# Lab #8: Exercise Testing the Healthy Elderly Client

**Overview:** This laboratory will provide methods for exercise testing the healthy elderly client. Of course the majority of the elderly population will have some co-morbidity associated with one or more disease states. If this is the case for your client, the exercise testing procedure will have to follow specific ACSM guidelines with regards to the modifications in the testing protocol that may be the focus when assessing the elderly client who also has an underlying chronic disease. The testing procedures included in this laboratory can be utilized for those with underlying chronic diseases, with modifications in the duration or progression.

Elderly is defined as an individual $\geq$ 65 years old and those individuals 50-64 years old with clinically significant conditions or physical limitations that affect movement, physical fitness or physical activity.

Diagnostic Testing: Exercise evaluation includes:

a. Review of the absolute and relative contraindications to exercise testing. Most common contraindications are: elevated resting blood pressure (diastolic > 115mmHg or systolic > 200mmHg), moderate valvular heart disease, electrolyte abnormalities, complex ventricular ectopy; ventricular aneurysms; uncontrolled diabetes; neuromuscular disease; musculoskeletal or rheumatoid disorders.

b. The questionnaire below provides a general guide for pre-exercise evaluation. In addition, there is a PAR-Q test that is specifically tailored to the healthy elderly client.

**QUICK PHYSICAL ACTIVITY READINESS QUESTIONNAIRE**

| Questions | Yes | No |
|---|---|---|
| A. Do you get chest pains while at rest or during exertion? | | |
| B. If the answer to question A is yes, is it true that you have not had a physician diagnose those pains yet? | | |
| C. Have you ever had a heart attack? | | |
| D. If the answer to question C is yes, was your heart attack within the last year? | | |
| E. Do you have high blood pressure? | | |
| F. If you don't know the answer to question E, was your blood pressure reading more than 150/100? | | |
| G. Are you short of breath after extremely mild exertion and sometimes even at rest or at night in bed? | | |
| H. Do you have any ulcerated wounds or cuts on your feet that do not seem to heal? | | |
| I. Have you lost 10 lb (4.5 kg) or more in the past 6 months? | | |
| J. Do you get pain in your buttocks or the back of your legs—thighs and calves—when you walk? | | |
| K. While at rest, do you frequently experience fast irregular heartbeats or, at the other extreme, very slow beats? (Although a low heart rate can be a sign of an efficient and well-conditioned heart, a very low rate can indicate a complete heart block.) | | |
| L. Are you currently being treated for any heart or circulatory condition such as vascular disease, stroke, angina, hypertension, congestive heart failure, poor circulation in the legs, valvular heart disease, blood clots, or pulmonary disease? | | |
| M. As an adult, have you ever had a fracture of the hip, spine, or wrist? | | |
| N. Did you fall more than twice in the past year (no matter what the reason)? | | |
| O. Do you have diabetes? | | |

*Key:* If the answer to any of these questions is yes, an individual should be advised to undergo an evaluation by a physician.

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c. Decision to be made what type of diagnostic test to do. A treadmill or leg cycle ergometer test can be used with modification (Walking is appropriate for most). Handrail holding is a must to provide balance assistance. The handrail holding will artificially elevate the maximal attained MET level, this effect should be taken into consideration. The protocol should be low intensity with small increments in work rate (e.g. 1-2 METS). The most popular protocols for elderly include the Balke protocols (see below)

Cycling should be considered for those with balance or gait problems. Performing an exercise test during the morning hours may be best, because may people are less fatigued when arising in the morning. The most popular cycling protocol starts at zero load and increases of 25 to 30 Watt increments. Each stage should be short, 1-2 minutes or a ramp protocol of 1 minute duration increasing 25 Watts each increment. (see below)

| Protocol | Stage | Time (min) | Speed in mph (kph) | Grade (%) | $VO_2$ ($ml \cdot kg^{-1} \cdot min^{-1}$) | METs |
|---|---|---|---|---|---|---|
| Superstandard Balke | 1 | 2 | 3.4 (5.5) | 2.0 | 15.9 | 4.5 |
| | 2 | 2 | 3.4 (5.5) | 4.0 | 19.2 | 5.5 |
| | 3 | 2 | 3.4 (5.5) | 6.0 | 22.5 | 6.4 |
| | 4 | 2 | 3.4 (5.5) | 8.0 | 25.7 | 7.4 |
| | 5 | 2 | 3.4 (5.5) | 10.0 | 29.0 | 8.3 |
| | 6 | 2 | 3.4 (5.5) | 12.0 | 32.3 | 9.2 |
| | 7 | 2 | 3.4 (5.5) | 14.0 | 35.6 | 10.2 |
| | Stage | Duration (min) | RPM | $kg \cdot m \cdot min^{-1}$: watts | $VO_2$ ($ml \cdot kg^{-1} \cdot min^{-1}$)[b] | METs |
| Standard bicycle test | 1 | 2 or 3 | 50.0 | 150: 25 | 10.9 | 3.1 |
| | 2 | 2 or 3 | 50.0 | 300: 50 | 14.7 | 4.2 |
| | 3 | 2 or 3 | 50.0 | 450: 75 | 18.6 | 5.3 |
| | 4 | 2 or 3 | 50.0 | 600: 100 | 22.4 | 6.4 |
| | 5 | 2 or 3 | 50.0 | 750: 125 | 26.3 | 7.5 |
| | 6 | 2 or 3 | 50.0 | 900: 150 | 30.1 | 8.6 |

*Note.* When trying to determine the appropriate protocol, consider the client's age, current functional capacity, activity level, and medical history and disease status. MET = metabolic equivalent.

