

Health and Functional Fitness Assessment

Learning Objectives

1. Identify the importance of appropriate health and fitness assessment for mature clients
2. List the three criteria for selecting assessments
3. Identify common functional assessments that are useful with mature clients
4. Describe how to properly perform the following assessments:
 - a. 30 second Chair Stand
 - b. 8' Up and Go
 - c. Resting blood pressure
 - d. Modified Clinical Test of Sensory Interaction in Balance (mCTSIB)
 - e. Posture and Body Alignment

Introduction

The assessment of health and functional fitness should be an integral first step in the training process for mature clients whenever possible. It will provide critical information necessary for developing a prioritized and effective exercise program. Additionally, follow-up assessments should be performed periodically to gauge progress and, if necessary, redirect the exercise routine. While there are numerous assessments to choose from not all are appropriate and most do not assess functional performance.

Assessments should be well-documented in the research literature as being valid and reliable with mature populations and provide information as to a client's functional abilities. Prudent selection is also important because some tests have floor or ceiling effects which limit their ability to be used with certain individuals. This module will explain the criteria for selecting appropriate assessments, describe useful assessments with mature clients and teach you how to perform several of them.

Considerations for Exercise Testing

Due to the increased risk for and prevalence of chronic diseases and orthopedic limitations in the mature population trainers should fully evaluate their clients before beginning an exercise training program with them. The evaluation should include a comprehensive health history questionnaire, goal setting and fitness testing. While it

is common for trainers to use the Physical Activity Readiness Questionnaire (PAR-Q) to screen clients this is not always appropriate for older clients since the tool is only validated for use with clients up to the age of 69. In addition, the PAR-Q does not provide any specific information on the types and/or severity of existing diseases and conditions. It is more appropriate to instead evaluate clients using a health history questionnaire that includes an assessment of: current chronic diseases; current risk factors for disease; current medications; prior surgeries and their dates; current musculoskeletal/orthopedic conditions; current illnesses and injuries; and history of physical activity and exercise. If qualified the fitness professional could also conduct some basic health-related tests such as height/weight, body composition, resting heart rate and resting blood pressure. This information will provide a well-rounded view of the client's physical needs. Following the health history evaluation should be a discussion of the client's goals. Given the diversity of the mature population it is a mistake to make assumptions about the client's goals. It is critical to understand what outcomes are important to them – improved health, quality of life, fitness, function, pain reduction, sports performance, disease management, stress reduction, social interaction or more.

Exercise testing is an extremely useful tool that should be a standard part of the client intake process in addition to a comprehensive health history questionnaire. Testing can help the trainer develop appropriate training programs, monitor outcomes more effectively and make referrals for further medical evaluation when necessary. There are a wide variety of fitness assessment tools available for professionals to use but not all have been validated for use with older populations.

Trainers should choose assessments for their older clients based on three basic criteria: 1) existing health conditions and physical limitations of the client; 2) purposes for conducting the assessment; and 3) expertise or skill of the professional conducting the test. Although numerous assessments have been developed and validated for use with older populations (see table) the trainer must choose judiciously. Many assessments have either floor or ceiling effects that limit their use to clients within certain ranges of functional capacity.

Elite and physically fit older adults can typically participate in many of the standard fitness tests validated with younger populations that measure maximal aerobic capacity or muscle strength. Maximal tests of aerobic capacity can be conducted using motorized treadmills, cycle ergometers or in the field (e.g. Cooper 12-minute test; 1.5 mile test for time). The gold standard for measuring muscle strength is the one-repetition maximum (1RM) test. This can be conducted using free weights, variable resistance machines or specialized equipment such as isokinetic dynamometers following established protocols and guidelines.

Physically independent, frail and dependent older adults should participate in targeted assessments appropriate for their level of function and health. For the independent adult this could also include submaximal measures of fitness commonly used with younger populations such as the YMCA submaximal bicycle ergometer test, a standard sit and reach test or abdominal curl-up test. Multiple repetition maximum tests of muscular strength are commonly used as a safer alternative to 1RM testing. However, predicting maximal strength with older populations is not as accurate and

may therefore yield unreliable results.

