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## Physical Activity and Public Health in Older Adults Recommendation From the American College of Sports Medicine and the American Heart Association

Miriam E. Nelson, PhD, FACSM; W. Jack Rejeski, PhD; Steven N. Blair, PED, FACSM, FAHA;  
Pamela W. Duncan, PhD; James O. Judge, MD; Abby C. King, PhD, FACSM, FAHA;  
Carol A. Macera, PhD, FACSM; Carmen Castaneda-Sceppa, MD, PhD

**Objective**—To issue a recommendation on the types and amounts of physical activity needed to improve and maintain health in older adults.

**Participants**—A panel of scientists with expertise in public health, behavioral science, epidemiology, exercise science, medicine, and gerontology.

**Evidence**—The expert panel reviewed existing consensus statements and relevant evidence from primary research articles and reviews of the literature. Process: After drafting a recommendation for the older adult population and reviewing drafts of the Updated Recommendation from the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) for Adults, the panel issued a final recommendation on physical activity for older adults.

**Summary**—The recommendation for older adults is similar to the updated ACSM/AHA recommendation for adults, but has several important differences including: the recommended intensity of aerobic activity takes into account the older adult's aerobic fitness; activities that maintain or increase flexibility are recommended; and balance exercises are recommended for older adults at risk of falls. In addition, older adults should have an activity plan for achieving recommended physical activity that integrates preventive and therapeutic recommendations. The promotion of physical activity in older adults should emphasize moderate-intensity aerobic activity, muscle-strengthening activity, reducing sedentary behavior, and risk management. (*Circulation*. 2007;116:1094-1105.)

**Key Words:** older adults ■ physical activity ■ benefits ■ risks ■ health

In 1995 the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) published a preventive recommendation that "Every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week" (46). Subsequently, ACSM and the American Heart Association (AHA), in a companion paper (25) to the present article, provide an update to this recommendation. The update is more inclusive and provides recommendations for moderate-intensity aerobic activity, vigorous-intensity aerobic activ-

ity, and muscle-strengthening activity. It states explicitly that many adults should exceed the minimum recommended amount of activity. In considering an update of the 1995 recommendation, ACSM deemed it appropriate to issue a separate recommendation for older adults (men and women age  $\geq 65$  yr and adults age 50 to 64 yr with clinically significant chronic conditions and/or functional limitations). Issues naturally arise about how to apply a recommendation intended mainly for the generally healthy adult population to older adults, who commonly have chronic medical

The first two authors were co-chairs of the expert panel; the other coauthors were members of the expert panel and are listed alphabetically.

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conditions, low fitness levels, and/or functional limitations. In addition, the amount of scientific information on physical activity in older adults has grown rapidly. For example, a recent meta-analysis located 66 randomized trials of resistance exercise as the sole form of exercise for older adults (35). Older Americans are the least physically active of any age group (13) and generate the highest expenditures for medical care. Older Americans have been the most rapidly growing age group, yet more rapid growth in this group will occur in the next 20–30 yr when millions of baby boomers turn 65. The feasibility of attaining higher levels of physical activity in the population of older adults is encouraging in that recent trends, albeit modest, are on the upswing (14). It is possible that increasing levels of activity could reduce medical expenditures in this group within a year or so of the onset of behavior change (41).

The objectives of this article are to 1) provide a preventive recommendation on physical activity for older adults that consists of the updated ACSM/AHA recommendation for adults with additions and modifications appropriate for older adults; 2) explain and clarify the additions and modifications; and 3) discuss the promotion of physical activity in older adults so as to provide guidance about appropriate types and amounts of physical activity.

## EXPERT PANEL PROCESS

In 1999, an expert panel was convened with the assistance and support of the International Life Sciences Institute (<http://www.ils.org>). The panel had expertise in public health, behavioral science, epidemiology, exercise science, medicine, and gerontology. The panel was initially charged with issuing a comprehensive preventive recommendation on physical activity for older adults that addressed aerobic, muscle-strengthening, flexibility, and balance activities, as well as the promotion of physical activity. The panel was instructed to base its recommendation on a review of primary research articles, literature reviews, existing preventive recommendations, and therapeutic recommendations. (Selected therapeutic recommendations are shown in Table 1.)

Panel members wrote background papers addressing components of the proposed recommendation, using their judgment to develop a strategy for locating and analyzing relevant evidence. The panelists relied as appropriate on earlier reviews of evidence, without repeating them. The panel did not undertake a full review of the evidence of the benefits of aerobic activity in the older population, because previous evidence-based recommendations for aerobic activity applied to all adults (61). But the panel considered whether modifications or clarifications were needed when applying these recommendations to older adults who commonly have chronic diseases, low fitness levels and/or functional limitations. Recommendations for muscle-

strengthening exercises, which applied to older adults, had also been issued by the 1990s (61). In 2001, a consensus statement dealt with the role of balance exercise in preventing falls among older adults (7). In that same year, an extensive evidence summary and consensus statement was published from a CDC/Health Canada Expert Panel meeting entitled “Dose-Response Aspects of Physical Activity and Health” (30). Three years earlier, ACSM had published positions stands for older adults (39) and for healthy adults (5), and ACSM regularly updated its guidelines for exercise prescription (20). Late in the process, the panel had access to draft conclusions of an expert panel convened by the University of Illinois at Chicago that had reviewed the evidence on the health effects of physical activity in older adults.

The background papers developed by the expert panel were discussed and critiqued by all members of the panel. In 2001, following regular discussions, the panel completed a draft of a preventive recommendation. Shortly thereafter, ACSM/AHA agreed to update the 1995 CDC/ACSM recommendation for adults. Issuing a separate older adult recommendation had the risk of causing confusion, if it was not consistent with the updated adult recommendation. Hence, the panel was given a revised charge of issuing an older adult recommendation, which was consistent with the updated recommendation for adults. Both recommendations would be issued simultaneously.

Given drafts of an update to the 1995 recommendation for adults, in 2004 the panel on older adults synthesized a companion recommendation. Manuscripts describing both recommendations were circulated for comments, revised, and edited for consistency, prior to review and approval by ACSM and AHA.