[a]$\dot{V}O_2$ is calculated while the client is walking through stage 6. If the client is running at stage 6, the $\dot{V}O_2$ would be 42.4 $ml \cdot kg^{-1} \cdot min^{-1}$ and 12.1 METs. The conventional Bruce protocol begins at 1.7 mph (2.7 kph) and a 10% grade; modified versions start at 1.7 mph (2.7 kph) at 0% or 1.7 mph (2.7 kph) and 5%. [b]$\dot{V}O_2$ and METs determined for a 70 kg individual. Values need to be adjusted based on body weight.



**Maximal attainable workload during a graded exercise test is less likely to be greater than 7 METS for a healthy untrained elderly individual.**

**EXERCISE TESTING SPECIFICS FOR THE ELDERLY**

| Test type | Mode | Protocol specifics | Clinical measures | Clinical implications | Special consideration |
|---|---|---|---|---|---|
| Cardiovascular | Treadmill or ergometer | Low intensity with small increments in work rate, steady state or ramp | Estimated METs or peak$\dot{V}O_2$, heart rate, ECG, blood pressure | Describing or determining exercise prescription | Mornings may be better, high incidence of undiagnosed heart disease |
| Strength | Weight machines | Modified 1RM with focus on muscles of ADL | Weight lifted, repetitions | | Agility, balance, coordination, and gait deficits may affect safety and ability to perform testing |
| Range of motion | Goniometer | Hip, ankle, knee, shoulder and elbow, lower back and hamstrings | Degrees of motion | Limited ROM in these joints is related to limitations in performing ADL | Evaluation of mental and intellectual impairment as it may affect ability to perform testing |

Some additional tests may be performed to evaluate mental and intellectual impairment because they may affect the ability to perform exercise training and maintain exercise compliance.

Below is a list of additional protocols that may be used for the elderly client, especially for those who are sedentary and first time exercisers and for the frail elderly client.

**Instructions:**

1. Read and perform each test on the list. Record your results on the worksheet provided and make note of those normative values established when testing the elderly client (See tables).

These assessments will measure one or more of the basic elements of functional fitness: strength, power, agility, endurance, balance and flexibility. These tests have been shown to be valid and reliable and normative data has been established for men and women age 60-94yrs. These tests are practical and easy to administer and use to track progress over the course of a training program or to document loss of function that may necessitate medical attention. You can find the illustrations for each test on page 13.

## 1a. Chair Stand Test (Version 2)

The chair stand test is a physical performance test used to assess lower-extremity function. Lower-extremity function has been shown to predict subsequent development of disability because it reflects the effects of chronic disease, coexisting conditions, and overall physiologic decline. A 5 repetition test is a measure of strength; a 10 repetition test is a measure of strength and endurance.

## Equipment/Set Up

Use a standard chair with arms and with a seat height of approximately 17 inches for all assessments, regardless of the height of the subject. Place the back of the chair against a wall to prevent movement during the test.

## Procedure

Instruct and demonstrate the following protocol *before* asking the subject to perform the test:

• Sit as far back as possible in the chair seat. Keep feet firmly planted on the floor approximately hip width apart and the back of lower legs away from the chair. Keep knees bent at a 90-degree angle with arms crossed over the chest. (An individual of average or taller height will be able to sit with their upper back against the back of the chair. Individuals of shorter than average height will *not* be able to touch the chair back while maintaining proper position and are *not* required to touch the chair back during testing).

• Stand up one time and sit down, returning completely to the correct starting position.

• Indicate that any chair stands done with improper technique, e.g. not standing all the way up, not sitting all the way back, lifting feet off the floor, etc. will not be counted.

• Allow the participant the opportunity to try one chair stand to be sure when they stand up the back of their legs are not touching the chair.

• Instruct the subject that the timed assessment will begin on the command, “Ready, Set, Go” and that they are to stand up and sit back down 10 times as quickly and safely as possible.

At the command “Ready, Set, Go” the tester begins timing by starting the stopwatch.

• Count each chair stand out loud when the subject is in the standing position. Provide continuous verbal encouragement during the test.
• At the tenth repetition click the stopwatch off while participant is in the standing position.
• Conduct two trials, separated by three minutes.

## 1b. Chair Stand (version 1) Results on the table below

Stand from a chair of standard height, unaided and without using the arms. The arms are placed across the chest. Measure the time required to stand and sit back down. If unable or > 2 seconds the person is at risk for falls.

## 2. 6 Minute Walk Test Instructions

**Description** The six-minute walking test (6MWT) is a commonly used objective measure of functional exercise capacity individuals with moderately severe impairment (ATS 2002).The distance an individual is able to walk along a flat 30 m walkway over a 6 minute period (6MWD), with breaks as required, is recorded. The test is a self paced, submaximal test of exercise capacity, which may better reflect the exercise level needed for daily task.

### Instructions

Individual walks without physical assistance for 6 minutes and the distance is measured
start timing when the individual is instructed to "Go" stop timing at 6 minutes
assistive devices can be used but should be kept consistent and documented from test to test if physical assistance is required to walk, this should not be performed
a measuring wheel is helpful to determine distance walked
should be performed at the fastest speed possible

### Set-up and equipment:

Ensure the hallway free of obstacles. The 6MWT is a practical simple test that requires a 100-ft hallway but no exercise equipment or advanced training for technicians. You just need cones or pylons to mark off the area and a stop watch.

### Precautions

Reasons for immediately stopping a 6MWT include the following(*1)*chest pain, (*2*) intolerable dyspnea, (*3*) leg cramps, (*4*) staggering, (*5*) diaphoresis, and (*6*) pale or ashen appearance.

