs. prior 4 years Patients and families found program acceptable

Table 9.5 Components of hospital-wide approaches

Patient baseline and current function assessed on admission and daily
Functional information shared among clinical staff, including nurses, physical therapists, and physicians, such as during handovers and interdisciplinary discharge rounds
Eliminate bed rest orders as the default order; the default order is out of bed daily and walk each shift
Involve patients and family members in exercise activities
Assistive mobility devices available on admission
Ongoing monitoring of the environment's role in encouraging exercise activities, such as walking
Ongoing tracking and reporting of statistics measuring patients requiring higher level of care environments at discharge, as compared with before admission
Ongoing clinical staff education about the hazards of immobility

Case Part 3
By the fourth day of hospitalization, Lavern is able to walk 20 feet with an assistive device and can get to the bathroom in her room on her own. The red area on her sacrum has reduced in size. She is discharged home with physical therapy services for home rehabilitation.

Conclusion

Older adults are at particularly high risk for consequences of immobility due to hospitalization. Feared yet common outcomes are loss of physical function, mobility, and discharge to a higher level of care rather than home. Older age and prior cognitive and IADL impairments are associated with greater risk for these outcomes. Traditionally, hospitals have focused on the acute illness more than the hazards of hospitalization experienced by older patients. Yet research in the hospital setting reveals opportunities to prevent deconditioning and loss of function.

The most valuable intervention appears to be the geographic, multidisciplinary geriatrics unit, which may also reduce hospital costs. However, simple walking programs with trained escorts or family members can increase amount of time walking and out of bed greatly and are acceptable to patients and families. Similarly, order sets that default to "out-of-bed" activity status will greatly reduce the time in bed. Although many clinicians accept the cycle of hospitalization, muscle weakness, functional loss, nursing home stay, and rehospitalization as inevitable and indeed this may be true for older adults at highest risks of decline, greater adoption of hospital "best practices" such as ACE units could break this cycle for many hospitalized older adults.

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Nurses Improving Care for Healthsystem Elders (NICHE) Try This® series of assessment tools, http://hartfordign.org/practice/try_this/ For reducing hospital functional decline, http://consultgerirn.org/uploads/File/trythis/try_this_31.pdf. Accessed 9 Dec 2014.

Chapter 10
Frailty and Older Adults

Ellen Binder

Key Points

- Frailty is a clinical syndrome that increases in prevalence with increasing age.
- Frailty is strongly associated with poor outcomes for older adults: functional loss, falls, hospitalization, and death.
- Screening tools, developed for research, may be adaptable for clinical settings.
- Frailty can be treated with exercise and thus may be reversible, if recognized.

Case Part 1
Max is an 80-year-old man living alone at home. Previously vigorous and independent, in the last year his wife died, and he fell, fractured his left femur, and underwent a hemiarthroplasty procedure. After surgery, he was transferred to a skilled nursing facility (SNF) for rehabilitation. He received physical and occupational therapy and has been discharged home after a 3-week stay. He has lost 12 lbs. (8 % of his body weight) in the past year and reports that he is more easily fatigued. He walks slowly, at 0.6 m/s, and appears unsteady without his walker. His exam shows overall loss of muscle mass, with greater loss in his left leg, and 1+ ankle edema, but is otherwise unremarkable. Max tells you that he wants to be able to play golf and will do whatever it takes to get back to where he was a year ago.

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The Importance of Frailty

Most clinicians who work with older adults have an intuitive understanding of what a frail person looks like (referred to as the "phenotype" of frailty). They envision someone who is slow-moving, unsteady, and easily exhausted or overwhelmed by daily activities. Despite our familiarity with this type of individual, the fields of geriatrics and gerontology have struggled to reach a consensus regarding an operational definition of frailty and related clinical screening tools. Frailty has been conceptualized as an age-associated medical syndrome or clinical state, characterized by decreases in an individual's functional reserve and resistance to physiological and psychological stressors [1].

The frailty syndrome encompasses physiological changes related to aging, lifestyle, chronic diseases and related treatments, and the interaction among all these factors. Frailty is distinguished from multi-morbidity, which focuses more on specific diseases and related management, and disability, which is a potential consequence of frailty [2]. It is important for clinicians to recognize frailty as a clinical syndrome because frail older adults are at high risk for poor outcomes, including disability, falls, hospitalization, and death. Frailty is also a syndrome that may be amenable to interventions. Exercise is one intervention for which there is at least modest evidence for amelioration of frailty.

Definitions of Frailty

To date, two groups of researchers have dominated the discussion about the definition of frailty. One research group, led by Dr. Linda Fried and colleagues, has focused on a "phenotype" [3]. By this definition frailty is solely a physical condition that requires the presence of three out of five of the following components: weight loss, exhaustion, muscle weakness, slow gait, and low physical activity. Another group, led by Dr. Kenneth Rockwood and colleagues, has conceptualized frailty more broadly and defined it based on the number of impairments present in multiple domains, including mood, continence, and cognition, in addition to physical impairments (Table 10.1) [4].

Table 10.1 Definitions of frailty

Phenotypic definition	Global definition
Three or more of the following:	Assess problems in multiple domains:
Weight loss, unintended	Muscle strength, mobility, balance
Sense of exhaustion	Mood
Muscle weakness, such as impaired grip strength	Motivation
Slow gait	Cognition
Low level of physical activity	Functional status
	Nutritional status
	Continence
	Sleep
	Social engagement

Both definitions have been used to recognize frailty and "pre-frailty," which is an intermediate condition conceptualized to lie between frail and non-frail individuals. There is no evidence to suggest that one definition is superior to the other, and both have validity evidence supporting their ability to predict adverse health outcomes and mortality. A recent consensus conference on frailty could not reach agreement on a single operational definition of frailty [5].

Frailty Prevalence in Older Adults

The various operationalized definitions of frailty have been employed by research groups to characterize populations of older adults in different countries. Because of variations in definitions and the study population, the prevalence of frailty has varied widely among studies. A 2012 systematic review of the literature included 21 studies of community-dwelling adults aged 65 years and older. It found that the prevalence of frailty varied from 4 % to 59 %, with an overall weighted average of approximately 10 % [6]. The prevalence of frailty increased with age and was higher in women than in men.