Functional fitness testing in the older adult can include assessments of static balance, dynamic balance, agility, mobility, gait, flexibility, whole-body function and other components. Assessments can be single-task, dual-task, combinations of functional activities or composite measures. A commonly used assessment tool is the Senior Fitness Test Battery.

The Senior Fitness Test Battery [21] consists of 7 tests that measure muscular strength, flexibility, cardiorespiratory endurance, dynamic balance/agility and body composition (Table 26.1). Each test has been proven to be valid and reliable for use with older populations; is relatively safe; requires minimal equipment; requires minimal training for the tester; and can easily be performed with groups. Normative tables allow comparison of results with others of similar age and gender.

A number of questionnaires and scales have been developed to evaluate functional capacity such as the Katz Index of Activities of Daily Living, Barthel Index, Instrumental Activities of Daily Living (IADL) Screening Questionnaire and the Medical Outcomes Study Short Form 36 (SF36). However, the usage of these tools is typically limited to the clinical, nursing home or retirement setting for use with frail and dependent populations.

Common Tests of Physical Function for Older Adults

Senior Fitness Test Battery

Test	Measures	Descriptions
<i>8' Up and Go</i>	Agility; Dynamic Balance	How quickly a person can walk around a cone 8 feet away from, and returning to, a sitting position
<i>30 Second Chair Stand</i>	Lower-Body Strength	How many times a person can stand up from a seated position in 30 seconds.
<i>2-minute Step Test</i>	Cardiorespiratory Endurance	How many times a person can step in place in 2 minutes.
<i>6-minute Walk</i>	Cardiorespiratory Endurance	How far a person can walk in 6 minutes.
<i>Back Scratch</i>	Upper-Body Flexibility	How close a person can get their fingers when reaching one hand over their shoulder and the other hand behind their back.

Test	Measures	Descriptions
<i>Sit and Reach</i>	Lower-Body Flexibility	How close to, or past, their toe a person can reach with both hands while in a seated position with an outstretched leg.
<i>30-second Arm Curl</i>	Upper-Body Strength	How many times a person can curl a dumbbell (5 pounds for women; 8 pounds for men) in 30 seconds in a seated position.

Other Tests

Test	Measures	Descriptions
<i>Continuous Scale Physical Functional Performance 10 Test (CS-PFP)</i>	Upper and lower body strength, upper body flexibility, balance and coordination, and endurance.	A battery of 10 everyday tasks such as pouring, sweeping a floor, and climbing stairs.

Test	Measures	Descriptions
<i>Performance-Oriented Mobility Assessment (POMA)</i>	Static and Dynamic Balance and Gait	Composite score of a variety of functional tasks involving balance and gait.
<i>Dynamic Gait Index</i>	Gait and Dynamic Balance	Composite score of several gait-related tasks such as walking with head turns; stepping over obstacles; and stair-climbing.
<i>Walkie-Talkie Test</i>	Divided Attentional Demands	How well a person can talk and walk simultaneously.

Balance-Specific Tests

Test	Measures	Descriptions
<i>One-Leg Stand</i>	Static Balance	How long a person can stand on one leg (up to 30 seconds).

Test	Measures	Descriptions
<i>Modified Clinical Test of Sensory Interaction in Balance</i>	Visual, Vestibular and Somatosensory System Contributions to Balance	How long (up to 30 seconds) and individual can stand under four conditions: Eyes Open Stable Surface; Eyes Closed Stable Surface; Eyes Open Unstable Surface; Eyes Closed Unstable Surface
<i>Berg Balance Scale</i>	Static and Dynamic Balance	Composite score of 14 different tasks such as transferring from a chair; turning 360 degrees while standing; stepping up onto a bench.
<i>Fullerton Advanced Balance Scale</i>	Static and Dynamic Balance	Composite score of 10 functional tasks such as tandem walk, stand on one leg, and two-foot jump.