In its recommendation for older adults, the panel used terms as they are defined conventionally (20,62). With the exception that only exercise is recommended to improve balance, the recommendation uses “physical activity” to indicate that exercise programs are not the only way to meet the recommendation. Additionally, because of its focus on older adults, the text uses the terms impairments, functional limitations, and disability (50). Impairments refer to abnormalities at the level of tissues, organs, and body systems, whereas functional limitations are deficits in the ability to perform discrete tasks such as climbing stairs. Disability on the other hand is a functional limitation expressed in a social context such as the inability to clean one’s home or to shop independently.

## RECOMMENDATION STATEMENT

The following recommendation for older adults describes the amounts and types of physical activity that promote health and prevent disease. The recommendation applies to all adults aged 65+ years, and to adults aged 50–64 with clinically significant chronic conditions or functional limitations that affect movement ability, fitness, or physical activity. For the

TABLE 1. Summary of selected preventive or therapeutic recommendations for aerobic activity, muscle-strengthening activity, flexibility activity, and balance exercises.

Recommendation	Aerobic Activity			Muscle-Strengthening Activity			Flexibility/Balance
	Frequency	Intensity	Duration	Frequency	Number of Exercises	Sets and Repetitions	
Healthy adults, 2007, ACSM/AHA (25) (companion recommendation to 2007 older adult recommendation)	A minimum of 5 d·wk <sup>-1</sup> for moderate intensity, or a minimum of 3 d·wk <sup>-1</sup> for vigorous intensity	Moderate intensity between 3.0 and 6.0 METS; vigorous intensity above 6.0 METS	Accumulate at least 30 min·d <sup>-1</sup> of moderate-intensity activity, in bouts of at least 10 min each; continuous vigorous activity for at least 20 min·d <sup>-1</sup>	At least 2 d·wk <sup>-1</sup>	8–10 exercises involving the major muscle groups	8–12 repetitions	
Older adults, 2007, ACSM/AHA Recommendation (described in present paper)	A minimum of 5 d·wk <sup>-1</sup> for moderate intensity, or a minimum of 3 d·wk <sup>-1</sup> for vigorous intensity	Moderate intensity at 5 to 6 on a 10-point scale; vigorous intensity at 7 to 8 on 10-point scale	Accumulate at least 30 min·d <sup>-1</sup> of moderate-intensity activity, in bouts of at least 10 min each; continuous vigorous activity for at least 20 min·d <sup>-1</sup>	At least 2 d·wk <sup>-1</sup>	8–10 exercises involving the major muscle groups	10–15 repetitions	At least 2 d·wk <sup>-1</sup> flexibility; for those at risk for falls, include exercises to maintain or improve balance
Bone Health and Osteoporosis: A Report of the Surgeon General, 2004 (64)	A minimum of 3 d·wk <sup>-1</sup>	Begin slowly and work up to 60 to 85% of maximal heart rate	Accumulate at least 30 min·d <sup>-1</sup> of moderate-intensity physical activity on most, preferably all, days of the week; those who have been inactive should start with 5–10 min of activity per day	2–3 d·wk <sup>-1</sup> for strength training	A progressive program of weight training that uses all muscle groups	Sufficient intensity to improve muscle strength; increase amount of weight lifted gradually over time	Include balance training in overall exercise program
Older adults, 1999, Health Canada (26)	4–7 d·wk <sup>-1</sup>	Moderate intensity, but may progress to vigorous	Accumulate 30 to 60 min of moderate-intensity activity in bouts of at least 10 min each	2–4 d·wk <sup>-1</sup>		Weights that a person can lift 10 times “before they become too heavy”	Daily flexibility; and balance activities
Coronary artery disease, 2001, American Heart Association (aerobic recommendation) (19)	At least 3 d·wk <sup>-1</sup>	Moderate intensity at 40–60% of HR reserve; vigorous intensity as tolerated at 60–85% of HR reserve	At least 30 min				

(continued on next page)

TABLE 1. (Continued)

Recommendation	Aerobic Activity			Muscle-Strengthening Activity			Flexibility/Balance
	Frequency	Intensity	Duration	Frequency	Number of Exercises	Sets and Repetitions	
Cardiovascular disease, 2000. American Heart Association (flexibility and resistance training recommendation) (49) Hypertension, 2004. ACSM (6)	Most, preferably all days per week	Moderate intensity at 40–60% of $VO_{2max}$ (vigorous intensity acceptable for selected adults)	Accumulate 30–60 min·d <sup>-1</sup> of moderate-intensity activity in bouts of at least 10 minutes each	2–3 d·wk <sup>-1</sup>	8–10 exercises involving the major muscle groups	1 set of 8–15 reps (may progress to >1 set)	2–3 d·wk <sup>-1</sup> flexibility
Type 2 diabetes, 2004. American Diabetes Association (64)	At least 3 d·wk <sup>-1</sup> with no more than 2 consecutive days without activity	Moderate intensity at 50–70% of $HR_{max}$ ; vigorous intensity at >70% of $HR_{max}$	At least 150 min·wk <sup>-1</sup> of moderate-intensity and/or at least 90 min·wk <sup>-1</sup> of vigorous intensity	3 d·wk <sup>-1</sup>	All major muscle groups	Progress to 3 sets of 8–10 reps; use a weight that cannot be lifted >8–10 times	Flexibility regarded as beneficial
Cholesterol, 2001. National Cholesterol Education Program (66) recommended physical activity as in 2000 Dietary Guidelines (65)	Most days of the week, preferably daily	Moderate intensity	At least 30 min·d <sup>-1</sup>	Muscle-strengthening activities recommended as beneficial			
Stroke, 2004. American Heart Association (23)	3–7 d·wk <sup>-1</sup>	50–80% of $HR_{max}$	20–60 min/session (or multiple 10 min sessions)	2–3 d·wk <sup>-1</sup>	8–10 exercises involving the major muscle groups	1–3 sets of 10–15 reps	2–3 d·wk <sup>-1</sup> flexibility
Osteoarthritis, 2001. American Geriatrics Society (8)	3–5 d·wk <sup>-1</sup>	50–60% of $HR_{max}$	Begin with 20–30 min·d <sup>-1</sup> (if possible) and progress as appropriate	2–3 d·wk <sup>-1</sup> for isotonic resistance exercises (isometric exercises also recommended)	8–10 isotonic exercises involving the major muscle groups (isometric exercises also recommended)	6–15 reps of isotonic exercises, depending upon intensity; begin with one set and progress as appropriate	3–5 d·wk <sup>-1</sup> flexibility