### Patient Instructions:

*"Cover as much ground as possible over 6 minutes. Walk continuously if possible, but do not be concerned if you need to slow down or stop to rest. The goal is to feel at the end of the test that more ground could not have been covered in the 6 minutes."*

***Reference Equations to predict 6 minute walk distance***

**REFERENCE EQUATIONS FOR 6-MIN WALK DISTANCE IN HEALTHY ADULTS**

Men:

$6MWD = (7.57 \times height_{cm}) - (5.02 \times age) - (1.76 \times weight_{kg}) - 309$ m.

Alternate equation using BMI*:

$6MWD = 1{,}140$ m $- (5.61 \times BMI) - (6.94 \times age)$

When using either equation, subtract 153 m for the LLN

Women:

$6MWD = (2.11 \times height_{cm}) - (2.29 \times weight_{kg}) - (5.78 \times age) + 667$ m.

Alternate equation using BMI:

$6MWD = 1{,}017_{m} - (6.24 \times BMI) - (5.83 \times age)$

When using either equation, subtract 139 m for the LLN

*Definition of abreviations*: BMI = body mass index; 6MWD = 6-min walk distance; LLN = lower limit of normal.

* BMI in $kg/m^2$.

## 3. Timed Up and Go (TUG) Test

1. Equipment: arm chair, tape measure, tape, stop watch.

2. Begin the test with the subject sitting correctly in a chair with arms, the subject's back should resting on the back of the chair. The chair should be stable and positioned such that it will not move when the subject moves from sitting to standing.

3. Place a piece of tape or other marker on the floor 3 meters away from the chair so that it is easily seen by the subject.

**Instructions** :
1. "On the word *GO* you will stand up, walk to the line on the floor, turn around and walk back to the chair and sit down. Walk at your regular pace.
2. . Start timing on the word "*GO*" and stop timing when the subject is seated again correctly in the chair with their back resting on the back of the chair.
3. . The subject wears their regular footwear, may use any gait aid that they normally use during ambulation, but may not be assisted by another person. There is no time limit. They may stop and rest (but not sit down) if they need to.
4. Normal healthy elderly usually complete the task in ten seconds or less. Very frail or weak elderly with poor mobility may take 2 minutes or more.
5. The subject should be given a practice trial that is not timed before testing.

**Results correlate with gait speed, balance, functional**

**Interpretation**
< 10 seconds = normal
< 20 seconds = slightly limited mobility, can go out alone, mobile without a gait aid.
< 30 seconds = problems, cannot go outside alone, requires a gait aid.
A score of more than or equal to fourteen seconds has been shown to indicate high risk of falls.

Patient Score: _____Seconds Chair height: _____inches

## 4. Single Leg Stance

**Description:** The one-leg stance test is a measure considered to assess postural steadiness in a static position by a temporal measurement. The common notion is that a better postural steadiness, i.e. less force variability, allows for longer time standing on one leg. However, there is lack of evidence how postural steadiness during one-leg stance changes over time. Timed single leg stance (SLS) has been correlated with amplitude and speed of sway in people without disease. The ability to maintain SLS generally decreases with increasing age. Single leg stance has been shown to improve over the course of 6 months of rehabilitation.

**Instructions for the Patient (Eyes Open, SLS):**

Stand on one leg, place your arms across your chest with your hands touching your shoulders and do not let your legs touch each other. Look straight ahead with your eyes open and focus on an object about 3 feet in front of you. Ideally do this with the shoes off.

**Criteria to stop timing the test:**

The legs touched each other, the feet moved on the floor, their foot touches down, or the arms moved from their start position.

**ONCE YOU HAVE COMPLETED THE TEST WITH EYES OPEN, NOW TRY AGAIN WITH EYES CLOSED.**

## 5. Chair Sit and Reach

The Chair Sit and Reach test is designed to test the functional fitness of seniors. It is a variation of the traditional sit and reach flexibility test.

- **Purpose:** This test measures lower body flexibility. This test is contraindicated in those with severe osteoporosis.
- **Equipment required:** ruler, straight back or folding chair, (about 17 inches/44 cm high).
- **Procedure:** The subject sits on the edge a chair (placed against a wall for safety). One foot must remain flat on the floor. The other leg is extended forward with the knee straight, heel on the floor, and ankle bent at 90°. Place one hand on top of the other with tips of the middle fingers even. Instruct the subject to Inhale, and then as they exhale, reach forward toward the toes by bending at the hip. Keep the back straight and head up. Avoid bouncing or quick movements, and never stretch to the point of pain. Keep the knee straight, and hold the reach for 2 seconds. The distance is measured between the tip of the fingertips and the toes. If the fingertips touch the toes then the score is zero. If they do not touch, measure the distance between the fingers and the toes (a negative score), if they overlap, measure by how much (a positive score). Perform two trials.
- **Scoring:** The score is recorded to the nearest 1/2 inch or 1 cm as the distance reached, either a negative or positive score. Record which leg was used for measurement. Below is a table showing the recommended ranges (in inches) for this test based on age groups.