Causes of Frailty

Although many physiological factors and medical conditions have been associated with frailty, rarely is one factor or condition considered to be the sole cause. Indeed, for a given individual, it is the *interaction* among multiple factors and conditions that can lead to frailty. To illustrate this point, experts depict this interaction as the "cycle of frailty," by which continued progression of a condition, such as poor nutrition, contributes to declines in skeletal muscle mass, which in turn contribute to muscle weakness and declines in aerobic power, which in turn lead to reductions in mobility and endurance for daily activities (Fig. 10.1).

Age-associated declines in muscle mass (sarcopenia), low steroid hormone levels, reduced vitamin D absorption and related hypovitaminosis D, and impaired heart rate responses to increased physiologic demand are all examples of age-associated decrements in physiological processes that can contribute to the development of frailty. Similarly, diseases such as arthritis, Parkinson's disease, and diabetes have effects on neuromuscular function that can contribute to frailty. Lifestyle choices such as low physical activity levels and dietary choices with poor food quality also contribute to frailty. Depression and social isolation can lead to similar reductions in activity and nutrition. Medications and polypharmacy can contribute to frailty through several mechanisms, including impaired cognition, psychomotor slowing, increased fatigue, decreased taste and appetite, and incontinence, all of which can lead to reduced socialization and physical activity. Inadequate pain relief may also contribute through reduced physical activity.

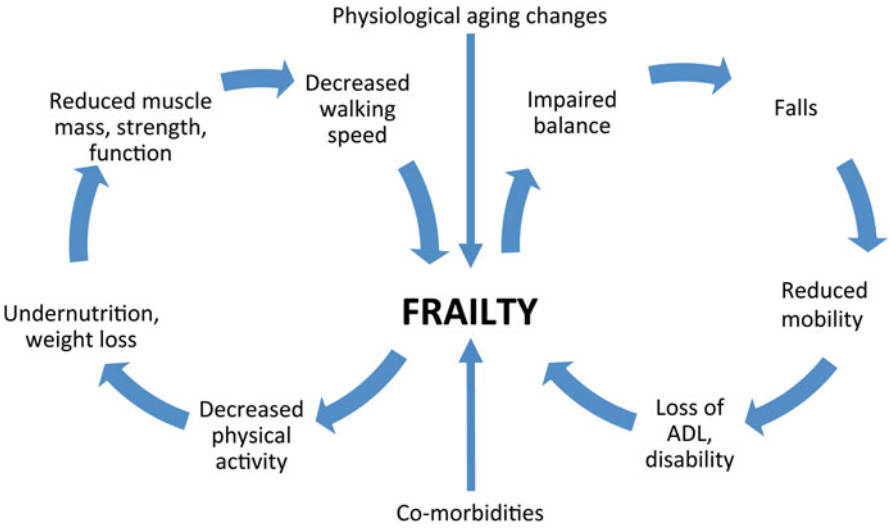

Fig. 10.1 Cycle of frailty

These are some examples of the myriad of age-associated physiological processes, medical conditions, and lifestyle changes that can lead to frailty. A comprehensive evaluation of the older patient should be undertaken to identify all issues that may be contributing to frailty, so that they can be addressed in a stepwise manner, with appropriate interventions.

Identifying Frailty in Older Adults in Clinical Settings

Currently there is no consensus about the optimal methods for identification of frailty. Several screening instruments have been developed and have validity evidence for population-based and community-dwelling samples. These interview-based instruments include the Frailty Index, Fried Frailty Measure, FRAIL instrument, and Gerontopole Frailty Screening Tool. However, none of these screening tools have sufficient validity evidence for primary care settings. Therefore, the applicability of these instruments to real-world, clinical settings has not been adequately studied.

Physical performance batteries have also been used to screen for physical frailty, such as the short physical performance battery (SPPB) and the physical performance test (PPT). These instruments also have inadequate validity evidence for use in primary care.

Despite limited information about the use of existing instruments for clinical screening, several medical societies have advocated for screening in older adults given the high association of frailty with poor patient outcomes. A recent consensus

conference on frailty concluded that (1) all persons aged 70 years and older and (2) those with significant weight loss, defined as ≥5 % in the previous 12 months due to chronic illness, should be screened for frailty [5]. At this time the choice of screening method (interview questions vs. physical performance measure) for a particular clinical setting should be determined by practical considerations (personnel, training, time, and space resources) that will facilitate adoption of screening procedures.

Interventions for Older Adults Identified as Frail

Older adults who screen positive for frailty should be carefully evaluated by their physician and other appropriate clinicians, in order to identify specific factors contributing to the development of frailty and to develop a plan for appropriate, targeted interventions. Frail individuals are at high risk for falls. Although the efficacy of multidisciplinary assessments has not been tested specifically for amelioration of frailty, it can be argued that, based on the success of this approach for fall risk reduction, multidisciplinary assessments also should be considered for frailty interventions. Referral to a geriatrician for a detailed evaluation should also be considered.

Four types of interventions have evidence supporting efficacy for the treatment of components of the frailty syndrome: (1) exercise, (2) caloric and protein supplementation, (3) vitamin D supplementation, and (4) reduction of polypharmacy (Table 10.2).

Several systematic reviews and meta-analyses have been conducted on the effects of exercise interventions on frailty in older adults [7]. There is strong evidence that exercise improves global physical performance, muscle strength, and

Table 10.2 Evidence-based approach to frailty

Screening considerations
Unintended weight loss
Slow gait
Falls
Complaints of fatigue
Decline in function
Social isolation
Assessment
Multidisciplinary assessments
Medical history, physical exam, medication review
Consider geriatrician referral
Interventions targeting frailty components
Exercise: strength, endurance, and balance training—targeted to person's fitness level
Caloric and protein supplementation
Vitamin D supplementation
Reduction of polypharmacy

gait speed and moderate evidence that it improves endurance and balance. Multicomponent exercise programs that include strength, endurance, and balance training appear to be the best strategy to reduce falls and improve physical performance. High-intensity programs conducted 2–3 day/week have shown greater benefit than low-intensity programs. Walking programs have shown variable effects and may be insufficient to produce improvements.