Abbreviations: ACSM, American College of Sports Medicine;  $HR_{max}$ , maximal heart rate; HR reserve, heart rate reserve;  $VO_{2max}$ , maximal aerobic capacity; Reps, repetitions. Note: Only one indicator of aerobic intensity is provided in the table, even if the recommendation provided several (comparable) indicators. Some recommendations were for strength-training activity rather than exercise per se. For comparability, when sufficient information was provided in the recommendation, recommendations for muscle-strengthening activity were all summarized in the form of an exercise program that specifies number of sets and number of repetitions per set of the movement performed against resistance.

purposes of this recommendation, a chronic condition is “clinically significant” if a person receives (or should receive) regular medical care and treatment for it. A functional limitation is “clinically significant” if it impairs the ability to engage in physical activity. Thus, adults age 50–64 with chronic conditions that do not affect their ability to be active (e.g., controlled hypertension) would follow the adult recommendation (25). The parts of the recommendation below that are not italicized repeat the recommendation for adults, meaning these parts apply to all adults; the italicized parts are specific for older adults. Classification of recommendations and level of evidence are expressed in American College of Cardiology/American Heart Association (ACC/AHA) format as defined in Table 2 and the *Methodology Manual for ACC/AHA Guideline Writing Committees* (3).

*Regular physical activity, including aerobic activity and muscle-strengthening activity, is essential for healthy aging. This preventive recommendation specifies how older adults, by engaging in each recommended type of physical activity, can reduce the risk of chronic disease, premature mortality, functional limitations, and disability.*

**Aerobic activity.** To promote and maintain health, older adults need moderate-intensity aerobic physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic activity for a minimum of 20 min on three days each week. [I (A)] Also, combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. [IIa (B)] *Moderate-intensity aerobic activity involves a moderate level of effort relative to an individual’s aerobic fitness. On a 10-point scale, where sitting is 0 and all-out effort is 10, moderate-intensity activity is a 5 or 6 and produces noticeable increases in heart rate and breathing. On the same scale, vigorous-intensity activity is a 7 or 8 and produces large increases in heart rate and breathing. For example, given the heterogeneity of fitness levels in older adults, for some older adults a moderate-intensity walk is a slow walk, and for others it is a brisk walk.* This recommended amount of aerobic activity is in addition to routine activities of daily living of light-intensity (e.g., self care, cooking, casual walking or shopping) or moderate-intensity activities lasting less than 10 min in duration (e.g., walking around home or office, walking from the parking lot).

**Muscle-strengthening activity.** To promote and maintain health and physical independence, older adults will

benefit from performing activities that maintain or increase muscular strength and endurance for a minimum of two days each week. [IIa (A)] It is recommended that 8–10 exercises be performed on two or more nonconsecutive days per week using the major muscle groups. *To maximize strength development, a resistance (weight) should be used that allows 10–15 repetitions for each exercise. The level of effort for muscle-strengthening activities should be moderate to high. On a 10-point scale, where no movement is 0, and maximal effort of a muscle group is 10, moderate-intensity effort is a 5 or 6 and high-intensity effort is a 7 or 8.* Muscle-strengthening activities include a progressive-weight training program, weight bearing calisthenics, and similar resistance exercises that use the major muscle groups.

**Benefits of greater amounts of activity.** Participation in aerobic and muscle-strengthening activities above minimum recommended amounts provides additional health benefits and results in higher levels of physical fitness. [I (A)] *Older adults should exceed the minimum recommended amounts of physical activity if they have no conditions that preclude higher amounts of physical activity, and they wish to do one or more of the following; (a) improve their personal fitness, (b) improve management of an existing disease where it is known that higher levels of physical activity have greater therapeutic benefits for the disease, and/or (c) further reduce their risk for premature chronic health conditions and mortality related to physical inactivity.* In addition, to further promote and maintain skeletal health, older adults should engage in extra muscle strengthening activity and higher-impact weight-bearing activities, as tolerated. [IIa (B)] To help prevent unhealthy weight gain, some older adults may need to exceed minimum recommended amounts of physical activity to a point that is individually effective in achieving energy balance, while considering diet and other factors that affect body weight. [IIa (B)]

**Flexibility activity.** *To maintain the flexibility necessary for regular physical activity and daily life, older adults should perform activities that maintain or increase flexibility on at least two days each week for at least 10 min each day.* [IIb (B)]

**Balance exercise.** *To reduce risk of injury from falls, community-dwelling older adults with substantial risk of falls (e.g., with frequent falls or mobility problems) should perform exercises that maintain or improve balance.* [IIa (A)]

TABLE 2. ACC/AHA approach to assigning the classification of recommendations and level of evidence.

Classifications of recommendation (COR) I, II, and III are used to summarize indications (suggested phrases for writing recommendations)

**Class I:** Conditions for which there is evidence and/or general agreement that a given procedure or treatment is useful and effective (should; is recommended; is indicated; is useful/effective, beneficial)

**Class II:** Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment

IIa: Weight of evidence/opinion is in favor of usefulness/efficacy (is reasonable; can be useful, effective or beneficial; is probably recommended or indicated)

IIb: Usefulness/efficacy is less well established by evidence/opinion (may/might be considered, may/might be reasonable, usefulness/effectiveness is unknown, unclear/uncertain or not well established)

**Class III:** Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful (is not recommended; is not indicated; should not; is not useful/effective, beneficial; may be harmful)

Levels of evidence (LOE) for individual class assignments (with suggested language to be used with each level)

A: Data derived from multiple randomized clinical trials

B: Data derived from a single randomized trial or from nonrandomized studies

C: Consensus opinion of experts

**Integration of preventive and therapeutic recommendations.** *Older adults with one or more medical conditions for which physical activity is therapeutic should perform physical activity in the manner that effectively and safely treats the condition(s). [IIa (A)] So as to prevent other conditions from developing, older adults should also perform physical activity in the manner recommended for prevention as described herein. When chronic conditions preclude activity at minimum recommended levels for prevention, older adults should engage in regular physical activity according to their abilities and conditions so as to avoid sedentary behavior.*