Men

| Age | below average | average (inches) | above average |
|---|---|---|---|
| 60-64 | < -2.5 | -2.5 to 4.0 | > 4.0 |
| 65-69 | < -3.0 | -3.0 to 3.0 | > 3.0 |
| 70-74 | < -3.5 | -3.5 to 2.5 | > 2.5 |
| 75-79 | < -4.0 | -4.0 to 2.0 | > 2.0 |
| 80-84 | < -5.5 | -5.5 to 1.5 | > 1.5 |
| 85-89 | < -5.5 | -5.5 to 0.5 | > 0.5 |
| 90-94 | < -6.5 | -6.5 to -0.5 | > -0.5 |

Women

| Age | below average | average (inches) | above average |
|---|---|---|---|
| 60-64 | < -0.5 | -0.5 to 5.0 | > 5.0 |
| 65-69 | < -0.5 | -0.5 to 4.5 | > 4.5 |
| 70-74 | < -1.0 | -1.0 to 4.0 | > 4.0 |
| 75-79 | < -1.5 | -1.5 to 3.5 | > 3.5 |
| 80-84 | < -2.0 | -2.0 to 3.0 | > 3.0 |
| 85-89 | < -2.5 | -2.5 to 2.5 | > 2.5 |
| 90-94 | < -4.5 | -4.5 to 1.0 | > 1.0 |

**6. Arm Curls**

The purpose of this test is to assess upper body strength needed to perform regular household chores and other activities of daily living such as lifting and carrying groceries and grandchildren and opening containers

Description: Complete as many one arm bicep curls as you can in 30 seconds, holding a hand weight of 5 lbs for women and 8lbs for men. Each rep must be with good form.

**High Risk Zone:** Completing less than 11 curls in 30 seconds with good form.

**7. 2-minute Step test**

The purpose of this test is to assess aerobic endurance which is important for activities such as walking, stair climbing and performing ADL's for extended periods of time

Description: Stand facing the wall, put a pencil mark or piece of tape on the wall at a height that is halfway between the top of your knee and the top of your hipbone. Begin stepping in place, raising each knee up as high as the wall marker each time. Step for two minutes and record the number of steps taken, ***counting the right and left legs together as one step.***

**High Risk Zone:** Less than 65 full steps in 2 minutes

**8. Back Scratch**

The purpose of this test is to assess shoulder flexibility, if you are not measuring it directly with a goniometer. This is important for movements such as brushing the hair, putting on clothes over the head, putting on a car seat belt etc.

Description: With one hand, reach behind your back and slide the hand up towards the opposite shoulder as far as possible, do not force the movement. With the opposite hand, reach back over the same shoulder and try to come as close as you can to touching the tip of the other hand. Have a partner measure the distance between your hands.

**High Risk Zone:** Women with 2 inches or more between the hands and men with 4 inches or more between the hands.

**9. Trunk rotation Test (average of the left and right sides)**

The trunk rotation flexibility test measures flexibility across several joints of the body. To perform the test follow these procedures AFTER WARMINING UP. Warm-up is similar to the flexibility warm-ups that were performed for the previous flexibility lab 95 minutes general of the treadmill, leg cycle or air-dyne and 5 minutes of stretching)

a. Tape two yardsticks to the wall at shoulder height, one right side up and the other upside down. Draw a line on the floor perpendicular to the wall at 15-inch marks on the rulers.
b. Stand with feet shoulder-width apart, toes on the line, left shoulder to the wall at arms length (fist closed).
c. With the left arm at the side, raise the right arm to shoulder height and rotate the trunk to the right as far as possible, reaching along the yardstick with the fist closed and palm down. Reach as far as possible, and then hold the final position for 2 seconds. During the test, the knees should be slightly bent, with the feet always pointing straight ahead and on the toe line.
d. A partner should record the distance reached by the knuckle of the little finger to the nearest 1/inch. Perform the test twice and average the two scores.
e. Now, perform the test facing the opposite direction using the upside down yardstick (THE GREATER THE ROTATION, THE HIGHER THE SCORE). Perform two trials and average. Then average the scores from both directions and used the table below for classification.

Trunk Rotation Norms (inches, average of the left and right sides

| | Poor | Below Average | Average | Above Average | Excellent |
|---|---|---|---|---|---|
| Males and Females | < 13 | 13-15.75 | 16-18.75 | 19-21.75 | $\geq$ 22 |

## Averages based on age group for Men and Women

| Results by Age | 60-64 | 65-69 | 70-74 | 75-79 | 80-84 | 85-89 | 90-94 |
|---|---|---|---|---|---|---|---|
| Chair Stand (reps) | 14-19<br>12-17 | 12-18<br>11-16 | 12-17<br>10-15 | 11-17<br>10-15 | 10-15<br>9-14 | 8-14<br>8-13 | 7-12<br>4-11 |
| Arm Curls (reps) | 16-22<br>13-19 | 15-21<br>12-18 | 14-21<br>12-17 | 13-19<br>11-17 | 13-19<br>10-16 | 11-17<br>10-15 | 10-14<br>8-13 |
| 2-Minute Step (steps) | 87-115<br>75-107 | 86-116<br>73-107 | 80-110<br>68-101 | 73-109<br>68-100 | 71-103<br>60-91 | 59-91<br>55-85 | 52-86<br>44-72 |
| Sit & Reach (inches) | < 2.5<br>< 0.5 | < 3.0<br>< 0.5 | < 3.5<br>< 1.0 | < 4.0<br>< 1.5 | < 5.5<br>< 2.0 | < 5.5<br>< 2.5 | < 6.5<br>< 4.5 |
| Back Scratch (inches) | < 6.5<br>< 3.0 | 1.0-7.5<br>< 3.5 | 1.0-8.0<br>< 4.0 | 2.0-9.0<br>< 5.0 | 2.0-9.5<br>< 5.5 | 3.0-10<br>1.0-7.0 | 4.0-10.5<br>1.0-8.0 |
| Up & Go (seconds) | 3.8-5.6<br>4.4-6.0 | 4.3-5.7<br>4.8-6.4 | 4.2-6.0<br>4.9-7.1 | 4.6-7.2<br>5.2-7.4 | 5.2-7.6<br>5.7-8.7 | 5.3-8.9<br>6.2-9.6 | 6.2-10.0<br>7.3-11.5 |