Before initiating an exercise program in a frail older adult, a thorough medical history, physical examination, and medication review should be performed. Physical impairments, such as range of motion limitations, should be carefully identified and clearly communicated to the individual who will be training or supervising the older adult. Referral for a physical therapy evaluation may assist clinicians in identifying significant impairments, developing an individualized exercise prescription, and determining the amount of direct supervision needed for appropriate, safe conduct of the exercise. To prevent injury in this population, it is important to begin at the appropriate exercise level and gradually advance the exercise prescription.

Case Part 2
Max's daughter brings him to a geriatrician for a comprehensive assessment soon after returning home. The physician identifies Max as frail, based on Max having all five characteristics of the phenotypic definition. After a medical history, physical examination, lab test review (including vitamin D-25-OH), and medication review, the physician recommends an increase in dietary protein and calories, referral to outpatient physical therapy as well as home exercises, and vitamin D supplements. After several months, Max is able to walk around in his house independently and outside with a cane and has increased lower extremity muscle mass and strength. He is able to perform his ADLs independently. He continues with his exercise program with the goal of eventually returning to full independence, including social events and golf.

Conclusions

The risk that a person will become frail increases substantially with age and is highly associated with poor outcomes that are important to older adults and their care providers. The optimal screening instrument and target populations for screening are not entirely clear. However, instruments developed initially for research purposes exist and have been implemented in clinical settings. Key professional groups have advocated for the need to identify pre-frail and frail older adults and implement multicomponent assessments to direct appropriate interventions. Evidence supports the use of exercise as an effective and safe treatment for frail older adults.

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Resources

American Geriatrics Society Geriatric Evaluation and Management Tool for frailty. http://familymed.uthscsa.edu/gerifellowship/redirect/articles/CLC/Geriatrics%20Eval%20Management%20Tool%20for%20Frailty.pdf

Clinical Frailty Scale. http://geriatricresearch.medicine.dal.ca/pdf/Clinical%20Faily%20Scale.pdf

Gerontopole Frailty Screening Tool (in English; other languages are available) http://www.frailty.net/Media/Default/Diagnostictools/Gerontopole_Frailty_Screening_Tool_English.pdf

Physical Performance Test. http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=1104 and scoring form, http://www.brightonrehab.com/wp-content/uploads/2012/02/Physical-Performance-Test-PPT.pdf

Short Physical Performance Battery (SPPB). http://geriatrictoolkit.missouri.edu/ShortPhysicalPerformanceBattery.pdf and diagrams and explanations, http://www.ndorms.ox.ac.uk/prove/documents/assessors/outcomeMeasures/SPPB_Protocol.pdf

Chapter 11
Community-Based Exercise Programs for Older Adults

Jennifer Sokol Brach

Key Points

- Community-based programs are designed to reach people outside the traditional healthcare setting, in "real-world" settings.
- Community-based programs have been shown to increase the time and frequency of physical activity in older adults.
- Community partnerships are critical to the sustainability of a community-based program.
- Evidence-based programs increase the likelihood of a positive outcome, lead to efficient use of resources, and make it easier to justify funding.
- The RE-AIM framework is a useful, comprehensive framework for program planning and evaluation.

Introduction

In older adults physical activity and exercise can prevent mobility disability, hospitalization, and institutionalization as well as improve physical and mental health. Despite these benefits, the older adult age group engages in the least amount of moderate-to-vigorous physical activity and the most time in sedentary behavior compared to other age groups. One attractive way to promote exercise is through community-based programs. Community-based programs take what we know from research and make that knowledge usable by public health and aging services providers.

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The idea is to take a research model which has been shown to work in the laboratory and to adapt it for use in the "real world."

Community-based programs are designed to reach people outside the traditional healthcare setting. These settings may include schools, worksites, community centers, congregate living areas, and churches. These nontraditional settings can encourage informal information sharing within communities through peer social interactions and social support.

An excellent example of a community-based program occurring outside the traditional healthcare setting is the "Sisters in Motion" program [1]. The goal of this faith-based intervention is to increase walking among older, sedentary African American women. The multicomponent program, which includes scripture readings, prayer, goal-setting, a community resource guide, and walking competitions, is delivered through churches in the Los Angeles area. The program has been successful in producing an increase in walking and a decrease in systolic blood pressure at 6 months [1]. The use of settings outside the traditional healthcare setting is critical for serving hard to reach populations. The "Sisters in Motion" program is an option for older African Americans who may not be involved with community centers that offer physical activity programs, but are likely to attend church a few times per month.

Community-based exercise programs for older adults have several benefits. Research studies show that group-based community exercise programs for older adults can increase time spent exercising, the frequency of exercise, and aerobic capacity. However, less is known about the health cost implications of these programs. Ackermann and colleagues conducted a matched cohort study to determine if healthcare costs for Medicare-eligible adults who chose to participate in a community-based exercise program were different from individuals who did not participate in the community-based programs [2]. They found the average increase in annual total healthcare costs was less in those who participated in the community-based exercise program. If these findings are confirmed in other studies, group-based exercise programs could play a role in reducing overall healthcare costs.

Translation of Research into Evidence-Based Community Programs

Recently there is a push to translate successful research into practice. The goal is to bridge the gap between academic clinical research on exercise and the community. In the past decade the aging network has increasingly implemented only evidence-based health promotion programs. In fact, the Federal FY-2012 Congressional appropriations law includes an evidence-based requirement for all health promotion programs funded by Older Americans Act (OAA) Title IIID funds (http://www.aoa.acl.gov/AoA_Programs/HPW/Title_IIID/index.aspx. Accessed December 17, 2014).

