

TABLE 7.2**Effects of Aging on Selected Physiologic and Health-Related Variables (107)**

Variable	Change
Resting heart rate	Unchanged
Maximum heart rate	Lower
Maximum cardiac output	Lower
Resting and exercise blood pressure	Higher
Absolute and relative maximum oxygen uptake reserve ($\dot{V}O_{2R_{max}}$ L \cdot min ⁻¹ and mL \cdot kg ⁻¹ \cdot min ⁻¹)	Lower
Residual volume	Higher
Vital capacity	Lower
Reaction time	Slower
Muscular strength	Lower
Flexibility	Lower
Bone mass	Lower
Fat-free body mass	Lower
% Body fat	Higher
Glucose tolerance	Lower
Recovery time	Longer

Older Adults - Exercise Testing

- Most older adults do not require an exercise test prior to initiating a moderate intensity PA program
- If exercise testing is recommended, the associated ECG has higher sensitivity (*i.e.*, ~84%) and lower specificity (*i.e.*, ~70%) than in younger age groups (*i.e.*, <50% sensitivity and >80% specificity), producing a higher rate of false positive outcomes.
- The increased prevalence of cardiovascular, metabolic, and orthopedic problems among older adults increases the overall likelihood of an early test termination.

Older Adults - Exercise Testing (cont.)

- The initial workload should be light (<3 metabolic equivalents [METs]) and workload increments should be small (*i.e.*, 0.5–1.0 MET) for those with low work capacities. The Naughton treadmill protocol is a good example of such a protocol.
- A cycle ergometer may be preferable to a treadmill for those with poor balance, poor neuromotor coordination, impaired vision, impaired gait patterns, weight-bearing limitations, and/or foot problems. However, local muscle fatigue may be a factor for premature test termination when using a cycle ergometer.

Older Adults Exercise Testing (cont.)

- Adding a treadmill handrail support may be required because of reduced balance, decreased muscular strength, poor neuromotor coordination, and fear. However, handrail support for gait abnormalities will reduce the accuracy of estimating peak MET capacity based on the exercise duration or peak workload achieved.
- Treadmill workload may need to be adapted according to walking ability by increasing grade rather than speed.

Older Adults Exercise Testing (cont.)

- Many older adults exceed the age-predicted HR_{max} during a maximal exercise test, which should be taken into account when considering test termination.
- The influence of prescribed medications on the electrocardiographic (ECG) and hemodynamic responses to exercise may differ from usual expectations.

Exercise Testing for the Oldest Segment of the Population

- The oldest segment of the population (≥ 75 yr and individuals with mobility limitations) most likely has one or more chronic medical conditions.
- The likelihood of physical limitations also increases with age.
- The approach to exercise testing described in the previous slides may not be applicable for the oldest segment of the population and for individuals with mobility limitations.

Exercise Testing for the Oldest Segment of the Population (cont.)

- Currently, there is a paucity of evidence demonstrating increased mortality or cardiovascular event risk during exercise or exercise testing in this segment of the population, therefore eliminating the need for exercise testing unless medically indicated (*e.g.*, symptomatic CVD, uncontrolled diabetes).
- Individuals free from CVD symptoms should be able to initiate a light intensity (<3 METs) exercise program without undue risk.

Older Adults Physical Performance

Testing

- Physical performance testing has largely replaced exercise stress testing for the assessment of functional status of older. Most physical performance tests require little space, equipment, and cost; can be administered by lay or health/fitness personnel with minimal training; and are considered extremely safe in healthy and clinical populations

TABLE 7.3

Commonly Used Physical Performance Tests

Measure and Description	Administration Time	Cutpoint Indicative of Lower Function
<p>Senior Fitness Test (101) Seven items: 30 s chair stand, 30 s arm curls, 8 ft up and go, 6-min walk, 2-min step test, sit and reach, and back scratch with normative scales for each test</p>	30 min total Individual items range from 2 to 10 min each	≤25th percentile of age-based norms
<p>Short Physical Performance Battery (56) A test of lower extremity functioning that combines scores from usual gait speed and timed tests of balance and chair stands; scores range from 0 to 12 with higher score indicating better functioning.</p>	10 min	10 points
<p>Usual Gait Speed Usually assessed as the better of two trials of time to walk a short distance (3–10 m) at a usual pace</p>	<2 min	1 m · s ⁻¹
<p>6-Min Walk Test Widely used as an indicator of cardiorespiratory endurance; assessed as the most distance an individual can walk in 6 min. A change of 50 m is considered a substantial change (54).</p>	<10 min	≤25th percentile of age-based norms
<p>Continuous Scale Physical Performance Test (29) Two versions — long and short — are available. Each consists of serial performance of daily living tasks, such as carrying a weighted pot of water, donning and removing a jacket, getting down and up from the floor, climbing stairs, carrying groceries, and others, performed within an environmental context that represent underlying physical domains. Scores range from 0 to 100 with higher scores representing better functioning.</p>	60 min	57 points

Older Adults – Exercise Prescription

- Age should not be a barrier to PA because positive improvements are attainable at any age.
- The relative adaptations to exercise and the percentage of improvement in the components of physical fitness among older adults are comparable with those reported in younger adults and are important for maintaining health and functional ability and attenuating many of the physiologic changes that are associated with aging.

Older Adults Exercise Prescription (cont.)

- Low aerobic capacity, muscle weakness, and deconditioning are more common in older adults than in any other age group and contribute to loss of independence, and therefore an appropriate Ex R_x should include aerobic, muscle strengthening/endurance, and flexibility exercises.
- Individuals who are frequent fallers or have mobility limitations may also benefit from specific neuromotor exercises to improve balance, agility, and proprioceptive training (*e.g.*, Tai Chi), in addition to the other components of health-related physical fitness.