**Activity plan.** *Older adults should have a plan for obtaining sufficient physical activity that addresses each recommended type of activity. [IIa (C)] In addition, to specifying each type of activity, care should be taken to identify, how, when, and where each activity will be performed. Those with chronic conditions for which activity is therapeutic should have a single plan that integrates prevention and treatment. For older adults who are not active at recommended levels, plans should include a gradual (or stepwise) approach to increase physical activity over time using multiple bouts of physical activity ( $\geq 10$  min) as opposed to continuous bouts when appropriate. Many months of activity at less than recommended levels is appropriate for some older adults (e.g., those with low fitness) as they increase activity in a stepwise manner. Older adults should also be encouraged to self-monitor their physical activity on a regular basis and to re-evaluate plans as their abilities improve or as their health status changes.*

## BENEFITS OF REGULAR PHYSICAL ACTIVITY IN OLDER ADULTS

The benefits of regular physical activity in older adults are extensive. As noted in the adult recommendation (25), regular physical activity reduces risk of cardiovascular disease, thromboembolic stroke, hypertension, type 2 diabetes mellitus, osteoporosis, obesity, colon cancer, breast cancer, anxiety, and depression. Of particular importance to older adults, there is substantial evidence that physical activity reduces risk of falls and injuries from falls (7), prevents or mitigates functional limitations (30,31,37,44), and is effective therapy for many chronic diseases. Clinical practice guidelines identify a substantial therapeutic role for physical activity in coronary heart disease (19,49,59), hypertension (6,15,59), peripheral vascular disease (42), type 2 diabetes (54), obesity (66), elevated cholesterol (21,59), osteoporosis (22,64), osteoarthritis (4,8), claudication (57), and chronic obstructive pulmonary disease (47). Clinical practice guidelines identify a role for physical activity in the management of depression and anxiety disorders (11), dementia (17), pain (2), congestive heart failure (51), syncope (10), stroke (23), prophylaxis of venous thromboembolism (53), back pain (24), and constipation (38). There is some evidence that physical

activity prevents or delays cognitive impairment (1,34,67) and disability (31,48,55,60), and improves sleep (32,56).

The 2001 consensus statement on the dose-response relationship between physical activity and health applies to all adults (though the statement notes that the effect of age on dose-response relationships has not been carefully studied) (30). As an example of studies providing evidence of a dose-response relationship in older adults, at least 33 of 44 papers that provided data on the dose-response relationship between physical activity and all cause mortality either recruited adults age 65 and over, or followed cohorts of adults over time until a substantial percentage were age 65 and over at the end of follow-up (28,36).

The recommendation for older adults states that greater volumes of aerobic activity help prevent unhealthy weight gain. The dose-response consensus panel found evidence that increased levels of physical activity are associated with prevention of weight gain, but the nature of the dose-response relationship was unclear, and in general there was insufficient information on whether age modified dose-response relationships (30). The recommendation in the 2005 Dietary Guidelines that additional physical activity helps prevent unhealthy weight gain applies to older adults (65).

## DIFFERENCES BETWEEN THE OLDER ADULT AND ADULT RECOMMENDATIONS

**Definition of aerobic intensity.** The adult recommendation defines aerobic intensity in absolute terms, e.g., moderate intensity comprises 3.0 to 6.0 MET activities. A different definition of aerobic intensity is appropriate for older adults, because fitness levels can be low. For example, performing 3.0 to 6.0 MET activities either requires relatively vigorous effort or is impossible for older adults with low fitness. The older adult recommendation defines aerobic intensity as relative to fitness, in the manner of an exercise prescription. For aerobic exercise, ACSM recommends a target intensity of 50–85% of oxygen uptake reserve—a range that includes both moderate and vigorous exercise (20). If oxygen reserve is measured on a 10 point scale, then moderate intensity begins at around “5” (50%), and the range of vigorous intensity does not quite reach “9” (90%). Simply telling older adults that their perceived effort during activity should be 5–6 (or 7–8) on a 10-point scale may not achieve the desired level of effort. Subjective perception of effort is related to objectively measured level of effort, but not linearly (9). When there is concern an adult will not engage in activity at the desired intensity, a period of supervised exercise can help the adult learn the desired level of effort.

**Muscle-strengthening activities.** The recommendation specifies the intensity (level of effort) of activities that maintain and increase muscle strength. For adults generally, ACSM recommends resistance training of moderate intensity (20). High intensity training is an option for older adults, preferably in supervised settings or in adults

with sufficient fitness, experience, and knowledge of resistance exercise. Historically, people have increased and maintained their strength through purposeful physical activity, such as manual labor on a farm. Today, older adults will commonly elect to meet the muscle-strengthening recommendation through exercise programs involving such activities as weight bearing calisthenics or progressive weight training. For resistance exercise, ACSM recommends performing at least one set of repetitions for 8–10 exercises that train the major muscle groups, and recommends exercise for each muscle group occur on two or three nonconsecutive days each week (20). Experts recommend 10 to 15 (as opposed to 8–12) repetitions per set for older adults (20).

**Flexibility activities.** Flexibility activity is recommended to maintain the range of motion necessary for daily activities and physical activity. Unlike aerobic and muscle strengthening activities, specific health benefits of flexibility activities are unclear. For example, it is not known if flexibility activities reduce risk of exercise-related injury (58). In addition, few studies have documented the age-related loss of range of motion in healthy older adults. However, flexibility exercises have been shown to be beneficial in at least one randomized trial and are recommended in the management of several common diseases in older adults (Table 1) (33). At least 10 min of flexibility activities is recommended based upon the time required for a general stretching routine involving major muscle and tendon groups with 10–30 s for a static stretch and 3–4 repetitions for each stretch (20). Preferably, flexibility activities are performed on all days that aerobic or muscle-strengthening activity is performed.

**Balance exercise.** The recommendation for balance exercise is consistent with a clinical practice guideline published in 2001 (7). In community-living older adults at risk for falls (e.g., with frequent falls or mobility problems), multi-component interventions that include regular physical activity are effective in preventing falls (7). Physical activity, by itself, may reduce falls and fall injuries as much as 35–45% (52). Because research has focused on balance exercise rather than balance activity (e.g., dancing), only exercise is currently recommended (7). The preferred types, frequency, and duration of balance training are unclear and not specified in the clinical guideline (7). Balance exercise three times each week is one option, as this approach was effective in a series of four fall prevention studies (52). The recommendation applies only to community-dwelling older adults because of insufficient data in long-term care settings and hospital settings. The guideline for prevention of falls does not specify an age cutoff (7), but there are few data on the effects of physical activity on falls in adults less than age 65.