In response to this requirement, the Administration on Aging (AOA) developed an evidence-based definition to assist providers in identifying evidence-based programs. The original definition of "evidence based" included a three-level

Table 11.1 Administration on aging (AOA) current and future definitions of evidence-based

Current definition of evidence based (until October 1, 2016)	
Highest-level criteria	All intermediate and minimal criteria plus
	Proven effective with older adult population, using experimental or quasi-experimental design
	Fully translated in one or more community sites
	Includes developed dissemination products that are available to the public
Intermediate criteria	All of the minimal criteria plus
	Published in a peer-reviewed journal
	Proven effective with older adult population using some form of a control condition (e.g., pre-post study, case control design, etc.)
	Some basis in translation for implementation by community level organization
Minimal criteria	Demonstrated through evaluation to be effective for improving the health and well-being or reducing disease, disability, and/or injury among older adults
	Ready for translation, implementation, and/or broad dissemination by community-based organizations using the appropriately credentialed practitioners
Future definition of evidence based (effective October 1, 2016)	
	Demonstrated through evaluation to be effective for improving the health and well-being or reducing disease, disability, and/or injury among older adults
	Proven effective with older adult population, using experimental or quasi-experimental design
	Research results published in a peer-reviewed journal
	Fully translated in one or more community site(s)
	Includes developed dissemination products that are available to the public

definition: highest-level, intermediate, and minimal criteria (Table 11.1). Until October 1, 2016, OAA Title IIID funds can be used for health promotion programs that meet any of these three levels. However, by October 1, 2016, Title IIID funds will be used only for health promotion programs that meet a new, more rigorous definition of "evidence based."

Why this major switch to evidence-based programs? There are several perceived advantages of evidence-based programs. These programs increase the likelihood of a positive outcome, more efficient use of resources, spread of programs, use of common performance measures, continuous quality improvement, and successful partnerships; this strategy also more easily justifies funding. The push for evidence-based programming is coming from funders, agency leaders, and older adults themselves. Funders are increasingly demanding that programming be based on research evidence, agency leaders want to appropriate limited resources for proven programs, and older adults are looking for programs that are known to work.

The National Council on Aging Center for Healthy Aging has developed a series of tools and a checklist to assist individuals in the translation process from research evidence to practical, effective community-based programs (http://www.ncoa.org/improve-health/center-for-healthy-aging/content-library/IssueBrief_ReAim_Final-2.pdf. Accessed December 17, 2014). The National Council on Aging Center

for Healthy Aging describes the basic components of evidence-based health promotion planning as:

- Identification of an important health issue and population at risk
- Identification of effective interventions
- Establishing broad-based partnerships within the community
- Selecting an intervention from the identified effective interventions
- Translating the intervention into a program
- Implementing the translated program
- Evaluating the program
- Sustaining the program

The first component involves reviewing the literature, examining epidemiologic data and talking to individuals within the community to identify a key health condition or risk factor that is pertinent for older adults in this community. Examples of common health conditions or risk factors that are pertinent to older adults are injurious falls, prediabetes or diabetes mellitus, and hypertension.

Once a condition or risk factor is identified, the next step is to identify effective interventions. This is done by systematically searching and reviewing the research relevant to the health condition or risk factor. Table 11.2 contains sources to help identify this evidence. At this point, it is helpful to identify several potential programs that address the health condition or risk factor. If not already involved in the process, this is an optimal time to establish partnerships within the community. Community partners are critical in order to determine the priorities of the target population. Partners can also help to identify other relevant community stakeholders who should have early input into the process.

The next step is to select a proven, evidence-based intervention from the previously identified interventions. The selected intervention should be appropriate for the target population, suitable for adoption by the providers, and feasible given the available resources. When selecting the program, consider the time required to run the program, material and equipment needs, available personnel, training needed to run the program, and overall program and training costs. These factors will influence your selection of an intervention.

Table 11.2 Sources to identify evidence-based programs

Source	Link
Cochrane Reviews	http://www.cochrane.org
CDC Community Guide to Prevention Services	www.thecommunityguide.org
Cancer Planet Control	http://cancercontrolplanet.cancer.gov
NCOA Center for Healthy Aging	www.healthyaginbgprograms.org
Department of Aging and Disability Services	http://www.dads.state.tx.us/services/agingtexaswell/initiatives/ebased/index.cfm
SAMHSA National Registry of Evidence-Based Programs and Policies	http://nrepp.samhsa.gov/

Once the intervention is identified and approved by all stakeholders, it needs to be translated into a program that is suitable for implementation in the community while maintaining fidelity to the key components of the intervention. It is important to ensure the translation of the evidence-based intervention into a community program remains a faithful and accurate representation of the original program.

Once translated into operational steps, the program should be piloted in the community. In order to obtain an accurate trial run of the program, it is essential to test the new program in a group of older adults who are similar to the target population and may benefit from the intervention. For example, if the target population is sedentary older adults, it is important to implement the program in a group of sedentary older adults and not in a group of senior athletes. After piloting, some modifications to the original plan may be required. However, it is imperative to maintain the core concepts of the program when adapting to the target population and available community resources.

Prior to fully implementing the program, it is critical to have a plan in place for evaluation. This may require designing new or adapting existing instruments, such as surveys, for data collection. With new programs, one may want to obtain feedback from participants midway through the program so that the information can be used to make ongoing adjustments to the program. At the completion of the program, evaluate process measures such as drop-out rates and satisfaction of participants with the delivery of the program and key outcomes. The outcomes assessed should match the target of the intervention (i.e., if the goal is to increase physical activity, then amount of physical activity should be measured at completion of the program). Information from this final evaluation can be used to inform the next cycle of program planning.

The final step in the process is to ensure sustainability of the program. Throughout the translation process, one should collect information on the activities and resources needed to maintain a successful program. Issues to consider include staff, space, resources, and materials. Partnerships that have been developed throughout the process can be essential to sustaining programs. Ongoing evaluation and modifications are needed to ensure that the program continues to meet the interests and needs of the target population over time.

Community Program Planning Steps

There are four main stages involved in implementing an evidence-based program in the community (Table 11.3). As described above, the first step is selecting an evidence-based program that works for the target community. Questions to consider in the selection process include: (1) is the program based on best practices; (2) was the program tested with a rigorous research design; (3) is the program effective for the outcomes of interest; (4) are there protocols and manuals available so that the program can be easily replicated; (5) has the program been tested in multiple settings and populations; (6) has it been published in peer reviewed literature; and (7) is it feasible to scale up to a larger population?

Table 11.3 Community program planning steps

1. Selecting a program
2. Determining readiness
3. Using RE-AIM to plan[a]
4. Working with partners

[a]Reach, effectiveness, adoption, implementation, and maintenance (RE-AIM) [3]

The next stage of program planning is determining the readiness of your organization to implement the program. The National Council on Aging has an online "Innovation Readiness Assessment" link that can be used to determine if an organization is ready (http://www.ncoa.org/improve-health/innovation-readiness.html. Accessed December 17, 2014). Factors that contribute to the readiness of an organization to implement a program include willingness to stay true to the program (program fidelity), available funding for the program, access to personnel to run the program, access to the target population who need the program, and buy-in from senior leadership and key partners that is reflected in both programmatic and financial support.

