

# Exercise and the Elderly: Guidelines and Practical Prescription Applications for the Clinician


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## Abstract


- **Objective:** To review the components of exercise prescription and approaches to developing an exercise prescription for older persons.
- **Methods:** Case studies and qualitative review of the literature.
- **Results:** Effective exercise programs specify the appropriate mode, intensity, duration, frequency, and progression of training. According to the American College of Sports Medicine, patients should participate in aerobic exercise 3 to 5 days per week, maintaining target heart rate for 20 to 60 minutes. Resistance training should be performed at least twice per week and should target the 7 major muscle groups. Proper technique is necessary and speed and breathing should be controlled. Incorporation of warm-up and cool-down sessions is recommended for exercisers of all ages and physical conditions. Increased lifestyle activity also should be encouraged. In prescribing exercise for older patients, nutrition must be closely monitored. The prescription needs to be individualized, taking into consideration the patient's health status, nutritional intake, abilities, preferences, and resources.
- **Conclusion:** Physical activity should be encouraged in healthy seniors and should be considered a primary or adjunctive therapy in the treatment of chronic diseases associated with aging. Physician support of behavior changes is a major predictor of patient compliance.

Physical activity (PA) recommendations have evolved over the past few decades from emphasizing vigorous activity for cardiovascular health to supporting multiple bouts of moderate-intensity PA for overall health. The 1996 Surgeon General's Report on Physical Activity and Health recommends that people of all ages include a minimum of 30 minutes of moderate-intensity PA (such as brisk walking) on most, if not all, days of the week [1]. Based on more recent scientific literature, the 2002 recommendations go even further, recommending a cumulative 60 minutes of moderate exercise per day to maintain a healthy weight and decrease

## INSTRUCTIONS

 The following article, "Exercise and the Elderly: Guidelines and Practical Prescription Applications for the Clinician," is a continuing medical education (CME) article. To earn credit, read the article and complete the CME evaluation form on page 128.

## OBJECTIVES

 After participating in the continuing education activity, primary care physicians should be able to:

1. Know the components of an exercise prescription
2. Understand the different types of exercise and their potential benefits and risks in older age-groups
3. Understand how to develop an appropriate exercise prescription that considers the patient's health status, nutritional intake, abilities, preferences, and resources
4. Know strategies for improving exercise adherence

risk for chronic disease [2]. The Centers for Disease Control and Prevention (CDC) recommends supplementing cardiorespiratory endurance training with strength-developing exercises to improve musculoskeletal fitness, maintain independence in performing activities of daily living (ADLs), and reduce the risk of falls [3]. Recent CDC guidelines call for active participation on the part of the media, government, medical, and public health communities to influence PA patterns, make common knowledge the beneficial effects of exercise, and overcome real and perceived barriers to initiating and maintaining a physically active life [4,5].

This article is a companion article to "Exercise and the

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## EXERCISE PRESCRIPTION: APPLICATIONS

**Table.** Exercise and Physical Activity Web Sites

American College of Sports Medicine (ACSM) ([www.acsm.org](http://www.acsm.org))

Contains information on professional education, certification and credentialing, research programs, and links to fitness and health information, publications, guidelines, and product recommendations. Numerous position statements are available for download at the ACSM journal's Web site ([www.acsm-msse.org](http://www.acsm-msse.org)) including recommendations on exercise in healthy adults, older adults, and patients with specific medical conditions (ie, coronary artery disease, type 2 diabetes, osteoporosis, and hypertension). Papers that address intervention strategies for weight loss and prevention of weight regain, progression models in resistance training, and nutrition and athletic performance directives also are available.

American Heart Association (AHA) ([www.americanheart.org](http://www.americanheart.org))

The Healthy Lifestyle section of this site contains useful information on diet, exercise, and healthy lifestyles, including a section on calculating BMI, a physical activity calorie use chart, target heart rate tables, and exercise tips for older Americans.

Centers for Disease Control and Prevention (CDC) ([www.cdc.gov/nccdphp/dnpa](http://www.cdc.gov/nccdphp/dnpa))

The Nutrition and Physical Activity section contains information and tools on getting started with exercise, measuring exercise intensity, definitions of physical activity terms, and healthy eating tips.

The National Institute on Aging (NIA) ([www.nia.nih.gov/health/agepages/exercise.htm](http://www.nia.nih.gov/health/agepages/exercise.htm))

Contains information and safety tips, links to other reliable resources.

The President's Council on Physical Fitness and Sports ([www.presidentschallenge.org](http://www.presidentschallenge.org))

New interactive Web site with a section devoted to seniors. Includes tips on how to get started and challenges for seasoned senior athletes.

The National Heart, Lung, and Blood Institute (NHLBI) ([www.nhlbi.nih.gov/health/public/heart/obesity/lose\\_wt/phy\\_act.htm](http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/phy_act.htm))

Guide to Physical Activity includes recommendations and useful tools aimed at maintaining a healthy weight; BMI calculator; menu planner; daily food and activity diaries, recipes, shopping tips, and more.