**Integration of preventive and therapeutic recommendations.** Older adults should perform physical activity in the manner recommended for prevention as described herein. Older adults also commonly have chronic

conditions (Table 3) for which physical activity is therapeutic. Hence, many older adults require an activity plan that integrates preventive and therapeutic recommendations. Integration is facilitated by the fact preventive recommendations are similar to therapeutic recommendations for many common diseases, including coronary artery disease, hypertension, type 2 diabetes, stroke, high cholesterol, osteoporosis, and/or osteoarthritis (Table 1). In adults with no activity limitations, the activity plan specifies aerobic, muscle-strengthening, and flexibility activities (and possibly balance exercise), with types and amounts that meet both preventive and therapeutic recommendations. To illustrate combining recommendations, an activity recommendation for a person with osteoporosis would start with the preventive recommendation for aerobic, muscle strengthening, and balance activities, but emphasize weight bearing activities, and add high impact activities like jumping for those who tolerate them (64). Adjustments in the activity plan for a person with arthritis of moderate severity could involve in combination with strength training tailoring the number of aerobic activity days to 3–5 as tolerated every other day (8).

It is more challenging for a person with activity limitations to develop a physical activity plan, which combines preventive and therapeutic recommendations. In 1999, 20% of Medicare enrollees had impairment in IADLs (instrumental activities of daily living) or ADLs (activities of daily living) or were institutionalized (18). Inability to walk 2–3 blocks was reported by 14% of men and 23% of women (18). Clearly, a target level of physical activity below that of the typical preventive and therapeutic recommendations in Table 1 is appropriate for a subgroup of older adults. An assessment of the nature of the activity limitation and of the capability and preferences of the person will determine the target activity level and other details of the activity plan. Often the plan will rely on health care and community resources designed for people with activity limitations, such as cardiac rehabilitation and pulmonary rehabilitation centers, and exercise classes specifically designed for adults with arthritis.

TABLE 3. Percent of older adults with selected chronic conditions in 1995 and 2001–2002.

Condition	Age 55–65	Age 65+	Age 65+
	1995	1995	2001–2002
Arthritis	32.8	48.9	n/a
Hypertension	28.9	40.3	50.2
Heart disease	18.0	30.8	31.4
Selected respiratory diseases	13.7	13.8	n/a
Diabetes mellitus	9.7	12.6	15.5
Cerebrovascular disease	2.5	7.1	8.9
Osteoporosis*			
Women		26.1	
Men		3.8	

Note: n/a = not available; selected respiratory diseases include chronic bronchitis, asthma, and emphysema. Percents for 1995 are based on self-reported data from National Health Interview Survey (16). Percents for 2001–2002 are based on self-reported data from National Health Interview Survey (18).

\*Data for osteoporosis are from examinations conducted in 1988–1994 and are cited in the Surgeon General's report *Bone Health and Osteoporosis* (64).

**Need for an activity plan.** An activity plan identifies recommended levels of physical activity for a specific person and describes how the person intends to meet them. It is recommended that older adults with chronic conditions develop an activity plan in consultation with a health care provider so that the plan adequately takes into account therapeutic and risk management issues related to chronic conditions. The plan should be tailored according to chronic conditions and activity limitations, risk for falls, individual abilities and fitness, strategies for minimizing risks of activity, strategies for increasing activity gradually over time (if the person is not active at recommended levels), behavioral strategies for adhering to regular physical activity, and individual preferences. Healthy, asymptomatic older adults without chronic conditions should also develop an activity plan, preferably in consultation with a health care provider or fitness professional, so as to take advantage of expertise and resources on physical activity and injury prevention. This recommendation reframes the common advice to consult a health care provider before starting to increase physical activity. Health provider consultation regarding physical activity should occur regardless of whether an adult currently plans to increase physical activity, as it is part of the ongoing process of promoting physical activity that should occur in geriatric medicine. This recommendation is consistent with a recently developed quality of care measure for older adults that measures whether older adults discuss physical activity with a health care provider at least once a year (43).

**AREAS OF EMPHASIS IN PROMOTING PHYSICAL ACTIVITY IN OLDER ADULTS**

With sufficient skill, experience, fitness, and training, older adults can achieve high levels of physical activity. The promotion of physical activity in older adults should avoid ageism that discourages older adults from reaching their potential. At the same time, it is difficult or impossible for some older adults to attain high levels of activity. Several areas should be emphasized in promoting physical activity in older adults as described below.

**Reducing sedentary behavior.** There is substantial evidence that older adults who do less activity than recommended still achieve some health benefits. Such evidence is consistent with the scientific consensus for a continuous dose-response relationship between physical activity and health benefits (30). For example, lower risks of cardiovascular disease have been observed with just 45–75 min of walking per week (40).

**Increasing moderate activity and giving less emphasis to attaining high levels of activity.** Realistic goals for aerobic activity will commonly be in the range of 30–60 min of moderate-intensity activity a day, as illustrated by the Health Canada recommendation for older adults (26) (Table 1). Vigorous activity has higher risk of injury and lower adherence (20). Age-related loss of fitness, chronic

diseases, and functional limitations act as barriers to attaining high levels of activity. Vigorous activity and/or high levels of activity are appropriate for selected older adults with sufficient fitness, experience, and motivation.

**Taking a gradual or stepwise approach.** The standard advice to increase physical activity gradually over time is highly appropriate and particularly important for older adults. This advice minimizes risk of overuse injury, makes increasing activity more pleasant, and allows positive reinforcement for small steps that lead to attainment of intermediate goals. It can be appropriate for older adults to spend a long time at one step (e.g., attending exercise classes two or three days a week) so as to gain experience, fitness, and self-confidence. Very deconditioned older adults may need to exercise initially at less effort than a “5” on a

TABLE 4. Summary of physical activity recommendations for older adults – 2007.