The next stage is planning the intervention. One framework used to plan new interventions, adapt existing interventions, and design evaluations to assess potential health impacts is RE-AIM (www.re-aim.org). RE-AIM is a comprehensive framework that focuses on five critical elements: *r*each, *e*ffectiveness, *a*doption, *i*mplementation, and *m*aintenance (RE-AIM) [3, 4]. These five elements are defined:

Reach: the absolute number, proportion, and representativeness of the persons who participate in a given program
Effectiveness: the impact of the program on important outcomes
Adoption: the absolute number, proportion, and representativeness of settings that are willing to offer the program
Implementation: the degree to which staff members follow the program as designed (consistency, fidelity)
Maintenance: the extent in which the program becomes part of the routine in the setting of interest and at the level of the individual

The final stage in implementing community programs is establishing partnerships within the community. Without the support of community partners, programs are unlikely to be successful. Partnerships are crucial at every stage of the process (planning, implementation, evaluation, and sustaining) and should be identified early and maintained throughout the process. Community partners can make or break a program, and it is critical to identify key partners to ensure successful programming.

Evidence-Based Community Exercise Programs

As there are many evidence-based community exercise programs for older adults, a description of all such programs is not feasible. We have selected a sample of five community-based programs for older adults that have varying goals: reduce falls, improve fitness, manage lower extremity osteoarthritis, and improve balance, strength, and physical performance.

A Matter of Balance (*MOB*), www.mainehealth.org/mob. The MOB program was designed to reduce fall risk and fear of falling in older adults, 60+ years of age, who are ambulatory, able to problem solve, are concerned about falling, and want to increase their flexibility, balance, and strength. The class is delivered by two coaches who are volunteer lay leaders trained to teach the program. The program consists of 8 weekly, 2 h sessions or twice weekly, 1 h sessions for a total of 16 h of instruction. The program emphasizes practical coping strategies to reduce fear of falling and teaches fall prevention strategies. The instructional group activities include group discussions, problem-solving, videos, sharing practical solutions, and exercise training. Coaches are required to attend 8 h of initial training and 2.5 h of annual update training in order to lead the program. The MOB program is a national program with over 500 Master Trainer Sites located in 39 states and the District of Columbia.

Enhance Fitness, www.projectenhance.org/EnhanceFitness.aspx. The primary goal of the Enhance Fitness program is to improve the overall functional fitness and well-being of older adults. The program was designed for sedentary older adults wishing to improve their physical functioning. Enhance Fitness is currently offered in hundreds of locations, throughout the United States. The program is an ongoing, 1 h, 3 times per week group physical activity program that focuses on stretching and flexibility, low-impact aerobics, strength training, and balance. The classes are led by certified fitness instructors who have completed 1.5 day Enhance Fitness new instructor training.

Fit and Strong!, www.fitandstrong.org. The Fit and Strong! program targets sedentary older adults who are experiencing lower extremity joint pain and stiffness. The goal of the program is to manage lower extremity osteoarthritis through engagement in a safe, balanced program of physical activity that builds lower extremity strength. Currently, Fit and Strong! is offered in Illinois, North Carolina, and West Virginia. The program consists of 90 min sessions, 3 times per week for 8 weeks. The classes are led by a specially trained Fit and Strong! Master Trainer. To become a Master Trainer, an individual must be a certified exercise instructor or licensed physical therapist, or physical therapy or occupational therapy aide or student, and must complete 8 h of training.

Stepping On, http://wihealthyaging.org/stepping-on. The Stepping On program was designed for community-residing older adults who are at risk for falling or are fearful of falling. The 7 weeks, 2 h/week program offers strategies and exercises to reduce falls and increase self-confidence in making decisions and behavioral change

in situations where older adults are at risk of falling. Unique to this program is a home visit or follow-up phone call by the program leader to help facilitate follow through with the preventive strategies. The program is led by a trained leader or trained peer leader who has participated in a 3-day training session. The program is currently offered in 18 states.

Tai Chi: *Moving for Better Balance*, www.tjqmbb.org. The goals of the Tai Chi: Moving for Better Balance program are to improve balance, strength, and physical performance for older adults 65 years of age and older and to reduce fall frequency. The program runs for 24–26 weeks with three 1 h classes per week. The classes focus on 8 Tai Chi forms that focus on weight shifting, postural alignment, coordinated movements, and synchronized breathing. The classes are taught by qualified Tai Chi instructors who have completed 2 days of training specific to the program. The program is currently available in a several states in the United States.

Conclusions

Community-based programs which are delivered outside the traditional healthcare setting, in locations such as community centers, congregate living areas, and churches, can promote physical activity in older adults. Many factors such as the goals of the program, resources required to run the program, and efficacy of the program should be considered when selecting a program. Funders and agency leaders are increasingly demanding evidence-based programs because they increase the likelihood of a positive outcome, lead to efficient use of resources, support continuous quality improvement, and make it easier to justify funding. A variety of evidence-based programs have been implemented in community settings and can serve as models for interested communities and leaders.

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Chapter 12
Implementing and Disseminating Exercise Programs for Older Adult Populations

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Key Points

- Multiple existing evidence-based programs for promoting exercise and physical activity can be delivered through the aging services network.
- Marketing evidence-based physical activity programs to potential delivery sites and practitioners is essential for beginning community programs.
- Federal resources are available to help practitioners identify, implement, disseminate, and sustain evidence-based programs for promoting physical activity.
- Older adult participants can use guided decision-making tools to safely participate in community-based physical activity programs.
- In the USA, numerous national efforts are underway to develop community programs to enhance physical activity for older adults, yet major challenges remain in reaching the majority of older adults.