The Cooper Institute ([www.cooperinst.org](http://www.cooperinst.org))

Nonprofit research and education center conducts research in epidemiology, exercise physiology, behavior change, hypertension, children's health issues, obesity, nutrition, aging, and other health issues. Web site contains fitness training tools; active living resources.

The 50-Plus Fitness Association ([www.50plus.org](http://www.50plus.org))

Nonprofit organization whose mission is to promote an active lifestyle in older adults. Web site contains information on fitness challenge camps; annual fitness weekends; monthly discussion groups; links to health articles, product sites, senior health, diet and nutrition sites.

The International Council on Active Aging ([www.icaa.cc](http://www.icaa.cc))

Offers courses in exercise training for fitness professionals, specializing in courses aimed at instructing older adults with chronic diseases. Web site contains a research page with diet and exercise effects in health and disease; resources for health care teams with links to facility planning for older adults; preferred vendors of exercise and rehabilitation equipment; active aging conferences and exhibitions.

elderly: a scientific rationale for exercise prescription" (pp. 106–116), which reviews the literature pertaining to the role of exercise in cardiovascular health, strength, postural stability, cognition and psychological health, immune function, and the prevention and treatment of chronic disease. In this article, we present 3 cases studies to illustrate practical application of exercise prescription. Given the diversity of cases a clinician will encounter and the specificity of therapeutic exercise, it is not possible for a short review to provide sufficient details for prescribing in every case. We do provide references to useful resources and refer liberally to the American College of Sports Medicine's (ACSM's) guidelines for exercise testing and prescription [6]. Readers are referred to the **Table** of resources for additional position papers published by ACSM.

### Definitions

While the terms physical activity and exercise often are used

interchangeably, it is important to differentiate between them. **Physical activity** is any body movement produced by the contraction of skeletal muscle during work, daily activity, or play that results in increased energy expenditure. **Exercise**, a subcategory of PA, consists of structured, planned, repetitive body movement with the intent of improving physical fitness. With a balanced activity program, the end product is **physical fitness**, the summation of 4 factors: cardiorespiratory endurance, muscle power, flexibility, and body composition. In combination, these factors further increase the ability to perform physical work. In the elderly population, increases in both planned exercise and in overall PA should be encouraged.

### Components of Exercise Prescription

The 5 essential components of any exercise prescription are (1) mode, (2) intensity, (3) duration, (4) frequency, and

(5) progression. A comprehensive exercise prescription should address endurance, strength, and flexibility. A dietary prescription goes hand in hand with exercise to provide adequate energy as well as the nutrients needed for optimizing the beneficial effects of exercise.

**Mode**

There are 4 main modes to improve physical fitness: aerobic exercise, resistance training, flexibility, and lifestyle modification. **Aerobic exercise** is any repetitive activity that increases the heart rate for an extended period of time. To improve aerobic fitness, exercise must utilize large muscle groups over prolonged periods in activities that are rhythmic and aerobic in nature. Some aerobic activities are walking, jogging, cycling, swimming, dancing, and hiking.

**Resistance training or progressive resistance training (PRT)** uses body weight, machines, or free weights to apply resistance against which a muscle or muscle group must generate force to move or resist. PRT maintains or improves muscle mass and neurologic integration, increasing protein stores essential to survival in the face of sickness and disease [7]. While PRT does little to improve aerobic capacity, improved muscle strength and endurance enhance the ability to perform aerobic exercise and ADLs, such as rising from a seated position, carrying bags of groceries, or handling objects above shoulder level. Muscle power is a strong predictor of functional status [8] and declines more rapidly than strength with advancing age.

Tools utilized in PRT may include gym-based weight machines, hand-held weights, ankle and wrist cuffs (which do not require hand-grasp function), and rubber bands/tubes. Continued improvement requires the weight load lifted to increase progressively over time as the exerciser grows stronger. Controlled, high-velocity resistance training (timing: “quick to lift, stop at the top, slowly lower, stop near the bottom”) increases muscle strength and peak power more than the slow-but-steady muscular contraction commonly promoted for lifting [9]. Circuit training (moving from exercise to exercise without stopping to rest) can be designed to combine both strength training and aerobic conditioning in one time-efficient session.

**Flexibility** is the range of motion (ROM) around a joint and is associated with injury prevention through all life stages. Of particular importance in aging is the maintenance of lower back, posterior thigh, and ankle flexibility [10]. Adequate flexibility can ward off chronic lower back pain and maintain the ability to perform ADLs and prevent falls [6,11,12]. Activities that improve flexibility include exercises that lengthen the muscles such as swimming, tai chi, yoga, and stretching.