Older Adults Exercise Prescription (cont.)

- An important distinction between older and younger adults should be made relative to intensity.
 - Apparently healthy younger adults - moderate and vigorous intensity PA defined relative to METs (moderate intensity, 3–5.9 METs; vigorous intensity ≥ 6 METs)
 - For older adults, activities should be defined relative to an individual's physical fitness within the context of a perceived 10-point physical exertion scale which ranges from 0 (an effort equivalent to sitting) to 10 (an all out effort), with moderate intensity defined as 5 or 6, and vigorous intensity as ≥ 7 .

FITT ■ **FITT RECOMMENDATIONS FOR OLDER ADULTS** (9,46,85)

	Aerobic	Resistance	Flexibility
Frequency	$\geq 5 \text{ d} \cdot \text{wk}^{-1}$ for moderate intensity; $\geq 3 \text{ d} \cdot \text{wk}^{-1}$ for vigorous intensity; 3–5 $\text{d} \cdot \text{wk}^{-1}$ for a combination of moderate and vigorous intensity	$\geq 2 \text{ d} \cdot \text{wk}^{-1}$	$\geq 2 \text{ d} \cdot \text{wk}^{-1}$
Intensity	On a scale of 0–10 for level of physical exertion, 5–6 for moderate intensity and 7–8 for vigorous intensity	Light intensity (<i>i.e.</i> , 40%–50% 1-RM) for beginners; progress to moderate-to-vigorous intensity (60%–80% 1-RM); alternatively, moderate (5–6) to vigorous (7–8) intensity on a 0–10 scale	Stretch to the point of feeling tightness or slight discomfort.
Time	30–60 $\text{min} \cdot \text{d}^{-1}$ of moderate intensity exercise; 20–30 $\text{min} \cdot \text{d}^{-1}$ of vigorous intensity exercise; or an equivalent combination of moderate and vigorous intensity exercise; may be accumulated in bouts of at least 10 min each	8–10 exercises involving the major muscle groups; 1–3 sets of 8–12 repetitions each	Hold stretch for 30–60 s.
Type	Any modality that does not impose excessive orthopedic stress such as walking. Aquatic exercise and stationary cycle exercise may be advantageous for those with limited tolerance for weight-bearing activity.	Progressive weight-training programs or weight-bearing calisthenics, stair climbing, and other strengthening activities that use the major muscle groups	Any physical activities that maintain or increase flexibility using slow movements that terminate in static stretches for each muscle group rather than rapid ballistic movements.

1-RM, one repetition maximum

Older Adult Neuromotor Exercise for Frequent Fallers or Those with Mobility Limitations

- Neuromotor exercise training, which combines balance, agility, and proprioceptive training, is effective in reducing and preventing falls if performed 2–3 d · wk⁻¹.
- General recommendations include using the following:
 - Progressively difficult postures that gradually reduce the base of support (two-legged stand, semitandem stand, tandem stand, and one-legged stand)
 - Dynamic movements that perturb the center of gravity (tandem walk and circle turns)

Older Adult Neuromotor Exercise for Frequent Fallers or Those with Mobility Limitations (cont.)

- General recommendations include using the following:
 - Stressing postural muscle groups (heel and toe stands)
 - Reducing sensory input (standing with eyes closed)
 - Tai chi
- Supervision of these activities may be warranted.

Older Adults Special Considerations

- Intensity and duration of PA should be light at the beginning in particular for older adults who are highly deconditioned, functionally limited, or have chronic conditions that affect their ability to perform physical tasks.
- Progression of PA should be individualized and tailored to tolerance and preference; a conservative approach may be necessary for the most deconditioned and physically limited older adults.

Older Adults Special Considerations (cont.)

- Muscular strength decreases rapidly with age, especially for those >50 yr. Although resistance training is important across the lifespan, it becomes more rather than less important with increasing age.
- For strength training involving use of selectorized machines or free weights, initial training sessions should be supervised and monitored by personnel who are sensitive to the special needs of older adults.

Older Adults Special Considerations (cont.)

- Older adults may particularly benefit from power training because this element of muscle fitness declines most rapidly with aging, and insufficient power has been associated with a greater risk of accidental falls.
 - Increasing muscle power in healthy older adults should include both single- and multiple-joint exercises (1-3 sets) using light to moderate loading (30-60% of 1RM) for 6-10 repetitions with high velocity.
- Individuals with sarcopenia, a marker of frailty, need to increase muscular strength before they are physiologically capable of engaging in aerobic training.

Older Adults Special Considerations (cont.)

- If chronic conditions preclude activity at the recommended minimum amount, older adults should perform PA as tolerated to avoid being sedentary.
- Older adults should gradually exceed the recommended minimum amounts of PA and attempt continued progression if they desire to improve and/or maintain their physical fitness.
- Older adults should consider exceeding the recommended minimum amounts of PA to improve management of chronic diseases and health conditions for which a higher level of PA is known to confer a therapeutic benefit.

Older Adults Special Considerations (cont.)

- Moderate intensity PA should be encouraged for individuals with cognitive decline given the known benefits of PA activity on cognition. Individuals with significant cognitive impairment can engage in physical activity but may require individualized assistance.
- Structured physical activity sessions should end with an appropriate cool-down, particularly among individuals with CVD. The cool-down should include a gradual reduction of effort and intensity and optimally, flexibility exercises.

Older Adults Special Considerations (cont.)

- Incorporation of behavioral strategies such as social support, self-efficacy, the ability to make healthy choices, and perceived safety all may enhance participation in a regular exercise program.
- The exercise professional should also provide regular feedback, positive reinforcement, and other behavioral/programmatic strategies to enhance adherence.