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Introduction

Given the growing awareness of the importance of exercise throughout the life course, several federal agencies are increasingly promoting strategies for helping the aging population stay active. Through its Healthy Aging Research Network, the Centers for Disease Control and Prevention stresses the importance of helping older Americans stay healthy and active [1]. Similarly, the American College of Sports Medicine, through its Strategic Health Initiative Aging Task Force, has been a leading voice in promoting exercise for older adults [2]. Additionally, the Administration on Aging, a program division within the Administration for Community Living, provides funding for community-based disease prevention and health promotion services [3]. These funds are allocated to area agencies on aging, located in most counties in the USA. Local area agencies on aging provide services to older Americans as part of an aging services network which connects seniors to vital services to maintain health and independence. Recent regulations mandate that programs must be evidence-based in order to utilize these funds (see Chap. 11).

This chapter will guide persons interested in developing successful community exercise programs for older adults. Key areas to consider include: marketing evidence-based physical activity programs to potential delivery sites and practitioners; identifying, implementing, disseminating, and sustaining exercise programs (see Chap. 11); ensuring safety for older adults engaged in physical activity; coordination between the aging services network and other care sectors; and key lessons learned in delivering exercise programs to seniors.

Approaches to Potential Sites for Exercise

Exercise programs have been delivered by the aging services network in varied sites such as senior centers, health care organizations, residential facilities, community or multipurpose centers, faith-based organizations, educational institutions, recreational centers, tribal centers, and workplaces. Although there is greater appreciation of the myriad benefits of physical activity, program administrators often have questions about exercise programs. Before implementing any new program, an introductory session is often useful to discuss answers to common questions about the benefits of exercise, recommended activities, and strategies for encouraging older adults to be more physically active (see Table 12.1). Marketing materials adapted to older adults can enhance program adoption and participant recruitment (http://www.ncoa.org/improve-health/center-for-healthy-aging/chronic-disease/marketing-and-recruitment.html). The identification of a program champion within organizational settings is important for initial marketing success as well as actual program implementation and sustainability.

Table 12.1 Common stakeholder questions about physical activity for older adults

Common questions	Responses
Why should older adults be physically active?	Physical activity helps older adults stay active and engaged with family and community and prevents or improves many chronic diseases and conditions
How much physical activity is needed for seniors?	At least 150 min of moderate intensity aerobic activity per week plus two days per week of resistance exercises. Start out slowly. Do some activity on most days of the week
What is the best exercise for older adults?	A multicomponent regimen that includes endurance, strength, balance, and flexibility
Is exercise safe?	Yes, nearly everyone can find a safe and effective exercise program that is tailored to them. It is more risky to be sedentary than it is to be physically active
Is special clothing or equipment needed?	Comfortable street shoes and loose fitting everyday clothes can be used
	Inexpensive equipment such as elastic bands and water-filled jugs can be used for strength training
Are there available and affordable evidence-based physical activity programs for seniors?	Yes, see resources section

Adapted from Chodzko-Zajko W. ACSM's Exercise for older adults. Lippincott, Williams, and Wilkins. Philadelphia; 2013

Evidence-Based Exercise Programs

There are many evidence-based programs from which to choose for increasing physical activity in older adults. Individual programs differ in terms of program goals and target audience, types of interventions and activities, personnel training requirements, and costs (Table 12.2; see also Chap. 11). Specifically, some programs are more behaviorally based (*Active Living Every Day* [4]), others are more exercise based (*EnhanceFitness* [5]), and others are comprehensive programs including both elements (*Fit and Strong!* or *Texercise Select* [6, 7]). While most programs are time delimited—typically a fixed number of sessions over 6 to 12 weeks—others run continuously. Additionally, some programs are focused on more generic chronic disease management (*e.g., Standard Chronic Disease Self-Management Program* [8]), but have particular components focused on improving exercise behaviors. Others are exercise based but target specific problems such as fall prevention (*A Matter of Balance* [9] or *Tai-Chi: Moving for Better Balance* [10]).

The Community Resource Center for Senior Health has developed a web-based toolkit (http://www.evidencetoprograms.com/) to provide assistance in selecting and implementing an evidence-based exercise program. This website helps walk program administrators through key issues: understanding the importance of selecting evidence-based programs and factors to consider in selection and implementation, such as matching selected programs with organizational resources and the needs and preferences of a clientele.

Table 12.2 Examples of Evidence-based programs (EBPs): program goals, components, and training/licensure requirements and general costs[a]

Program/program contact	Program goals/target audience	Program components	Trainers/training requirements	Licensure/training costs and materials needed
Active Living Every Day (www.ActiveLiving.info/)	Goals: Learn to set goals, overcome barriers, and create plans to identify and engage in enjoyable physical activities	Group-based behavior change program	At least 1 trained facilitator per class	A license from ALP is required to become an ALED
	Target Audience: adults interested in integrating physical activity into their daily lives	12-week class sessions	No specific educational or fitness certification is required	Provider
		Short lecture and group discussion	Must complete an online course; participate in a live 2-hour, online training session; and pass a competency exam from Active Living Partners (ALP)	Training cost: per facilitator cost, includes materials (facilitator guide, lesson plans, sample marketing materials, handouts), training fee, and competency test
		No in-class exercises		Participants are expected to buy class books and pedometers
Chronic Disease Self-Management Program (http://patienteducation.stanford.edu/)	Goals: Help individuals with chronic conditions learn skills and gain the confidence to manage and improve their health	Highly interactive group-based self-management program	Two trained peer facilitators	A license is required
		Scripted manual with goal setting, problem-solving, and action planning skills emphasized	Based on a train-the-trainer model with t-trainers, master trainers, and lay leaders	On-site and online training is available. See http://patienteducation.stanford.edu/training/trnfees.html
	Target audience: adults with at least one chronic condition	Exercise is the focus of one session	Cross-training for the suite of self-management programs is offered	http://patienteducation.stanford.edu/licensing/licfees.html
	There are programs geared for older adults with diabetes, arthritis, cancer, and chronic pain	Six weeks, once a week, 2.5 hours per session	A detailed implementation and fidelity manual is offered	For detailed costs of training and licensing fees see website
Texercise Select (http://www.dads.state.tx.us/texercise/; www.Programonhealthyaging.org)	Goals: Become more physically active and improve nutritional habits	Multicomponent behavioral and exercise training program	At least one trained facilitator per class	No licensure or training fees
			A lay-led model using community volunteers	
	Target Audience: Adults 45 and older who are sedentary	Ten-week program, twice weekly, 90 min per session with supervised in-class exercises	One-day in-person training using training manual	
			Online training being developed	Training and implementation manual, handbook, DVD, incentives for participation available at no cost

[a]It is best to contact programs directly for specific information, as licensure and training requirements and costs are likely to change over time

Texas Case Studies

Although there are guidelines for helping program administrators, choosing among different programs can be daunting. Starting in 2006, the Brazos Valley Area Agency on Aging and the Texas A&M School of Public Health received funding to disseminate evidence-based programs and evaluate their reach and impact. An important step was to build an infrastructure to provide seniors easy access to programs that could improve health and functioning. Drawing on these Texas case studies, this section will highlight key themes in implementing, disseminating, and sustaining different exercise programs at the state and local level.