**Lifestyle modification** encourages individuals to find opportunities within their existing daily routine to increase

activity, such as walking stairs, manually opening doors, carrying groceries, or gardening. Lifestyle modifications can increase stamina and improve cardiovascular fitness or improve muscle strength and balance, depending on the type and duration of activity. At all ages, total fitness requires a combination of activities, or a “cross-training” program.

**Dose: Intensity, Duration, Frequency**

Heart rate is commonly used as a guide to exercise intensity, with 55% to 90% of maximum heart rate being the recommended range for aerobic exercise [6]. Maximum heart rate can be estimated by subtracting the patient’s age from 220. The American Heart Association lists the following target ranges for moderate-intensity exercise (50% to 75% of average maximum heart rate [max HR]):

Age	Target Zone	Average Max HR
60 years	80–120 bpm	160 bpm
65 years	78–116 bpm	155 bpm
70 years	75–113 bpm	150 bpm
75 years	73–109 bpm	145 bpm

Heart rate can be monitored manually by taking frequent pulse rates or monitored mechanically with personal heart rate monitors or the built-in monitors available on some exercise machines. Exercise sessions should aim to maintain target heart rate for 20 to 60 minutes, continuous or intermittent, with a minimum of three 10-minute bouts accumulated throughout the day. According to ACSM, to achieve cardiorespiratory fitness patients should participate in aerobic exercise 3 to 5 days per week [6]. An alternative measure of aerobic exertion is the “talk test:” the exerciser’s breathing is increased, but he remains able to comfortably carry on a conversation. Incorporating more rigorous PA lowers the duration and frequency of exercise necessary to elicit benefit. In both aerobic and resistance training, sedentary individuals should start at lower intensity levels and progress, while moderately fit individuals can start at higher intensities.

Resistance training should be performed at least twice per week. Exercises should target the 7 “major muscle groups” (gluteals, quadriceps, hamstrings, pectorals, latissimus dorsi, deltoids, and abdominals) [13]. Patients can exercise all muscle groups at each session (2–3 training sessions/week) or split the series into shorter sessions of 3 to 4 muscle groups that are worked on alternate sessions (4–6 sessions/week). Each set should consist of 8 to 12 repetitions at a somewhat hard to hard intensity level using the Borg Rating of Perceived Exertion (RPE) scale [14]. Exercise adherence appears maximal when sessions are kept to no longer than an hour [6], with 48 hours between sessions in which the same muscle group is exercised.

A static stretching program involving all major muscle groups performed a minimum of 2 to 3 times per week can

## EXERCISE PRESCRIPTION: APPLICATIONS


improve balance and agility in all age-groups [6]. Yoga and tai chi movements as well as regular stretching may be useful during the warm-up and cool-down phases of an aerobic or resistance training workout.

### Individualizing the Prescription

The exercise prescription should take into consideration the patient's health status, chronic disease risk factors, behavioral characteristics, personal goals, and exercise preferences [6]. Some people like solitude, are disciplined, and prefer to start an exercise program on their own. A brisk walk in the morning and/or evening or an efficient circuit of weight training may best fit their schedule and temperament. Others may prefer the support and camaraderie of a partner, while others may prefer attending a fitness club with organized classes, personal trainers, and group energy. In response to community and public health activists, many shopping malls now open early to accommodate "mall walking groups" in a safe, well-lit, climate-controlled environment. Home-based exercise offers an effective modality in individuals with physical limitations or financial constraints [15,16]. For seniors worried about balance and agility, aerobic exercise may include stationary cycling or swimming. Many frail elders find greater confidence when under supervision. Specialized aqua aerobics classes geared toward the elderly offer aerobic and ROM components, with reduced joint stress and balance assisted by water buoyancy. Chair- and bed-based exercises should usually be reserved for the very frail and considered a beginning point. When the goal is to improve physical fitness and increase functional capacity in performing ADLs, exercises that require the participation of core muscle groups in the back, thighs, and abdomen and weight-bearing exercises are preferred.

### CASE STUDY 1

#### Initial Presentation

 Mrs. Delicata Flower, an 82-year-old woman living in a 650-bed nursing home, was brought to the attention of the medical staff because of her increasing difficulty in getting out of her chair unaided. At 5'3" and 108 lb, Mrs. Flower is thin and frail but has no other major complaints. The nursing home set up an appointment with a facility physician.

#### History

The patient has been living in the nursing home for 8 years. At entry, her recorded height was 5'5", and her weight of 128 lb had been held throughout her adult life. Her weight has gradually declined, and after losing her last 5 teeth, she is now edentulous and fitted with full dentures. Nursing home staff report that she takes most of her meals on a tray at her chair, has not attempted stairs in over a year, and walks with a

4-pronged quad cane. Mild dementia is evident, with difficulty remembering people and events in her recent history. Each day Mrs. Flower takes a liquid high-protein, high-caloric canned supplement, a soluble fiber product for diverticulosis, and an antiresorptive medication for her osteoporosis.