Test	Measures	Descriptions
<i>Tinetti Balance and Gait</i>	Static and Dynamic Balance and Gait	Composite score of 9 functional tasks such as rising from a chair and standing with eyes closed.
<i>Functional Reach Test</i>	Limits of Stability	How far a person can reach forward in a standing position.
<i>Multi-Directional Reach Test</i>	Limits of Stability	How far a person can lean to the front, sides and rear in a standing position.

Functional Assessments

The 30 second chair stand and the 8' up and go are both part of the Senior Fitness Test (SFT). The full battery also includes the following tests: seated arm curl, 2 min step (or 6 min walk), chair sit-and-reach, back scratch, and height and weight. The SFT is a widely used assessment battery designed and validated specifically for use with older adults. It uses normative tables from data collected on over 7,000 men and women, ages 60-94.

In order to score the 30 second chair stand and the 8' up and go you will need to purchase the Senior Fitness Test Manual -2nd edition by Rikli and Jones (Human Kinetics), 2013.

30 second Chair Stand

The purpose of this test is to assess lower-body strength in a functional manner.

The test can be performed with minimal equipment. All that is needed is a stopwatch and a straight-back or folding chair with a seat height of 17 in. The chair should be placed against the wall to prevent slipping during the test.

Instruct the client to sit in the middle of the chair with back straight, feet flat on the floor and arms crossed at the wrists and held against the chest. Using the command “Ready, Set, Go” the client should rise to a full stand and then return to a fully seated position. You should encourage them to complete as many full stands as possible in 30 seconds. Demonstrate the test slowly to them to show proper form, then at a faster pace to show that the purpose of the test is to do as many as they can in the 30 seconds. Before testing, have the client practice one or two chair stands with proper form.

The client's score is the number of stands that they are able to complete in 30 seconds. If a person is more than halfway up at the end of 30 seconds, it counts as a

full stand. If the client cannot perform even one chair stand without using their hands their score is zero. However, allow the client to perform the test by using their arms to push off their legs or the chair, or use a cane or walker if necessary. This will provide a baseline for assessing improvement or decline over time. Only one trial should be administered.

Tips:

- Elbows should stay tight to the body the whole time. The client should avoid swinging their arms away from their body.
- Brace the chair against the wall or have someone hold it steady during the test.
- Stay close to the client and be ready to steady them if needed.
- The client's body weight should shift fully to the chair seat when they sit down.

8' Up and Go

The purpose of this test is to assess agility and dynamic balance.

The only equipment needed is a stopwatch, a straight-back or folding chair with a seat height of 17 in, a tape measure and a cone. Place the chair against the wall facing a cone placed exactly 8 feet away (measured from the front edge of the chair to the farthest edge of the cone).

Instruct the client to sit in the middle of the chair with back straight, feet flat on the floor and hands on the thighs. One foot should be placed slightly in front of the other foot with the torso slightly leaning forward (in the “ready” position). On the command “ready, set, go” the client gets up from the chair, walks as quickly as possible around either side of the cone, and sits back down in the chair. The timer should start on the word “go” whether or not the client has started to move and the timer should stop at the instant the person sits back down on the chair.

Demonstrate the proper form and have the client practice it once at slow speed. Instruct the participant to walk “as quickly and safely as possible”. Administer two test trials. Record both times to the nearest tenth of a second, and use the fastest time for their score. If needed, a cane or walker can be used for this test, but scores should not be compared to the norms and the type of adaptation used should be recorded.

Tips:

- It is important to spot the client during the test. Stand between the chair and cone in order to assist them if they lose their balance but without impeding their path.
- For frailer clients move with them so that you will be within helping distance as they round the cone and as they sit back down.

Berg Balance Scale

The Berg Balance Scale (BBS) is a 14-item scale designed to measure balance of the older adult in a clinical or community setting with minimal equipment. It typically takes around 15-20 minutes to complete. It is more appropriate for lower-functioning adults since there is a potential ceiling effect with higher level clients. The BBS is one of the most widely used and researched balance tools.

For detailed instructions and a description of each test item refer to the supplementary document.