A Matter of Balance

This fall prevention program is disseminated widely throughout Texas and has been sustained for nearly 10 years. The program consists of 2 hours per week sessions over 8 weeks, with a focus on practical coping strategies to reduce fear of falling and falls, delivered through group discussions, problem-solving, videos, and exercise training. Coaches attend 8 hours of initial training and 2.5 hours of annual update training. This example illustrates the set of steps involved in choosing an evidence-based programs, from starting with identifying a health issue in need of attention to ending with strategies for sustaining the selected program(s).

Select a Health Issue

Costing billions of dollars a year in medical expenses alone, falls were recognized as a major health problem that could be preventable if older adults could learn fall prevention strategies and increase their physical activity [11]. This issue initially galvanized statewide activity and since has been sustained through the Texas Falls Prevention Coalition (http://fallsfreetexas.org/).

Identify Effective Interventions

The *Aging Texas Well* initiative (http://www.agingtexaswell.org/initiatives/ebased/index.cfm) and other regional sites (http://www.sph.tamhsc.edu/pha/ebp/) maintain an inventory of evidence-based exercise programs. The American College of Sports Medicine also disseminates information about best physical activity programming practices through position statements and other publications [12].

Establish Broad-Based Partnerships

Partnerships are important to accomplish widespread programmatic dissemination. The state established a partnership with the Texas Association of Area Agencies on Aging, which had a common interest in reducing falls among vulnerable older Texans.

Select an Intervention

Reviewing the list of evidence-based programs provided by the National Council on Aging, *A Matter of Balance* was chosen by the coalition because it was multicomponent and included behavioral strategies and a range of exercises. Further, it was led by a volunteer lay person with the potential for widespread dissemination, at a relatively low cost. Program match issues were also considered. The Texas Association of Area Agencies on Aging could answer affirmatively to questions such as: Does the program fit your mission? Is leadership supportive of the program? Are clients interested in the program? Can the program be implemented as designed?

Create an Infrastructure for Program Dissemination

Working with most of the area agencies on aging throughout the state, *A Matter of Balance* was delivered to more than 3,000 older Texans. The Area Agency on Aging network built the program capacity to deliver over 200 classes by certifying almost 100 master trainers who trained over 400 lay leaders.

Evaluate the Program

Evaluations are important for local and state program administrators to make the case that a program should be continued. In the initial statewide program, a set of community-friendly tools was developed to track the number and type of participants reached, the delivery infrastructure including the number and type of delivery settings as well as the number and type of class facilitators, and program effects in terms of health, behavioral, and functional outcomes. As anticipated, *A Matter of Balance* resulted in (1) increased confidence to prevent falls, (2) improved overall physical activity level, and (3) reductions in interference with the ability to conduct everyday activities. Findings from the Centers for Medicare and Medicaid Services showed that *A Matter of Balance* was associated with reductions in medical cost savings, which became a key factor in further dissemination and sustainability.

Sustain the Program

Program sustainability is critical but often challenging. Reinforced by Administration on Aging funding mandates, there is a commitment to the delivery of exercise programs that can address a major senior health concern. In Texas, *A Matter of Balance* continues to be delivered throughout the state, along with other physical activity programs to reduce fall risk. Sustainability has been enhanced through the establishment of a Texas A&M evidence-based program infrastructure. As part of a statewide implementation of a Medicaid transformation demonstration program, Texas has been able to provide a unified resource clearinghouse, training, and technical assistance for evidence-based programs.

Fit and Strong!

This program consists of 90 min sessions, 3 times per week for 8 weeks for sedentary individuals with lower extremity mobility problems. As initially conceived, *Fit and Strong!* required delivery by health care professionals or certified fitness instructors. Thus, this model was seen as less compatible with the aging services network volunteer model. The original *Fit and Strong!* program was subsequently adapted to a lay person-led model and delivered in several counties in Texas. Initial results suggested that with structured facilitator training, *Fit and Strong!* could be delivered as a lay person-facilitated model, reach a broad audience of older adults, and achieve positive outcomes similar to those with the original program, such as improvements in quality of life indicators. However, high program attrition rates have underscored the need for adapting evidence-based strategies to improve participant retention. It has been challenging to retain a key audience for *Fit and Strong!* older adults with multiple chronic conditions and living in rural areas. *Fit and Strong!* also demonstrates the possibility of adapting programs for new target audiences. With growing awareness of the importance of physical activity for cancer survivors, *Fit and Strong!* has been successfully adapted to focus on adults with cancer [6].

Texercise Select

This is an example of a practice-based lifestyle program that highlights some of the differences between practice-based and research-based programs. The original *Texercise* program was based on best practices for exercise with a large selection of group and home activities; thus the program was highly variable. This is an appealing aspect of *Texercise* as program facilitators can customize the program for different audiences with a list of suggested exercises and a handbook/DVD for seniors to exercise on their own. *Texercise* has been widely implemented for more than ten years and has won state and national awards. Yet, in contrast to the two programs described above, the original *Texercise* program was not externally evaluated with outcomes published in a peer review journal. Thus, it is not an evidence-based program under the highest criteria established by the Administration on Aging (see Chap. 11). Further, a key criterion for future Administration on Aging funding is standard delivery across time and settings. Investigators at the Texas A&M School of Public Health and others have helped to standardize and create manuals for the program so that it can be delivered more consistently and can be tested in multiple settings. Also, a one-day training protocol has been developed for the volunteer program facilitators. Preliminary evaluation of the standardized *Texercise Select* program confirms the value of practice-based exercise programs which have built-in delivery systems for widespread adoption. Preliminary evaluation show improvements in self-reported health status, amount of physical activity, quality of life, and functional performance.