The physician meets Mrs. Flower in her room and finds her in good spirits and happy to chat, yet frustrated at the recent decline in her physical abilities and in her memory. When asked about social activities, Mrs. Flower mentions only a weekly card game in the nursing home common room. She reports no PA and spends the majority of her time watching television. When asked if she is open to becoming more physically active, Mrs. Flower expresses doubts, given the fact that she feels very tired most of the time, especially when trying to move about the nursing home. She also worries about injuring herself, and she mumbles a remark about missing her favorite shows. Upon speaking with her son, it is evident that both Mrs. Flower and her family believe that her recent decline is "just a normal part of aging," with nothing to be done except to sit back and accept it. The mention of strength training elicits fears that she'll "break her fragile bones."

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- What approach should be taken with regard to exercise prescription in this patient?
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### Begin Organized Exercise Program

A "total fitness program" that includes exercises to improve flexibility, ROM, and strength, with an emphasis on balance involving the lower body muscles would be a good choice for this patient. Such integrative programs have been demonstrated to be beneficial in improving strength and balance in the oldest and frailest patients [17,18]. Gardner et al [19] describe an exercise program used for fall prevention. The 60-minute session, conducted to music, generally begins with 15 minutes of seated stretching and ROM exercises for arms, shoulders, lower back, lower legs, hamstrings, and ankles, and chair-assisted standing balance moves [19]. A 30-minute strength training component includes 1 set of 8 repetitions of each of the following exercises: chair stands, knee extension, side hip raises, overhead dumbbell press, bent-over row, calf raises, lateral shoulder raises, and arm curls. The intensity goal is to bring the muscle to the point of fatigue by the 8th repetition, whether lifting the weight of the limb alone or lifting weights. If time permits, the series is repeated for a total of 2 sets of 8 repetitions each. The final 15 minutes are devoted to stretching and balance movements integrating yoga and tai chi, with external support provided by bars, chairs, and walkers as needed [19]. Emphasis is placed on maintaining proper technique, posture, and continuing to breathe

while performing all lifts in a controlled manner. Frail seniors are encouraged to start out with light weights or body weight, and everyone is encouraged to progress as they grow stronger.

An awareness of fluid consumption during exercise is important for seniors. Given the daily fluid intake recommendations in the elderly ( $\geq 2$  quarts per day in addition to water from foods [20]), plus a less effective thirst mechanism for sensing mild dehydration [21], monitoring fluids before, during (8 ounces every 15 minutes), and after workouts is crucial. Elderly exercisers should be encouraged to drink even when not thirsty.

### Increase Lifestyle Activity


Increased PA should be encouraged as a way to improve functional capacity and quality of life for Ms. Flower, with the possible additional benefit of increased appetite. Her PA prescription could include a daily 10-minute walk, even if she reports fatigue, with the staff encouraged to support her efforts. This may include an accompanied walk around the floor, a trip to the nursing home gift shop or beauty shop, or stroll in the garden. If she is feeling OK, encouragement will be offered to increase the walk duration by as little as 2 minutes or add additional sessions. A fall risk assessment will be done and identified factors addressed [22].

### Improve Caloric Intake

In prescribing PA and exercise for elderly patients, nutrition must be closely monitored. In the general population, low energy intake intensifies the muscle and bone loss associated with aging and hinders the muscle growth and development that should accompany exercise. Insufficient calorie and protein intake can further stress a weakened immune system and hamper illness recovery [17]. Further, when energy intake is low, micronutrient needs often go unmet. Because Mrs. Flower is prone to memory lapses and resides in a nursing home, dietary intake information may best be obtained by having staff monitor food served and eaten.

Mrs. Flower's visible thinness and body mass index (BMI) of 19 is indicative of insufficient energy intake. To promote socialization and dietary variety and to provide staff supervision and encouragement, the physician will suggest that Mrs. Flower eat at least 3 meals per week in the nursing home dining room and eat a small snack between meals. A micronutrient supplement formulated for older adults, including calcium, vitamin D, and vitamin B<sub>12</sub>, may be beneficial, especially with documented inadequate intake [20].

### Initial Management and Follow-up

 Mrs. Flower agrees to participate in the group exercise sessions 3 times per week, participating intermittently when tired. In addition, she will try the daily walk,


take 3 meals a week in the dining room, and eat snacks between meals.

Four weeks later, Mrs. Flower has gained 4 lb but continues to feel tired after exercise. She reports attempting to take a walk every day but often has to stop and sit down, and there are some days she does not feel up to it. Mrs. Flower has attended the exercise classes 3 times per week, and while she hasn't always been able to participate, she reports she enjoys going, is inspired by the other residents, and feels she may be getting stronger and more stable on her feet. She consistently attempts the stretching exercises and some strength moves, but doesn't feel strong enough to add any weights or attempt the more complicated balance poses. She reports taking an increasing number of meals in the community dining room. Despite growing social interactions, the majority of Mrs. Flower's time is still spent isolated in front of the television.