1. To promote and maintain good health, older adults should maintain a physically active lifestyle. I (A)
2. They should perform moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic activity for a minimum of 20 min on three days each week. I (A) Moderate-intensity aerobic activity involves a moderate level of effort relative to an individual's aerobic fitness. On a 10-point scale, where sitting is 0 and all-out effort is 10, moderate-intensity activity is a 5 or 6 and produces noticeable increases in heart rate and breathing. On the same scale, vigorous-intensity activity is a 7 or 8 and produces large increases in heart rate and breathing. For example, given the heterogeneity of fitness levels in older adults, for some older adults a moderate-intensity walk is a slow walk, and for others it is a brisk walk.
3. Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. IIa (B) These moderate- or vigorous intensity activities are in addition to the light intensity activities frequently performed during daily life (e.g., self care, washing dishes) or moderate-intensity activities lasting 10 min or less (e.g., taking out trash, walking to parking lot at store or office).
4. In addition, at least twice each week older adults should perform muscle strengthening activities using the major muscles of the body that maintain or increase muscular strength and endurance. IIa (A) It is recommended that 8–10 exercises be performed on at least two nonconsecutive days per week using the major muscle groups. To maximize strength development, a resistance (weight) should be used that allows 10–15 repetitions for each exercise. The level of effort for muscle-strengthening activities should be moderate to high.
5. Because of the dose-response relationship between physical activity and health, older persons who wish to further improve their personal fitness, reduce their risk for chronic diseases and disabilities, or prevent unhealthy weight gain will likely benefit by exceeding the minimum recommended amount of physical activity. I (A)
6. To maintain the flexibility necessary for regular physical activity and daily life, older adults should perform activities that maintain or increase flexibility on at least two days each week for at least 10 min each day. IIb (B)
7. To reduce risk of injury from falls, community-dwelling older adults with substantial risk of falls should perform exercises that maintain or improve balance. IIa (A)
8. Older adults with one or more medical conditions for which physical activity is therapeutic should perform physical activity in a manner that effectively and safely treats the condition(s). IIa (A)
9. Older adults should have a plan for obtaining sufficient physical activity that addresses each recommended type of activity. IIa (C) Those with chronic conditions for which activity is therapeutic should have a single plan that integrates prevention and treatment. For older adults who are not active at recommended levels, plans should include a gradual (or stepwise) approach to increase physical activity over time. Many months of activity at less than recommended levels is appropriate for some older adults (e.g., those with low fitness) as they increase activity in a stepwise manner. Older adults should also be encouraged to self-monitor their physical activity on a regular basis and to reevaluate plans as their abilities improve or as their health status changes.

10-point scale and may need to perform activity in multiple bouts ( $\geq 10$  min) rather than in a single continuous bout (20). In addition, activity plans need to be reevaluated when there are changes in health status.

#### **Performing muscle-strengthening activity and engaging in all recommended types of activity.**

Muscle-strengthening activity is particularly important in older adults, given its role in preventing age-related loss of muscle mass (60), bone (44), and its beneficial effects on functional limitations (30,31,35,55,60). Currently, only about 12% of older adults perform muscle-strengthening activities at least twice a week (63).

**Sustaining emphasis on individual-level and community-level approaches.** As with younger adults, promotion of physical activity in older adults relies upon both individual and community approaches that are evidence-based and reflect theory and research on behavior change. For example, the Task Force on Community Preventive Services has recommended or strongly recommended several community-level interventions as effective in promoting physical activity, such as interventions to increase access to places of physical activity combined with informational outreach (29).

**Using risk management strategies to prevent injury.** Chronic conditions increase risk of activity-related adverse events, e.g., heart disease increases risk of sudden death and osteoporosis increases risk of activity-related fractures. Activity-related musculoskeletal injuries act as a major barrier to regular physical activity (27). While these

considerations lead to more emphasis on risk management, there is insufficient research on effective strategies to prevent injuries. Risk management strategies mainly reflect clinical experience, expert opinion, and legal liability concerns. Evidence that risk management strategies can be effective comes from the observation that published exercise studies routinely implement risk management and serious adverse events in these studies are rare (12,45). However, research studies presumably exclude adults at high risk of injury.

## **CONCLUSION**

Virtually all older adults should be physically active. See Table 4. An older adult with a medical condition for which activity is therapeutic should perform physical activity in a manner that treats the condition. In addition, an older adult with medical conditions should engage in physical activity in the manner that reduces risk of developing other chronic diseases as described above. Given the breadth and strength of the evidence, physical activity should be one of the highest priorities for preventing and treating disease and disablement in older adults. Effective interventions to promote physical activity in older adults deserve wide implementation.

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## **REFERENCES**

1. ABBOTT, R., L. WHITE, G. ROSS, K. MASAKI, J. CURB, and H. PETROVITCH. Walking and dementia in physically capable elderly men. *JAMA* 292(12):1447–1453, 2004.
2. AGS PANEL ON PERSISTENT PAIN IN OLDER PERSONS. The management of persistent pain in older persons. *J. Am. Geriatr. Soc.* 50(6 Suppl):S205–S224, 2002.
3. AMERICAN COLLEGE OF CARDIOLOGY/AMERICAN HEART ASSOCIATION. *Methodology Manual for ACC/AHA Guideline Writing Committees*. American College of Cardiology Foundation and the American Heart Association, Inc. 2006.
4. AMERICAN COLLEGE OF RHEUMATOLOGY. Recommendations for the medical management of osteoarthritis of the hip and knee: 2000 update. American College of Rheumatology Subcommittee on Osteoarthritis Guidelines. *Arthritis Rheum.* 43:1905–1915, 2000.
5. AMERICAN COLLEGE OF SPORTS MEDICINE POSITION STAND. The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. *Med. Sci. Sports Exerc.* 30:975–991, 1998.
6. AMERICAN COLLEGE OF SPORTS MEDICINE. Position Stand. Exercise and hypertension. *Med. Sci. Sports Exerc.* 36:533–553, 2004.
7. AMERICAN GERIATRICS SOCIETY, BRITISH GERIATRICS SOCIETY, AND AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS PANEL ON FALLS PREVENTION. Guideline for the prevention of falls in older persons. *J. Am. Geriatr. Soc.* 49:664–672, 2001.
8. AMERICAN GERIATRICS SOCIETY. Exercise prescription for older adults with osteoarthritis pain: consensus practice recommendations. A supplement to the AGS Clinical Practice Guidelines on the management of chronic pain in older adults. *J. Am. Geriatr. Soc.* 49:808–823, 2001.
9. BORG, G. Psychophysical bases of perceived exertion. *Med. Sci. Sports Exerc.* 14:377–381, 1982.
10. BRIGNOLE, M., P. ALBONI, D. BENDITT, et al. Guidelines on management (diagnosis and treatment) of syncope. *Eur. Heart J.* 22:1256–1306, 2001.
11. BROSSE, A., E. SHEETS, H. LETT, and J. BLUMENTHAL. Exercise and the treatment of clinical depression in adults: recent findings and future directions. *Sports Med.* 32:741–760, 2002.
12. BUCHNER, D., and E. COLEMAN. Exercise considerations in older adults: intensity, fall prevention, and safety. *Phys. Med. Rehabil. Clin. N. Am.* 5:357–375, 1994.
13. CENTERS FOR DISEASE CONTROL AND PREVENTION. Prevalence of physical activity, including lifestyle activities among adults - United States, 2000–2001. *MMWR* 52:764–769, 2003.
14. CENTERS FOR DISEASE CONTROL AND PREVENTION. Prevalence of no leisure-time physical activity - 35 States and the District of Columbia, 1988–2002. *MMWR* 53:82–86, 2004.
15. CHOBANIAN, A., G. BAKRIS, H. BLACK, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 289:2560–2572, 2003.
16. DESAI, M. M., and P. ZHANG. Surveillance for morbidity and mortality among older adults - United States, 1995–1996. *MMWR: Surveillance Summary* 48(SS-8):7–25, 1999.
17. DOODY, R., J. STEVENS, C. BECK, et al. Practice parameter: management of dementia (an evidence-based review). Report of