From: Senior Fitness Test Manual, 1999 R.E Rikli and C.J Jones

**Table 10.9 Back Scratch Test Norms***

| Percentile rank | 60-64 YR | | 65-69 YR | | 70-74 YR | | 75-79 YR | | 80-84 YR | | 85-89 YR | | 90-94 YR | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | M | F | M | F | M | F | M | F | M | F | M | F | M |
| 95 | 5.0 | 4.5 | 4.9 | 3.9 | 4.5 | 3.5 | 4.5 | 2.8 | 4.3 | 3.2 | 3.5 | 1.7 | 3.9 | 0.7 |
| 90 | 3.8 | 2.7 | 3.5 | 2.2 | 3.2 | 1.8 | 3.1 | 0.9 | 2.8 | 1.2 | 1.9 | −0.1 | 2.2 | −1.1 |
| 85 | 2.9 | 1.6 | 2.6 | 1.0 | 2.3 | 0.6 | 2.2 | −0.3 | 1.8 | −0.1 | 0.8 | −1.2 | 0.9 | −2.2 |
| 80 | 2.2 | 0.6 | 1.9 | 0.0 | 1.5 | −0.4 | 1.3 | −1.3 | 0.9 | −1.2 | −0.1 | −2.2 | −0.1 | −3.2 |
| 75 | 1.6 | −0.2 | 1.3 | −0.8 | 0.8 | −1.2 | 0.6 | −2.2 | 0.2 | −2.1 | −0.9 | −3.0 | −1.0 | −4.0 |
| 70 | 1.1 | −0.9 | 0.7 | −1.6 | 0.3 | −2.0 | 0.0 | −2.9 | −0.4 | −2.9 | −1.6 | −3.7 | −1.8 | −4.7 |
| 65 | 0.7 | −1.5 | 0.2 | −2.2 | −0.2 | −2.6 | −0.5 | −3.6 | −1.0 | −3.6 | −2.1 | −4.3 | −2.5 | −5.3 |
| 60 | 0.2 | −2.2 | −0.3 | −2.9 | −0.8 | −3.3 | −1.1 | −4.3 | −1.6 | −4.3 | −2.8 | −5.0 | −3.2 | −6.0 |
| 55 | −0.2 | −2.8 | −0.7 | −3.5 | −1.2 | −3.9 | −1.6 | −4.9 | −2.1 | −5.0 | −3.3 | −5.6 | −3.8 | −6.6 |
| 50 | −0.7 | −3.4 | −1.2 | −4.1 | −1.7 | −4.5 | −2.1 | −5.6 | −2.6 | −5.7 | −3.9 | −6.2 | −4.5 | −7.2 |
| 45 | −1.2 | −4.0 | −1.7 | −4.7 | −2.2 | −5.1 | −2.6 | −6.3 | −3.1 | −6.4 | −4.5 | −6.8 | −5.2 | −7.8 |
| 40 | −1.6 | −4.6 | −2.1 | −5.3 | −2.6 | −5.7 | −3.1 | −6.9 | −3.7 | −7.1 | −5.0 | −7.4 | −5.8 | −8.4 |
| 35 | −2.1 | −5.3 | −2.6 | −6.0 | −3.2 | −6.4 | −3.7 | −7.6 | −4.2 | −7.8 | −5.7 | −8.1 | −6.5 | −9.1 |
| 30 | −2.5 | −5.9 | −3.1 | −6.6 | −3.7 | −7.0 | −4.2 | −8.3 | −4.8 | −8.5 | −6.2 | −8.7 | −7.2 | −9.7 |
| 25 | −3.0 | −6.6 | −3.7 | −7.4 | −4.2 | −7.8 | −4.8 | −9.0 | −5.4 | −9.3 | −6.9 | −9.4 | −8.0 | −10.4 |
| 20 | −3.6 | −7.4 | −4.3 | −8.2 | −4.9 | −8.6 | −5.5 | −9.9 | −6.1 | −10.2 | −7.7 | −10.2 | −8.9 | −11.2 |
| 15 | −4.3 | −8.4 | −5.0 | −9.2 | −5.7 | −9.6 | −6.4 | −10.9 | −7.0 | −11.3 | −8.6 | −11.2 | −9.9 | −12.2 |
| 10 | −5.2 | −9.5 | −5.9 | −10.4 | −6.6 | −10.8 | −7.3 | −12.1 | −8.0 | −12.6 | −9.7 | −12.3 | −11.2 | −13.3 |
| 5 | −6.4 | −11.3 | −7.3 | −12.1 | −7.9 | −12.5 | −8.8 | −14.0 | −9.5 | −14.6 | −11.3 | −14.1 | −13.0 | −15.1 |

*Score is measured in inches.
F = females; M = males.
To convert inches to centimeters, multiply value in table by 2.54.
Adapted, by permission, from R. Rikli and C. Jones, 2001, *Senior fitness test manual* (Champaign, IL: Human Kinetics), 130.