Modified Clinical Test of Sensory Interaction in Balance (mCTSIB)

The modified Clinical Test of Sensory Interaction on Balance (mCTSIB) is a simplified derivative of the CTSIB, or “Foam and Dome” test which assesses the patient’s functional balance control during four sensory conditions. Although the mCTSIB data set can document the presence of sensory dysfunction, it cannot provide impairment information specific to an individual sensory system. The information provided is designed to help the clinician assess the need for further testing in patients with complaints related to balance dysfunction, and to establish objective baselines for treatment planning and outcome measurement.

1. Eyes open firm surface
2. Eyes closed firm surface
3. Eyes open unstable surface (foam)
4. Eyes closed unstable surface (foam)

Purpose of Test

This test is designed to assess how well an older adult is using sensory inputs when one or more sensory systems are compromised. In condition one, all sensory systems (i.e., vision, somatosensory, and vestibular) are available for maintaining balance. In condition two, vision has been removed and the older adult must rely on the somatosensory and vestibular systems to balance. In condition three, the somatosensory system has been compromised and the older adults must use vision and the vestibular system to balance. In condition four, vision has been removed and the somatosensory system has been compromised so they must rely primarily on the vestibular inputs to balance.

Begin timing each trial using a stopwatch. The trial is over when (a) the participant opens his/her eyes in an eyes closed condition, (b) raises arms from sides, (c) loses balance and requires manual assistance to prevent a fall.

This test provides some insight into whether each of the sensory systems available for balance is being used effectively. Failure to maintain balance in condition two

indicates that the older adult is visually dependent. They are not using somatosensory inputs to maintain balance when eyes are closed. Failure to maintain balance in conditions 3 and 4 indicate that the visual and/or vestibular system is not being used to maintain balance. Poor performance on this test would suggest the need for multisensory training if the medical history does not indicate that an actual problem(s) exists (e.g. peripheral neuropathy).

*Administer only one trial per condition if participant able to complete first trial without loss of balance.

Condition One: Eyes Open, Firm Surface

Trial One Total Time: _____ / 30 sec

Trial Two Total Time: _____ / 30 sec

Trial Three Total Time: _____ / 30 sec

Condition Two: Eyes Closed, Firm Surface

Trial One Total Time: _____ / 30 sec

Trial Two Total Time: _____ / 30 sec

Trial Three Total Time: _____ / 30 sec

Condition Three: Eyes Open, Foam Surface

Trial One Total Time: _____ / 30 sec

Trial Two Total Time: _____ / 30 sec

Trial Three Total Time: _____ / 30 sec

Condition Four: Eyes Closed, Foam Surface

Trial One Total Time: _____ / 30 sec

Trial Two Total Time: _____ / 30 sec

Trial Three Total Time: _____ / 30 sec

TOTAL: _____ / 120 sec

Condition	Possible Impairments	Recommended Exercises
<i>1 – Eyes Open, Firm Surface (3/3 systems available)</i>	1. Poor gaze stabilization 2. Poor use of surface cues 3. Lower body weakness	Teach visual “spotting” Balance activities with reduced/occupied/absent vision
<i>2 – Eyes Closed, Firm Surface</i>	1. Poor use of surface cues 2. Lower body weakness 3. Fear of falling	Increased awareness of surface information through verbal cueing during standing exercises. Balance activities with reduced/occupied/absent vision Lower body activities against resistance Confidence-building activities

Condition	Possible Impairments	Recommended Exercises
3 – Eyes Open, Foam Surface (2/3 systems available) Somatosensory information reduced	1. Poor use of vision 2. Lower body weakness 3. Poor center-of-gravity control	Gaze stabilization techniques. Balance activities performed on compliant, or moving surfaces. Lower body exercises against resistance. Standing center-of-gravity activities on compliant surfaces of different thickness.
4 – Eyes Closed, Foam Surface (1/3 systems available) Somatosensory reduced and vision absent.	1. Poor use of vestibular inputs 2. Fear of falling in high sway condition 3. Lower body weakness	Balance activities performed on compliant/moving surfaces with vision reduced/occupied/absent. Voluntary sway activities to build confidence. Lower body exercise against resistance.