When the physician asks about symptoms of depression, Mrs. Flower says that she feels better than she has in a long time, especially when at exercise class or dinner with companions, and agrees to continue the effort to increase activity and social interactions. Given her struggle to meet the daily walking goal and continued lack of strength, Mrs. Flower redefines her PA goals. She will walk 5 days per week, with additional walks only when she feels up to it. Because of her deconditioned state and frailty, the PRT program starts out with no added resistance and progresses slowly. A new goal during her exercise class will be to perform the strength component with rubber tubing resistance, rather than adding weights. In addition to her current dining room meals, she will take at least 3 lunches per week in the dining room and join her dining companions for Sunday brunches at a nearby restaurant.

## CASE STUDY 2

### Initial Presentation

 George I. Joe, a 70-year-old male retiree, visits his primary care physician complaining of knee pain. He takes acetaminophen for his diagnosed knee osteoarthritis (OA) and back stiffness. He has a BMI of 32 (5'9" and 218 lb), a 42" waist circumference, weak abdominal muscles, and tight hip flexors. Recent laboratory findings included a fasting glucose level of 125 mg/dL and hemoglobin A<sub>1c</sub> of 6.0%, indicating impaired glucose disposal and possible underlying diabetes.

### History

Mr. Joe is a widower who lives alone and walks with a cane. He reports no PA for health or leisure, drives his car even for trips of very short distances, and has been increasingly sedentary since diagnosed with knee OA 2 years ago. His meals consist largely of prepackaged frozen entrees, fast

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food, and cold cuts on white bread. Alcohol intake has increased over the last 6 months, “mostly hard liquor,” but he won’t try to estimate the amount. A Korean War veteran, his social life consists of Saturday nights at the local VFW post, often missing dinner. When asked about his interest in increasing his PA level, the idea of initiating a daily aerobic exercise regimen is unappealing, but Mr. Joe is intrigued by the idea of strength training and increasing his social opportunities. Mr. Joe expresses concern about lifting heavy weights given his knee OA.

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- **What approach should be taken with regard to exercise prescription in this patient?**
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Mr. Joe is at increased risk of developing diabetes and is at increased cardiovascular risk. His prescription will include increased PA and exercise combined with a healthier diet to strengthen the supporting weight-bearing musculature and to aid in weight and abdominal fat loss. Mr. Joe’s local senior center offers an exercise class that focuses on upper and lower body strength training. The class meets twice per week and consists of ROM and flexibility exercises (10 min) and strength training (40 min) using a combination of hand and ankle weights and body weight as resistance, followed by a cool-down with stretching and yoga poses (10 min). Each session is designed to incorporate all major muscle groups. Strength training exercises consist of 2 sets of 10 to 12 repetitions using proper form and timing, bringing the muscle to fatigue by the final repetition, and alternating between upper and lower body exercises to allow local muscle recovery. If fatigue is not reached by the 12th repetition, the weight is increased at the next session.

Excessive alcohol intake and social isolation exacerbate Mr. Joe’s risk factors and reduce his likelihood of successful exercise intervention [23]. Since Mr. Joe will not try to estimate the amount of liquor he has been consuming, his first task will be to record alcohol volume and activities associated with alcohol consumption.

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- **What limits does knee OA impose on exercise?**
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While it is true that lifting inappropriately heavy weights can negatively affect arthritic joints (especially leg extension and leg press exercises), moderate-level exercise does not exacerbate OA pain or accelerate disease progression [24]. Strength training with proper weight selection, timing, and form can improve muscle strength and relieve joint stress [25]. In addition,

static stretching is recommended to decrease stiffness and increase joint mobility [24]. For additional information, see the American Geriatrics Society report on exercise for older adults with OA pain [24].

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- **What dietary goals should be recommended?**
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One of the goals for this patient is to increase the amount of dietary fiber, fruits, and vegetables in his diet while decreasing intake of processed meats, refined carbohydrates, and alcohol. When asked about his culinary skills, Mr. Joe responded that his wife had been “responsible for the kitchen.” To improve dietary knowledge and kitchen skills, patients can be advised that local community and senior centers may offer meals and/or cooking courses at reduced costs. Cooking courses can teach kitchen skills such as reading food labels; identifying foods to incorporate or minimize; preparing meals; and identifying easy, tasty, healthy entrees and snacks.

### Initial Management and Follow-up

 Mr. Joe agrees to start the strength training program and to eat more fruits and vegetables and whole-grain bread. To increase lifestyle activity, Mr. Joe agrees to a daily walk to the corner store for his newspaper, regardless of the weather. The storeowner is an old friend and the patient is looking forward to socializing. The clinician and patient agree that this combination of walking and community-based strength training is a reasonable start to an exercise program.