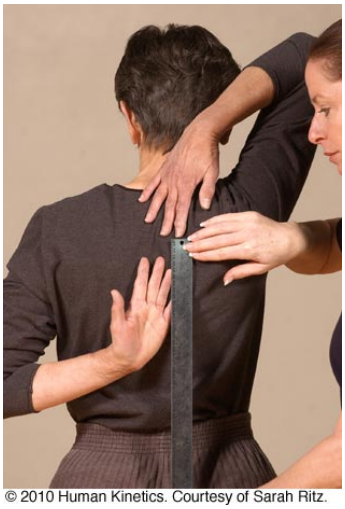

**Table 10.8 Chair Sit-and-Reach Test Norms***

| Percentile rank | 60-64 YR | | 65-69 YR | | 70-74 YR | | 75-79 YR | | 80-84 YR | | 85-89 YR | | 90-94 YR | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | M | F | M | F | M | F | M | F | M | F | M | F | M |
| 95 | 8.7 | 8.5 | 7.9 | 7.5 | 7.5 | 7.5 | 7.4 | 6.6 | 6.6 | 6.2 | 6.0 | 4.5 | 4.9 | 3.5 |
| 90 | 7.2 | 6.7 | 6.6 | 5.9 | 6.1 | 5.8 | 6.1 | 4.9 | 5.2 | 4.4 | 4.6 | 3.0 | 3.4 | 1.9 |
| 85 | 6.3 | 5.6 | 5.7 | 4.8 | 5.2 | 4.7 | 5.2 | 3.8 | 4.3 | 3.2 | 3.7 | 2.0 | 2.5 | 0.9 |
| 80 | 5.5 | 4.6 | 5.0 | 3.9 | 4.5 | 3.8 | 4.4 | 2.8 | 3.6 | 2.2 | 3.0 | 1.1 | 1.7 | 0.0 |
| 75 | 4.8 | 3.8 | 4.4 | 3.1 | 3.9 | 3.0 | 3.7 | 2.0 | 3.0 | 1.4 | 2.4 | 0.4 | 1.0 | −0.7 |
| 70 | 4.2 | 3.1 | 3.9 | 2.4 | 3.3 | 2.4 | 3.2 | 1.3 | 2.4 | 0.6 | 1.8 | −0.2 | 0.4 | −1.4 |
| 65 | 3.7 | 2.5 | 3.4 | 1.8 | 2.8 | 1.8 | 2.7 | 0.7 | 1.9 | 0.0 | 1.3 | −0.8 | −0.1 | −1.9 |
| 60 | 3.1 | 1.8 | 2.9 | 1.1 | 2.3 | 1.1 | 2.1 | 0.1 | 1.4 | −0.8 | 0.8 | −1.3 | −0.7 | −2.5 |
| 55 | 2.6 | 1.2 | 2.5 | 0.6 | 1.9 | 0.6 | 1.7 | −0.5 | 1.0 | −1.4 | 0.4 | −1.9 | −1.2 | −3.0 |
| 50 | 2.1 | 0.6 | 2.0 | 0.0 | 1.4 | 0.0 | 1.2 | −1.1 | 0.5 | −2.0 | −0.1 | −2.4 | −1.7 | −3.6 |
| 45 | 1.6 | 0.0 | 1.5 | −0.6 | 0.9 | −0.6 | 0.7 | −1.7 | 0.0 | −2.6 | −0.6 | −2.9 | −2.2 | −4.2 |
| 40 | 1.1 | −0.6 | 1.1 | −1.1 | 0.5 | −1.2 | 0.2 | −2.3 | −0.4 | −3.2 | −1.0 | −3.5 | −2.7 | −4.7 |
| 35 | 0.5 | −1.3 | 0.6 | −1.8 | 0.0 | −1.8 | −0.3 | −2.9 | −0.9 | −4.0 | −1.5 | −4.0 | −3.3 | −5.3 |
| 30 | 0.0 | −1.9 | 0.1 | −2.4 | −0.5 | −2.4 | −0.8 | −3.5 | −1.4 | −4.6 | −2.0 | −4.6 | −3.8 | −5.8 |
| 25 | −0.6 | −2.6 | −0.4 | −3.1 | −1.1 | −3.1 | −1.3 | −4.2 | −2.0 | −5.3 | −2.6 | −5.3 | −4.4 | −6.5 |
| 20 | −1.3 | −3.4 | −1.0 | −3.9 | −1.7 | −3.9 | −2.0 | −5.0 | −2.6 | −6.2 | −3.2 | −5.9 | −5.1 | −7.2 |
| 15 | −2.1 | −4.4 | −1.7 | −4.8 | −2.4 | −4.8 | −2.8 | −6.0 | −3.3 | −7.2 | −3.9 | −6.8 | −5.9 | −8.1 |
| 10 | −3.0 | −5.5 | −2.6 | −5.9 | −3.3 | −5.9 | −3.7 | −7.1 | −4.2 | −8.4 | −4.8 | −7.8 | −6.8 | −9.1 |
| 5 | −4.0 | −7.3 | −3.9 | −7.5 | −4.7 | −7.6 | −5.0 | −8.8 | −5.0 | −10.2 | −6.3 | −9.3 | −7.9 | −10.7 |

*Score is measured in inches.
F = females; M = males.
To convert inches to centimeters, multiply value in table by 2.54.
Adapted, by permission, from R. Rikli and C. Jones, 2001, *Senior fitness test manual* (Champaign, IL: Human Kinetics), 129.

## ILLUSTRATIONS

Chair Stand



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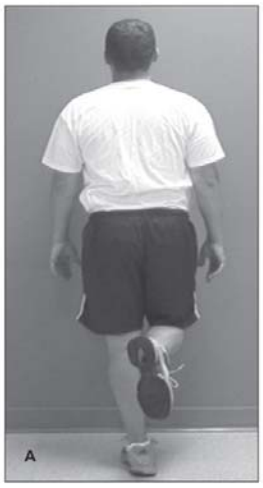
Back Scratch Test



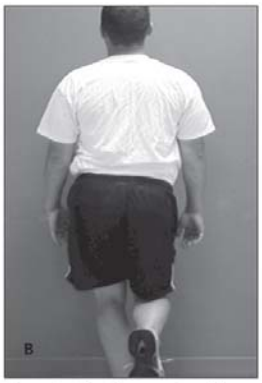


**Figure 4 –** *The 1-leg standing balance test (A) is used to assess a patient's core strength and stability. A positive Trendelenburg test result (B) indicates inability to control the posture and suggests proximal core weakness.*