Posture and Body Alignment

A systematic approach to postural analysis involves viewing the body's anatomical alignment relative to a certain established reference line. This reference (gravity) line serves to divide the body into equal front and back halves and to bisect it laterally. In preparing to carry out postural assessment, the examiner should be aware of factors that will enhance the success and validity of the examination process.

These factors are:

1. Postural assessment must be performed with the subject minimally clothed, in order to ensure a clear view of the contours and anatomical landmarks used for reference. Tank tops, sleeveless shirts or sports bras with shorts and bare feet are recommended.
2. Subjects should stand in front of a posture grid for evaluation of the lateral, anterior and posterior views. Pictures are a great way to show the clients the postural deviations that need to be addressed.
3. The examiner should instruct the subject to assume a comfortable and relaxed posture. Many clients will try to assume a “military” stance that does not represent their typical posture.
4. Subjects who use orthotic or assistive devices should be assessed with and without them to determine their effectiveness in correcting posture.
5. The examiner should note relevant medical history and other information that may account for certain postural abnormalities. Important information includes:
 - Any history that accounts for present postural abnormalities.
 - A complete description of present symptoms.
 - The upper limb dominance of the subject, which is often responsible for symptomatic postural deviations.

Postural examination is most commonly performed by assessing the body's alignment in lateral, posterior and anterior views.

Evaluating Standing Posture

a) Lateral View

Lateral postural assessments should be performed from both sides to detect and rotational abnormalities that might go undetected if observed from only one lateral perspective. Ideally, the plumb line should pass through the ear lobe and shoulder joint.

1. Head and neck:

Plumb line: The line falls through the ear lobe to the acromion process. Common faults include:

- Forward head: The head lies anterior to the plumb line.
- Flattened lordotic cervical curve: The plumb line lies anterior to the vertebral bodies.
- Excessive Lordotic curve: The gravity line lies posterior to the vertebral bodies.

2. Shoulder:

Plumb line: It falls through the acromion process. Common faults include:

- Forward shoulders: The acromion process lies anterior to the plumb line; the scapulae are abducted.
- Lumbar Lordosis: The lumbar region is flat as the subject raises arm overhead.

3. Thoracic vertebrae:

Plumb line: The line bisects the chest symmetrically. Common faults include:

- Kyphosis: Increased posterior convexity of the vertebrae.
- Pectus excavatum (Funnel chest): Depression of the anterior thorax and sternum.
- Barrel chest: Increased overall antero-posterior diameter of rib cage.
- Pectus cavinatum (Pigeon chest). The sternum projects anteriorly and downward.

4. Lumbar vertebrae:

Plumb Line: The line falls midway between the abdomen and back and slightly anterior

to the sacroiliac Joint. Common faults include:

- Lordosis: Hyperextension of lumbar vertebrae.
- Sway back: Flattening of the lumbar vertebrae (the pelvis is displaced forward).
- Flat back: Flattening of the lumbar vertebrae.

5. Pelvis and hip:

Plumb Line: The line falls slightly anterior to the sacroiliac joint and posterior to the hip joint, through the greater trochanter, creating an extension moment. Common faults include:

- Anterior pelvic tilt. The anterior superior iliac spines lie anterior to the pubic symphysis.
- Posterior pelvic tilt. The symphysis pubis lies anterior to the anterior superior iliac spines

6. Knee:

Plumb line: The line passes slightly anterior to the midline of the knee, creating an extension moment. Common faults include:

- Genu recurvatum: Knee is hyperextended and the gravitational stresses lie far forward of the joint axis
- Flexed knee: The plumb line falls posterior to the joint axis.

7. Ankle:

Plumb line: The line lies slightly anterior to the lateral malleolus, aligned with tuberosity of 5th metatarsal. Common faults include:

- Forward posture: The plumb line is posterior to the body; body weight is carried on the metatarsal heads of the feet.

b) Posterior view

In a posterior view examination, the examiner's plumb line divides the body into equal left and right halves.

1. Head and neck:

Plumb line: The midline bisects the head through the external occipital protuberance; head is usually positioned squarely over the shoulders so that eyes remain level. Common faults include:

- Head tilt: Subject's head lies more to one side of the plumb line.
- Head rotated: The plumb line is to the right or left of the midline.