Mr. Joe returns 6 weeks later for assessment of compliance with exercise and diet goals. He has been taking his daily walk and attending strength training classes twice per week. He has been staying for the senior center’s low-cost meal served after his late-morning strength class and is enrolled in a 12-week cooking course. This has provided an opportunity for increased social interaction and is giving him needed knowledge and meal preparation experience. Mr. Joe reports drinking less over the past 6 weeks, explaining, “I’m too busy with all the stuff you’ve got me doing.” Review of an alcohol log that the physician asked him to keep reveals that he tends to drink in the evening, when home alone. The physician encourages him to continue to explore options in terms of social activities, including dinner with friends from class.

While the strength training course at the senior center offers the supervision and social aspects that Mr. Joe desires, he feels he may soon outgrow this program and require a more rigorous regimen. He is interested in progressing to free weights and weight machines at a local gym.

- What advice should Mr. Joe be given regarding gym-based weight training?

This interest in gym-based weight training is encouraged, but additional advice is needed to ensure his safety. As he moves to this next phase, proper technique will be essential to prevent injury or aggravate his OA. Initial weight room sessions should be supervised by trained personnel who have experience working with the elderly and health-compromised individuals. If maximal strength testing is available, the initial resistance can be set at 30% to 40% the 1-repetition maximum (1-RM) for upper body exercises and 50% to 60% 1-RM for leg exercises [13]. Mr. Joe will start with 2 sets of 10 to 12 exercises, including leg extension, leg flexion, leg press, calf raises, standing arm curls, tricep extension, seated row, lat pull-downs, overhead press, chest press, back extension, and abdominal crunches. When a set of 12 to 15 repetitions is performed comfortably, a 5% increase in resistance should be recorded for the next session. If unable to complete 8 repetitions as one set, the weight should be reduced [13]. A Borg RPE of 12 to 18 should be maintained [14]. If the intensity is less than 12 (fairly light), the resistance should be increased; if the intensity more than 18 (very hard), it should be decreased.

Speed and breathing should be controlled when performing resistance exercises, and exercises should only be performed within a pain-free ROM. Mr. Joe is reminded to always exhale when lifting a weight and continue to breathe as the weight is slowly lowered. Controlled breathing prevents a Valsalva maneuver, where exhalation force against a closed glottis increases pressure in the thoracic cavity, causing an acute rise in blood pressure while inhibiting venous return [26]. The result can be dizziness, seeing “spots,” and even fainting.


Incorporation of warm-up and cool-down sessions is recommended for exercisers of any age and physical condition [6]. Mr. Joe will include a 5- to 10-minute low-intensity calisthenics and stretching warm-up followed by 5 to 10 minutes of progressive aerobic activity (slow walking or an easy version of the activity about to begin) to increase metabolic rate and blood flow to the muscles, and reduce injury susceptibility [6]. The cool-down period includes exercises of diminishing intensity, allowing the return of heart rate and blood pressure to near resting values. Especially important for cardiac patients, the cool-down period enhances venous return and slowly decreases heart rate and myocardial oxygen demands [6].

Physician support of behavior changes, including diet and exercise, is a major predictor of patient compliance [27,28]. Physicians should provide positive reinforcement to patients who are progressing toward their goals and remind them of the health benefits of their activity and lifestyle

changes. For example, in Mr. Joe’s case, strength training promotes increased muscle mass (the major site of glucose disposal) and glucose uptake by muscle [29]; a developed lower body musculature will support his arthritic knees and reduce pain [25,30]; flexibility/ROM exercises will help lengthen his lower back and hip flexor muscles; abdominal crunches will stabilize and support lower back muscles, thereby reducing his risk of back injury [6]; and calf and foot flexibility will improve his gait, making walking easier [19]. The combination of daily PA and dietary change can result in weight reduction and reduced total and visceral fat mass. In patients at high risk for diabetes, this can reduce risk of diabetes onset at an effectiveness level twice that of standard medication and care [31].

### CASE STUDY 3

#### Initial Presentation

 After 5 years away from the doctor’s office, Mr. Hugo Stressor, a 61-year-old male with a BMI of 23 (6’0” and 169 lb) and a waist circumference of 34” presents to his primary care physician for a check-up. He believes he has been experiencing bouts of angina and is feeling anxious because his older brother recently died of a heart attack. His blood pressure is 140/95 mm Hg.

#### History

Mr. Stressor is the busy owner of a large company and works long hours. He has smoked 1 pack of cigarettes per day for the past 40 years. He admits to a poor diet (he considers himself a “meat and potatoes man”) and notes that he eats very little of the vegetables that his wife serves with dinner. He has thought about starting an exercise program but has “no free time” and is worried that exercise might induce a heart attack. He is, however, very interested in trying to address his health issues with a minimum of additional medications. His wife, who has a similarly sedentary lifestyle and is overweight, is willing to exercise with her husband if he starts a program.