One-Legged Stand

Arm Curl Test

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Chair Sit and Reach

Timed Up and Go

2-Minute Step Up

**Table 7.3** Preexercise Training Evaluations

| Test | Measurement | Outcome | Risk |
|---|---|---|---|
| Chair stand | Stand from a chair of standard height, unaided and without using arms | Ability<br>Time required | Unable<br>>2.0 s |
| Step-ups | Step-ups onto a single 23 cm step in 10 s | Ability<br>Number of times | Unable<br><3 in 10 s |
| Walking speed | 6 m walk | Time<br>Number of steps<br>RPE<br>Heart rate<br>Blood pressure<br>Gait abnormalities such as asymmetry | <0.6 m · $s^{-1}$ |
| Tandem walk | Walking along a 2 m line, 5 cm wide | Number of errors (off line, touching examiner or another object) | >eight errors |
| One-leg stand | Stand on one leg | Ability<br>Time | <2 s |
| Functional reach | Maximal distance a person can reach forward beyond arm's length while maintaining a fixed base of support in the standing position | Inches | |
| Timed "up and go" | Stand up from standard chair, walk distance of 3 m, turn, walk back to chair, and sit down again | Time | >10 s |
| Range of motion | Using a goniometer, assess the following: shoulder abduction (SA), flexion (SF), extension (SE); elbow flexion (EF), extension (EE); hip flexion (HF), extension (HE); knee flexion (KF), extension (KE); ankle dorsiflexion (DF), plantar flexion (PF) | Degrees | <90° (SA); <150° (SF); <20° (SE); <140° (EF); <20° (EE); <90° (HF); within 10° (HE); <90° (KF); not within <10° full KE; unable to perform DF and PF |

*Note.* RPE = rate of perceived exertion.

Adapted from E.F. Binder et al., 1999, "Peak aerobic power is an important component of physical performance in older women," *Journal of Gerontology* 54A: M353-356; W.J. Chodzko-Zajko and K.A. Moore, 1994, "Physical fitness and cognitive function in aging," *Exercise in Sport and Science Review* 22: 195-220; R.J. Kuczmarski et al., 1994, "Increasing prevalence of overweight among U.S. adults," *Journal of the American Medical Association* 272: 205-211; M.C. Nevitt et al., 1989, "Risk factors for recurrent non-syncopal falls," *JAMA* 261: 2663-2668; M.L. Pollock et al., 2000, "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, and the American Heart Association," *Circulation* 101: 828-833.

## Table 12.1 Age–Gender Norms for the Unipedal (One-Leg) Stance Test[a]

| | EYES OPEN (SEC)[b] | | EYES CLOSED (SEC)[b] | |
|---|---|---|---|---|
| Age group (yr) | Females | Males | Females | Males |
| 18-39 | 45.1 | 44.4 | 13.1 | 16.9 |
| 40-49 | 42.1 | 41.6 | 13.5 | 12.0 |
| 50-59 | 40.9 | 41.5 | 7.9 | 8.6 |
| 60-69 | 30.4 | 33.8 | 3.6 | 5.1 |
| 70-79 | 16.7 | 25.9 | 3.7 | 2.6 |
| 80-99 | 10.6 | 8.7 | 2.1 | 1.8 |

[a]Maximum test duration is 45 sec.

[b]Use best of three trials.

Data from B.A. Springer et al., 2007, "Normative values for the unipedal stance test with eyes open and closed," *Journal of Geriatric Physical Therapy* 30: 8-15.

## Table 12.2 Age–Gender Norms for the 3 m (10 ft) Timed Up and Go Test[a]

| | AGE GROUP (YR) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 71-75 | | 76-80 | | 81-85 | | 86-99 | |
| Percentile | M | F | M | F | M | F | M | F |
| 95 | 13.3 | 15.0 | 14.3 | 18.6 | 19.5 | 20.0 | 21.0 | 22.0 |
| 90 | 11.0 | 14.0 | 13.6 | 15.2 | 14.0 | 17.6 | 18.2 | 19.6 |
| 80 | 10.0 | 13.0 | 11.0 | 13.0 | 13.0 | 15.0 | 13.8 | 16.0 |
| 70 | 9.0 | 12.0 | 10.0 | 12.0 | 12.0 | 14.2 | 12.0 | 15.0 |
| 60 | 9.0 | 11.0 | 10.0 | 11.0 | 10.0 | 12.0 | 11.2 | 13.8 |
| 50 | 8.0 | 10.0 | 9.0 | 10.0 | 9.0 | 12.0 | 11.0 | 12.0 |
| 40 | 8.0 | 10.0 | 8.0 | 9.4 | 8.0 | 11.0 | 10.6 | 12.0 |
| 30 | 7.0 | 9.0 | 7.0 | 9.0 | 8.0 | 10.0 | 8.1 | 10.4 |
| 20 | 7.0 | 9.0 | 7.0 | 8.0 | 8.0 | 10.0 | 7.4 | 9.8 |
| 10 | 6.4 | 7.5 | 7.0 | 6.6 | 7.0 | 8.0 | 6.7 | 9.0 |
| 5 | 5.7 | 7.0 | 6.0 | 5.8 | 6.0 | 8.0 | 6.0 | 9.0 |
| 1 | 5.0 | 6.0 | 5.0 | 5.0 | 5.0 | 8.0 | 6.0 | 9.0 |

[a]Time in seconds.

Data from M. Pondal and T. del Ser, 2008, "Normative data and determinants for the timed "up and go" test in a population-based sample of elderly individuals without gait disturbances," *Journal of Geriatric Physical Therapy* 31(2): 57-62.