2. Shoulder and scapula:

Plumb line: It falls midway between shoulders. Common faults include:

- Dropped shoulder: One shoulder is lower than the other.
- Elevated shoulder: One shoulder is higher than the other.
- Shoulder medial rotation: The medial epicondyle of the humerus is directed posteriorly
- Shoulder lateral rotation: Olecranon process faces posteriorly.
- Adducted scapulae: The scapulae are too close to the midline of the thoracic vertebrae.
- Abducted scapulae: The scapulae have moved away from the midline of the thoracic vertebrae.
- Winging of the scapulae: The medial borders of the scapulae lift off ribs.

3. *Trunk:*

Plumb Line: The line bisects the spinous process of the thoracic and lumbar vertebrae.

Common faults include:

- Lateral deviation (Scoliosis): The spinous processes of the vertebrae are lateral to the midline of the trunk.

4. *Pelvis and Hip:*

Plumb line: The line bisects the gluteal cleft and the posterior superior iliac spines are on the same horizontal plane; the iliac crests, gluteal folds and greater trochanters are level. Common faults include:

- Lateral pelvic tilt: One side of the pelvis is higher than the other
- Pelvic rotation: The plumb line falls to the right or left of the gluteal cleft.
- Abducted hip: The greater trochanter is higher on the involved side.

5. *Knee:*

Plumb Line: The plumb line lies, equidistant between the knees. Common faults include:

- Genu varum: The distal segment (leg) deviates toward midline in relation to the proximal segment (thigh); the knee joint lies lateral to the mechanical axis of the lower limb.
- Genu Valgum: The mechanical axis for the lower limbs is displaced laterally

6. Ankle and Foot:

Plumb line: The line is equidistant from the malleoli, a line (Feiss') is drawn from the medial malleolus to the first metatarsal bone and the tuberosity of the navicular bone lies on the line. Common faults include:

- Pes planus (Pronated): There is decreased medial longitudinal arch, the Achilles tendon is convex medially and the tuberosity of the navicular bone lies below the Feiss line.
- Pes Cavus (supinated): The medial longitudinal arch is high and the navicular bone lies above Feiss' line.

c) Anterior View

Relationships can be posturally assessed from the anterior view with the plumb line bisecting the body into equal left and right halves.

1. Head and Neck:

Plume Line: The line bisects the head at the midline into equal halves. Common faults include:

- Lateral Tilt: See section on posterior view.
- Rotation: See section on posterior view.

2. Shoulders:

Plumb Line: A vertical line bisects the sternum and xiphoid process. It may be due to:

- Dropped or elevated shoulder: See section on posterior view.
- Clavicle and joint asymmetry:

3. Elbows:

Plumb Line: A line bisects the upper limbs and forms an angle of 5° to 15° laterally at the elbow with the elbow extended. This angle is normal and is referred to as the carrying angle. Common faults include:

- Cubitus valgus: The forearm deviates laterally from the arm at angle greater than

15° (female) and 10° (male)

- Cubitus varus: The forearm deviates medially (adducts) from the arm, at an angle of less than 15° for females and 10° for males.

4. *Hip:*

Plumb line: Common faults include:

- Lateral rotation: The patellae angle out.
- Medial rotation: The patellae face inward.

5. *Knee:*

Plumb Line: The legs are equidistant from a vertical line through the body. Common Faults include:

- External tibial torsion: Normally, the distal end of the tibia is rotated laterally 25° from the proximal end. Excess of 25° rotation is an increase in torsion and is referred to as lateral tibial torsion (toeing out).
- Internal tibial torsion: The feet face directly forward or inward.

6. Ankle and Foot:

Plumb line: Common Faults include:

- Hallux valgus: Lateral deviation of the first digit at the metatarso-phalangeal joint.
- Claw toes: Hyperextension of the metatarso-phalangeal joint and flexion of the proximal interphalangeal joints, associated with pes cavus.
- Hammer toes: Hyperextension of the metatarsophalangeal joints and distal interphalangeal joints and flexion of the proximal interphalangeal joints.