#### Laboratory Data


A lipid panel reveals a total cholesterol level of 250 mg/dL, low-density lipoprotein (LDL) of 190 mg/dL, high-density lipoprotein (HDL) of 30 mg/dL, and triglycerides of 150 mg/dL.

- What safety issues need to be addressed before prescribing exercise in patients at high risk for heart disease?

Because of the patient’s risk factors and familial heart disease, the safety issues of an exercise program are addressed. ACSM has suggested that individuals aged 65 and older and

those at high risk of heart disease or stroke undergo a maximal, symptom-limited physician-supervised exercise stress-test performed in a fasting state taking their normal medications before beginning to exercise [6]. Abnormal exercise tests are referred to a cardiologist for further diagnosis and treatment prior to beginning the exercise program. Moderate exercise can be incorporated into the treatment plan after cardiology approval [32].

### Initial Management

 A blood pressure medication and lipid-lowering drug is added to Mr. Stressor's daily regimen of aspirin and a multivitamin/mineral supplement. He is referred to a nutritionist for a 3-day food record to evaluate dietary intake, quality, and eating patterns. He also is referred for exercise stress testing. The stress test reveals poor aerobic fitness but no clinical contraindications to exercise.

- What is the approach to this patient's exercise prescription?

### Make Time for Daily Physical Activity

Once his angina is under control and the cardiologist declares Mr. Stressor clinically stable, an exercise program should be started. A long-term goal of 45 to 60 minutes of moderate exercise on most days of the week is acceptable to the Stressors. It is hoped that the exercise program will decrease blood pressure and improve lipid values. In previously unfit people, PA resulting in increased aerobic power was associated with a reduction in cholesterol and systolic blood pressure in as little as 9 weeks [33].

The couple agrees to support one another and take daily 20-minute walks together around the neighborhood both before and after work [34]. Mr. Stressor will wear an inexpensive heart rate monitor during these walks and remain in his target heart rate zone of 95 to 120 bpm (60% to 75% of his predicted maximum heart rate). During morning walks, the couple will attempt to hold a constant pace for the 20 minutes, recording the distance covered. In the evening, they will alternate speed (2 minutes comfortable pace, 1 minute strong). This form of interval training works both the aerobic and the anaerobic system, further promoting synthesis of new capillaries, enhancing oxygen delivery, strengthening the heart and lower body muscle, reducing the risk of injury associated with repetitive endurance exercises, and resulting in more rapid physical improvements than seen with constant speed training [35]. As part of his PA prescription, Mr. Stressor also agrees to take the stairs up to his second floor office every morning and whenever he has to travel one flight up or down.

Upon probing for additional activities the couple could

do together, the physician learns that before the Stressors had children they enjoyed dancing. They agree to start ballroom dancing again on Saturday nights. In addition, to help loosen tight back and neck muscles and improve flexibility and balance, the physician recommends they rent some yoga videos to try together on Sunday mornings. Mr. Stressor is encouraged to use his personal digital assistant to log daily activities and identify factors that promote or interfere with achieving his PA goals and bring it to his next appointment.


### Adopt a Heart-Healthy Diet

The recently released national hypertension guidelines support the adoption of lifestyle modifications for patients with high blood pressure, noting the enhanced results in blood pressure reduction achieved with combination programs, such as exercise and the Dietary Approaches to Stop Hypertension (DASH) diet [36]. Mr. Stressor agrees to increase his consumption of fruits, vegetables, and high-fiber foods and reduce saturated fat intake (ie, meats and full-fat dairy). This goal also is communicated with his wife, as she is primarily responsible for meal preparation. Mr. Stressor agrees to have 2 fruits or vegetables prepared in a "heart-healthy" manner with every meal and will pack 1 piece of fresh fruit to snack on at work each day. The recommended increase in fruit and vegetable consumption should help Mr. Stressor increase his plasma antioxidant levels and decrease his blood pressure [37]. In addition, the exercise program should help him meet his dietary goals, as adults with higher fitness levels also tend to consume diets that more closely approach national recommendations for fat, saturated fat, cholesterol, and fiber [38].

### Reduce Smoking

Mr. Stressor believes he lacks the will power necessary to quit smoking at this time, especially with all the lifestyle changes to which he has agreed. Instead, he agrees to cut back from 1 pack to 3/4 pack per day, not smoke for 30 minutes before or after his daily walks, and search the internet for information about smoking cessation programs.

### Follow-up

 Six months later, Mr. Stressor reports that his diet has improved, the morning walk has become a ritual, and interval walks are attempted at least 3 evenings a week. Occasionally, he wears a pedometer throughout an entire day to see if he comes close to the "10,000 step a day" goal set by the U.S. Surgeon General's "Shape Up America!" program ([www.shapeup.org](http://www.shapeup.org)) [39]. His systolic blood pressure has decreased 4 mm Hg and his lipid panel reveals a 6% LDL decrease, 9% triglyceride decrease, and 7% HDL increase.