- the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology* 56:1154–1166, 2001.
18. FEDERAL INTERAGENCY FORUM ON AGING-RELATED STATISTICS. *Older Americans 2004: Key Indicators of Well-Being. Federal Interagency Forum on Aging-Related Statistics*, Washington, DC: U.S. Government Printing Office, 2004.
  19. FLETCHER, G., G. BALADY, E. AMSTERDAM, et al. Exercise standards for testing and training: a statement for healthcare professionals from the American Heart Association. *Circulation* 104:1694–1740, 2001.
  20. FRANKLIN, B., M. WHALEY, and E. HOWLEY. *ACSM's Guidelines for Exercise Testing and Prescription*. 6th edition. 137–164, 2000.
  21. GELIEBTER, A., M. MAHER, L. GERACE, B. GUTIN, S. HEYMSFIELD, and S. HASHIM. Effects of strength or aerobic training on body composition, resting metabolic rate, and peak oxygen consumption in obese dieting subjects. *Amer. J. Clin. Nutr.* 66:557–563, 1997.
  22. GOING, S., T. LOHMAN, L. HOUTKOOPER, et al. Effects of exercise on bone mineral density in calcium-replete postmenopausal women with and without hormone replacement therapy. *Osteoporos. Int.* 14(8):637–643, 2003.
  23. GORDON, N., M. GULANICK, F. COSTA, et al. Physical activity and exercise recommendations for stroke survivors: an American Heart Association scientific statement from the Council on Clinical Cardiology, Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascular Nursing; the Council on Nutrition, Physical Activity, and Metabolism; and the Stroke Council. *Circulation* 109:2031–2041, 2004.
  24. HAGEN, K., G. HILDE, G. JAMTVEDT, and M. WINNEM. The Cochrane review of advice to stay active as a single treatment for low back pain and sciatica. *Spine* 27:1736–1741, 2002.
  25. HASKELL W. L., I. M. LEE, R. R. PATE, K. E. POWELL, S. N. BLAIR, B. A. FRANKLIN, C. A. MACERA, G. W. HEATH, P. D. THOMPSON, and A. BAUMAN. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med. Sci. Sports Exerc.* 39:1423–1434, 2007.
  26. HEALTH CANADA. *Canada's Physical Activity Guide to Healthy Active Living for Older Adults*. Ottawa, Ontario, Canada, 1999.
  27. HOOTMAN, J., C. MACERA, B. AINSWORTH, C. ADDY, M. MARTIN, and S. BLAIR. Epidemiology of musculoskeletal injuries among sedentary and physically active adults. *Med. Sci. Sports Exerc.* 34:838–844, 2002.
  28. JANSSEN, I., and C. JOLLIFFE. Influence of physical activity on mortality in elderly with coronary artery disease. *Med. Sci. Sports Exerc.* 38:418–423, 2006.
  29. KAHN, E., L. RAMSEY, R. BROWNSON, et al. The effectiveness of interventions to increase physical activity. A systematic review. *Am. J. Prev. Med.* 22(4 Suppl):73–107, 2002.
  30. KESANIEMI, Y., E. DANFORTH Jr, M. JENSEN, P. KOPELMAN, P. LEFEBVRE, and B. REEDER. Dose-response issues concerning physical activity and health: an evidence-based symposium. *Med. Sci. Sports Exerc.* 33(6 Suppl):S351–S358, 2001.
  31. KEYSOR, J. Does late-life physical activity or exercise prevent or minimize disablement? A critical review of the scientific evidence. *Am. J. Prev. Med.* 25(3 Suppl 2):129–136, 2003.
  32. KING, A., R. OMAN, G. BRASSINGTON, D. BLIWISSE, and W. HASKELL. Moderate-intensity exercise and self-rated quality of sleep in older adults. A randomized controlled trial. *JAMA* 277:32–37, 1997.
  33. KING, A., L. PRUIT, W. PHILLIPS, R. OKA, A. RODENBURG, and W. HASKELL. Comparative effects of two physical activity programs on measured and perceived physical functioning and other health-related quality of life outcomes in older adults. *J. Gerontol. A Biol. Sci. Med. Sci.* 55(A):M74–M83, 2000.
  34. LARSON, E., L. WANG, J. BOWEN, et al. Exercise is associated with reduced risk for incident dementia among persons 65 years of age and older. *Ann. Intern. Med.* 144:73–81, 2006.
  35. LATHAM N., ANDERSON C., BENNETT D., STRETTON C. Progressive resistance strength training for physical disability in older people. *Cochrane Database Syst. Rev.* (2):CD002759, 2003.
  36. LEE, I., and P. SKERRETT. Physical activity and all-cause mortality: what is the dose-response relation? *Med. Sci. Sports Exerc.* 33 (6 Suppl):S459–S471, 2001. discussion S93–S94.
  37. LIFE STUDY INVESTIGATORS. Effects of a physical activity intervention on measures of physical performance: results of the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) Study. *J. Gerontol. A Biol. Sci. Med. Sci.* 61A(11):1157–1165, 2006.
  38. PEMBERTON, J., and S. PHILLIPS. American Gastroenterological Association Medical Position Statement: guidelines on constipation. *Gastroenterology* 119:1761–1766, 2001.
  39. LOUCKS, A., M. VERDUN, and E. HEATH. Low energy availability, not stress of exercise, alters LH pulsatility in exercising women. *J. Appl. Physiol.* 84:37–46, 1998.
  40. MANSON, J., P. GREENLAND, A. LACROIX, et al. Walking compared with vigorous exercise for the prevention of cardiovascular events in women. *N. Eng. J. Med.* 347:716–725, 2002.
  41. MARTINSON, B., A. CRAIN, N. PRONK, P. O'CONNOR, and M. MACIOSEK. Changes in physical activity and short-term changes in health care charges: a prospective cohort study of older adults. *Prev. Med.* 37:319–326, 2003.
  42. MCDERMOTT, M., K. LIU, L. FERRUCCI, et al. Physical performance in peripheral arterial disease: a slower rate of decline in patients who walk more. *Ann. Intern. Med.* 144:10–20, 2006.
  43. NATIONAL COMMITTEE FOR QUALITY ASSURANCE. HEDIS 2006, Volume 2: Technical Specifications. 2005.
  44. NELSON, M., J. LAYNE, M. BERNSTEIN, et al. The effects of multi-dimensional home-based exercise on functional performance in elderly people. *J. Gerontol. A Biol. Sci. Med. Sci.* 59A(2):154–160, 2004.
  45. ORY, M., B. RESNICK, P. JORDAN, et al. Screening, safety, and adverse events in physical activity interventions: collaborative experiences from the behavior change consortium. *Ann. Behav. Med.* 29 Suppl:20–28, 2005.
  46. PATE, R., M. PRATT, S. BLAIR, et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 273:402–407, 1995.
  47. PAUWELS, R. A., A. S. BUIST, P. M. CALVERLEY, C. R. JENKINS, and S. S. HURD. GOLD Scientific Committee. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease. NHLBI/WHO Global Initiative for Chronic Obstructive Lung Disease (GOLD) Workshop summary. *Am. J. Respir. Crit. Care Med.* 163:1256–1276, 2001.
  48. PENNINX, B., S. MESSIER, W. REJESKI, et al. Physical exercise and the prevention of disability in activities of daily living in older persons with osteoarthritis. *Arch. Intern. Med.* 161:2309–2316, 2001.
  49. POLLOCK, M., B. FRANKLIN, G. BALADY, et al. AHA Science Advisory. Resistance exercise in individuals with and without cardiovascular disease: benefits, rationale, safety, and prescription: an advisory from the Committee on Exercise, Rehabilitation, and Prevention, Council on Clinical Cardiology, American Heart Association; Position paper endorsed by the American College of Sports Medicine. *Circulation* 101:828–833, 2000.
  50. POPE, A., and A. TARLOV. *Disability in America. Toward a National Agenda for Prevention*, Washington, DC: National Academy Press, pp. 76–108, 1991.
  51. REMME, W., and K. SWEDBERG. Guidelines for the diagnosis and treatment of chronic heart failure. *Eur. Heart J.* 22: 1527–1560, 2001.
  52. ROBERTSON, M., A. CAMPBELL, M. GARDNER, and N. DEVLIN. Preventing injuries in older people by preventing falls: a meta-analysis of individual-level data. *J. Am. Geriatr. Soc.* 50:905–911, 2002.