Chronic Disease Self-Management Program (CDSMP)

In recognition of the importance of self-care for managing chronic conditions, *CDSMP* has become the predominant program within the aging services network, with over a 100,000 older adults being reached through national Administration on Aging initiatives alone. Participants learn about the importance of setting goals for physical activity, problem-solving barriers, and setting specific action plans for increasing physical activity. However, this program does not include an opportunity for in-class exercise training. *CDSMP* is an excellent example of a self-management program where participants can be linked to the American College of Sports Medicine's Exercise is Medicine practitioner network (www.exerciseismedicine.org) or other physical activity-rich, evidence-based programs delivered through the aging services network.

Safety in Community Physical Activity Programs

A traditional concern about safety of community-based physical activity programs for older adults still lingers, despite evidence that risks for moderate and light intensive activities are minimal and the risks for sedentary lifestyles are high. The Exercise and Screening for You (EASY Tool, http://easyforyou.info/; see also Chap. 3) can guide older adults regarding when to see a health care provider and how to choose activities for optimal benefit given particular health conditions and settings. In the Texas statewide implementation of *A Matter of Balance*, researchers found no relationship between higher risk on initial EASY score and ability to complete the program. Use of the EASY tool by seniors with a host of preexisting but medically managed conditions appeared to facilitate their ability to enroll in fall prevention classes. Use of the tool reduced the need for medical consent for participation without notable adverse consequences.

The EASY website includes safety tips to consider before initiating exercise and when to stop exercising. Similarly, clinicians should be prepared to address routine questions about exercise adaptations needed for different illnesses and conditions. In this vein, the *Exercise is Medicine* campaign provides helpful tools in their Prescription for Health Series about exercise with common conditions such as arthritis and cardiovascular, pulmonary, metabolic, immunological/hematological, orthopedic, and neuromuscular disorders. While some older individuals will prefer to exercise on their own, group-based programs are important for providing supervised training, access to an instructor or exercise specialist for discussion of concerns, and further referral for appropriate assessment and treatment.

Marketing to Community Stakeholders

It is essential to find a point of common interest for local stakeholders. All groups, including older adults, benefit by being engaged in establishing a program and then marketing the program. Several national programs are working to engage

medical professionals, fitness experts, and older adults in exercise initiatives. Starting in the early 2000s, the National Blueprint for Increasing Physical Activity in Adults Fifty and Older laid out a comprehensive national agenda to collaboratively increase physical activity among adults. This agenda includes research; strategies for home and community, medical systems, and workplaces; public policy; and marketing. Several national organizations are active participants in this collaborative effort. A key partner, the National Institute on Aging, has developed a public education campaign, Go4Life, with exercise guides, DVDS, and other older adult education materials.

As a joint partnership between the American Medical Association and the American College of Sports Medicine, the *Exercise is Medicine* movement advocates for a physical activity vital sign to increase attention to physical activity by the health care system. The Exercise is Medicine movement promotes collaboration between medical professionals and the fitness industry. Another large national group, the YMCA of the USA, has recently announced a healthy aging initiative that will expand its delivery of community-wide exercise programs such as EnhanceFitness and Tai Chi. Finally, the Building Health Communities for Active Aging National Recognition Award identifies innovative community partnerships, policies, and programs that combine principles of smart growth with active aging. These awards are given to communities that create attractive living choices for people of different ages, socioeconomic status, and physical abilities while promoting active living and efficient use of existing resources.

In Texas, application of the principle "think globally but act locally" led to having the local evidence-based resource center act as a clearinghouse to link clinical providers to evidence-based exercise programs. Through on-site presentations supplemented by resource materials, the local resource center encourages clinicians to employ "prescriptions" for exercise programs: refer patients to community-based organizations that deliver exercise programs. A key clearinghouse function is to maintain a schedule so that health care providers can know when and where exercise programs are being offered in the community. In some cases, integrated health care systems are training paraprofessional staff or volunteers to deliver the exercise or fall prevention programs on site.

Conclusion

Enhanced physical activity across the life course has received unprecedented attention over the past 15 years, with more opportunities for older adults to participate in evidence-based exercise programs than ever before. Creative partnerships between practitioners and researchers and the integration of medical, public health, fitness, public practice, and policy perspectives are essential to making the national blueprint become a reality. The Texas experience, a model for large-scale community programs, yields helpful insights into the challenges that remain in reaching a majority of older adults (Table 12.3).

Table 12.3 Lessons learned: successes, challenges, and potential solutions

Topical area	Successes and challenges	Solutions
Reaching large and representative populations of older adults	Successes: Older adults have been exposed to programs through the aging services network and other partners	Key stakeholders from aging, health care, and community organizations serving older adults should work together to increase awareness of different evidence-based exercise programs and promote better integration across delivery sectors
	Challenges: However, this is only a small percentage of the population	
Program effectiveness	Successes: Most programs have a standard set of data tools to assess program effectiveness	Funding agencies and program administrators should endorse evaluation activities as integral to program delivery and important for inclusion in program training
	Challenges: However, these are not always implemented	Assessment measures should be pragmatic and vetted with key stakeholders
Program adoption	Successes: Many stakeholders have a greater appreciation of the need for physical activity and the value of adopting exercise programs	Partnering with more service sectors (health care, public health, and faith-based organizations; county/city government) may be an effective way for expanding program adoption
	Challenges: Getting organizational buy-in to offer these programs in many more organizations that touch the lives of seniors	
Program implementation and treatment fidelity	Successes: Programs have developed standardized training and implementation manuals to provide more consistent program delivery	Quality assurance (QA) mechanisms should be built into program implementation and should specify what needs to be done before, during, and after program delivery
	Challenges: However, consistent program delivery remains difficult to achieve	Lead persons responsible for QA should be identified
Program maintenance	Successes: Some communities/states have sustained program delivery for nearly 10 years. Establishing a centralized administrative unit and developing a training infrastructure are keys to sustained programming	The availability of continued funding through Title 111-D for exercise programs helps maintain basic support. Health care cost-saving tools and business case training can help justify exercise program and lead to new funding partners
	Challenges: However, this can be a financial challenge	

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