Exercise was found to be a more positive experience than Mr. Stressor had anticipated, although they did not find a yoga video that they liked. To encourage stretching and



**PHYSICAL ACTIVITY Rx**



As your partner in health, I strongly recommend that you accumulate a total of 30 minutes of physical activity throughout your day on most, if not all, days of the week.

Start slow. Walking or spending more time doing activities you enjoy with others is a great place to start.

**YOUR PHYSICAL ACTIVITY PRESCRIPTION:**

	How Often	How Much
<input type="checkbox"/> Walk or wheel	_____	_____
<input type="checkbox"/> Walk stairs	_____	_____
<input type="checkbox"/> Dance fast	_____	_____
<input type="checkbox"/> Bicycle	_____	_____
<input type="checkbox"/> Swim	_____	_____
<input type="checkbox"/> Work in the garden	_____	_____
<input type="checkbox"/> Walk the dog	_____	_____
<input type="checkbox"/> Other activity	_____	_____

Start date: \_\_\_\_\_

Patient  \_\_\_\_\_

Health care provider  \_\_\_\_\_

**Figure.** Exercise prescription note that clinicians can give their patients to underscore the importance of regular physical activity (reprinted with permission from Massachusetts Department of Public Health, Nutrition and Physical Activity Unit).

balance exercises, the physician suggests structured classes at a local gym or senior center. Mr. Stressor agrees to try an 8-week Pilates class at the gym. The physician also suggests substituting gym-based PRT for walks 3 days per week to further improve muscular endurance and attenuate heart rate and blood pressure response to a given load [40]. However, Mr. Stressor believes a home-based program with instruction from a certified trainer once per week and other sessions on his own would offer the flexibility he needs given his hectic schedule. Mr. Stressor understands that if business constraints limit time, PRT sessions twice per week including upper and lower body can still yield significant strength and lean mass improvements.

- **What strategies are helpful for improving exercise adoption and adherence?**

Exercise prescription requires a collaborative effort on the part of the health professional and patient. For long-term sustainability, the prescription needs to be individualized, taking into consideration the patient’s health status, activity history and preferences, time availability, and resources (equipment and facilities or financial resources available to purchase equipment). To increase likelihood of compliance, patients should (1) understand how exercise impacts health, (2) recognize obstacles to exercise, (3) have an interest in beginning a program (readiness), (4) be able to identify activities they are willing to try, and (5) have the knowledge required to safely perform the exercise prescription. As with smoking cessation [41], clinicians should periodically counsel patients about PA, especially those who remain sedentary.

Once an exercise prescription has been generated, specific recommendations and clear instructions for increasing PA are required. Given that only a small fraction of auditory messages are retained, written exercise prescriptions using a

prescription pad can help emphasize the vital nature of the message. The Massachusetts Department of Public Health has generated its own version of an exercise prescription contract to be signed by both physician and patient (Figure). Continued advice, educational materials, telephone calls, and behavioral counseling provided by members of the medical team foster sustained lifestyle behaviors, especially in female patients [42].

### CONCLUSION

Effective exercise programs specify the appropriate mode, intensity, duration, and frequency of training. Work load progression is addressed by monitoring and periodically increasing the activity demands to meet fitness level improvements. Periodization is accomplished by varying the program intensity and activities in response to daily variations in health and energy level and within monthly cycles to maintain interest and reduce the likelihood of injury. Encouraging exercise may include negotiating limits on sedentary activities, such as television watching and computer time. Support networks within the family and community are key to continuous incorporation of PA.

American seniors are the demographic group at the highest risk for inactivity [1] and may benefit most from exercise, yet have the least access to PA information and programming. The message that improvements in fitness and weight are able to modify risk factors and even treat certain diseases remains unclear to the lay person. The economic ramifications are enormous, with the annual cost of inactivity and obesity in the United States estimated to be between \$24 and \$76.6 billion [43,44]. While having healthier elders would decrease burdens on the health care system, the rate of physician counseling regarding exercise remains low nationally [45], with the majority of counseling offered as secondary prevention. The physician's opinion carries substantial weight [28], both with patients and with community planning committees. Emphatic support of the benefits of exercise and healthy eating cannot be underestimated. A strong, clear voice supporting initiatives that encourage increased PA across all age-groups is needed to reverse the American trends toward obesity, inactivity, and uncontested functional decline in aging.

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	Strongly Agree		Strongly Disagree		
	5	4	3	2	1
I was provided with new information pertinent to my practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I reaffirmed a specific skill or knowledge.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
This article will help with clinical decision making.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relevant clinical outcomes are addressed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The case is communicated in a manner that kept my interest.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The case presentation is realistic and effective.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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My attitude about this topic changed in some way.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional comments: \_\_\_\_\_  
\_\_\_\_\_

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As a result of reading this case study, I . . .

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