## Table 12.3 Age–Gender Norms for 8 ft Timed Up and Go Test*

| Percentile rank | TIME (SEC) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60-64 YR | | 65-69 YR | | 70-74 YR | | 75-79 YR | | 80-84 YR | | 85-89 YR | | 90-94 YR | |
| | F | M | F | M | F | M | F | M | F | M | F | M | F | M |
| 95 | 3.2 | 3.0 | 3.6 | 3.1 | 3.8 | 3.2 | 4.0 | 3.3 | 4.0 | 4.0 | 4.5 | 4.0 | 5.0 | 4.3 |
| 90 | 3.7 | 3,0 | 4.1 | 3.6 | 4.0 | 3.6 | 4.3 | 3.5 | 4.4 | 4.1 | 4.7 | 4.3 | 5.3 | 4.5 |
| 85 | 4.0 | 3.3 | 4.4 | 3.9 | 4.3 | 3.9 | 4.6 | 3.9 | 4.9 | 4.5 | 5.3 | 4.5 | 6.1 | 5.1 |
| 80 | 4.2 | 3.6 | 4.6 | 4.1 | 4.7 | 4.2 | 5.0 | 4.3 | 5.4 | 4.9 | 5.8 | 5.0 | 6.7 | 5.7 |
| 75 | 4.4 | 3.8 | 4.8 | 4.3 | 4.9 | 4.4 | 5.2 | 4.6 | 5.7 | 5.2 | 6.2 | 5.5 | 7.3 | 6.2 |
| 70 | 4.6 | 4.0 | 5.0 | 4.5 | 5.2 | 4.6 | 5.5 | 4.9 | 6.1 | 5.5 | 6.6 | 5.8 | 7.7 | 6.6 |
| 65 | 4.7 | 4.2 | 5.1 | 4.6 | 5.4 | 4.8 | 5.7 | 5.2 | 6.3 | 5.7 | 6.9 | 6.2 | 8.2 | 7.0 |
| 60 | 4.9 | 4.4 | 5.3 | 4.8 | 5.6 | 5.0 | 5.9 | 5.4 | 6.7 | 6.0 | 7.3 | 6.5 | 8.6 | 7.4 |
| 55 | 5.0 | 4.5 | 5.4 | 4.9 | 5.8 | 5.1 | 6.1 | 5.7 | 6.9 | 6.2 | 7.6 | 6.9 | 9.0 | 7.7 |
| 50 | 5.2 | 4.7 | 5.6 | 5.1 | 6.0 | 5.3 | 6.3 | 5.9 | 7.2 | 6.4 | 7.9 | 7.2 | 9.4 | 8.1 |
| 45 | 5.4 | 4.9 | 5.8 | 5.3 | 6.2 | 5.5 | 6.5 | 6.1 | 7.5 | 6.6 | 8.2 | 7.5 | 9.8 | 8.5 |
| 40 | 5.5 | 5.0 | 5.9 | 5.4 | 6.4 | 5.6 | 6.7 | 6.4 | 7.8 | 6.9 | 8.5 | 7.9 | 10.2 | 8.8 |
| 35 | 5.7 | 5.2 | 6.1 | 5.6 | 6.6 | 5.8 | 6.9 | 6.6 | 8.1 | 7.1 | 8.9 | 8.2 | 10.6 | 9.2 |
| 30 | 5.8 | 5.4 | 6.2 | 5.7 | 6.8 | 6.0 | 7.1 | 6.9 | 8.3 | 7.3 | 9.2 | 8.6 | 11.1 | 9.6 |
| 25 | 6.0 | 5.6 | 6.4 | 5.9 | 7.1 | 6.2 | 7.4 | 7.2 | 8.7 | 7.6 | 9.6 | 8.9 | 11.5 | 10.0 |
| 20 | 6.2 | 5.8 | 6.6 | 6.1 | 7.3 | 6.4 | 7.6 | 7.5 | 9.0 | 7.9 | 10.0 | 9.4 | 12.1 | 10.5 |
| 15 | 6.4 | 6.1 | 6.8 | 6.3 | 7.7 | 6.7 | 8.0 | 7.9 | 9.5 | 8.3 | 10.5 | 9.9 | 12.7 | 11.1 |
| 10 | 6.7 | 6.4 | 7.1 | 6.6 | 8.0 | 7.0 | 8.3 | 8.3 | 10.0 | 8.7 | 11.1 | 10.5 | 13.5 | 11.8 |
| 5 | 7.2 | 6.8 | 7.6 | 7.1 | 8.6 | 7.4 | 8.9 | 9.0 | 10.8 | 9.4 | 12.0 | 11.5 | 14.6 | 12.9 |

*Score is measured in seconds.

F = females; M = males.

Based on R. Rikli and C. Jones, 2001, *Senior fitness test manual* (Champaign, IL: Human Kinetics).

## Data Collection Worksheet

**Name;_____ Age _____HGT _____ Wgt_____**

**1. Chair Stand**

**Version _____ 1 or 2 Trial 1 _____ Trial 2_____**

**Interpretation: _____**

**2. 6-minute Walk**

**Height_____Weight _____ Predicted distance_____**

**Results (distance in 6 minutes) _____**

**Interpretation based on predicted and actual _____**

**3. Timed Up and Go**

**Chair Height _____**

**Score _____sec**

**4. Single Leg Stance (eyes open)**

**Score _____ Eyes Closed Score _____**

**5. Chair Sit and Reach**

**Score _____**

**6. Arm curls**

**Score _____**

**7. 2-minute Step Test**

**Score _____**

**8. Back Scratch**

**Score _____**

**9. Trunk Rotation**

**Score _____**