53. SCOTTISH INTERCOLLEGIATE GUIDELINES NETWORK (SIGN). Prophylaxis of venous thromboembolism. A national clinical guideline. Edinburgh (Scotland), (SIGN publication; no. 62), 2002.
54. SIGAL, R., G. KENNY, D. WASSERMAN, and C. CASTANEDA-SCEPPA. Physical activity/exercise and type 2 diabetes. *Diabetes Care* 27: 2518–2539, 2004.
55. SINGH, M. Exercise to prevent and treat functional disability. *Clin. Geriatr. Med.* 18:431–462, 2002. vi–vii.
56. SINGH, N., K. CLEMENTS, and M. FIATARONE. A randomized controlled trial of the effect of exercise on sleep. *Sleep* 20:95–101, 1997.
57. STEWART, K., W. HIATT, J. REGENSTEINER, and A. HIRSCH. Exercise training for claudication. *N. Engl. J. Med.* 347:1941–1951, 2002.
58. THACKER, S., J. GILCHRIST, D. STROUP, and C. KIMSEY Jr. The impact of stretching on sports injury risk: a systematic review of the literature. *Med. Sci. Sports Exerc.* 36:371–378, 2004.
59. THOMPSON, P., D. BUCHNER, I. L. PIÑA, et al. Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: a statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). *Circulation* 107:3109–3116, 2003.
60. TSENG, B., D. MARSH, M. HAMILTON, and F. BOOTH. Strength and aerobic training attenuate muscle wasting and improve resistance to the development of disability with aging. *J. Gerontol. A Biol. Sci. Med. Sci.* 50 Spec No:113–119, 1995.
61. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. Physical Activity and Health: A Report of the Surgeon General. Atlanta, GA; U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
62. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. Healthy People 2010 2nd edition With Understanding and Improving Health Objectives for Improving Health. 22:22–39, 2000.
63. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. Strength training among adults aged >65 years - United States 2001. *MMWR* 53:25–28, 2004.
64. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. *Bone Health and Osteoporosis: A Report of the Surgeon General*, Rockville, MD: U.S. Department of Health and Human Services, Office of the Surgeon General, 2004.
65. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES AND U.S. DEPARTMENT OF AGRICULTURE. *Dietary Guidelines for Americans, 2005*, 6th, Washington, DC: U.S. Government Printing Office, 2005.
66. U.S. PREVENTIVE SERVICES TASK FORCE. Screening for obesity in adults: recommendations and rationale. *Ann. Intern. Med.* 139: 930–932, 2003.
67. WEUVE, J., J. KANG, J. MANSON, M. BRETILER, J. WARE, and F. GRODSTEIN. Physical activity, including walking, and cognitive function in older women. *JAMA* 292:1454–1461, 2004.

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James O. Judge	University of Connecticut, Evercare	None	None	None	None	None	None
Abby C. King	Stanford University	National Institutes of Health†	None	National Institutes of Health research/scientific panels and task forces*	None	None	None
Carol A. Macera	San Diego State University	None	None	None	None	None	None
Carmen Castaneda-Sceppa	Tufts University	None	None	None	None	None	None

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\*Modest.

†Significant.