

MODULE 5

HEALTH AND FUNCTIONAL FITNESS ASSESSMENT

Objectives

1. Identify the importance of appropriate health and fitness screening and assessment for mature clients
2. List the criteria for selecting assessments
3. Identify common screening tools and functional assessments that are useful with mature clients
4. Describe how to properly perform several key assessments

Introduction

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 begin with a comprehensive health history questionnaire, goal setting, screening and functional fitness assessment. While it is common for trainers to use the Physical Activity Readiness Questionnaire (PAR-Q) to screen younger 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.

The PAR-Q+ is an enhanced version of the PAR-Q tool that is designed for clients of all ages and includes more questions related to a broader range of health conditions that are useful for the health and fitness professional. It is appropriate and necessary to evaluate clients using a health history questionnaire, like the PAR-Q+ or others, that includes information regarding: 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.

Components of a proper health history evaluation include:

- Past and current chronic disease conditions, injuries and surgeries including dates and details regarding severity
- Past and current lifestyle habits including physical activity/exercise, nutrition, tobacco and alcohol use
- Current medications including dosages
- Current physical capabilities and limitations
- Short- and long-term health, fitness and functional goals

Given the diversity of the mature population it is a mistake to make assumptions about the client's goals based on their age, health conditions or functional ability. It is critical to understand what outcomes are important to the individual which may include: improved health, quality of life, fitness, function, pain reduction, sports performance, disease management, stress reduction, social interaction or more. Many older adults are motivated to exercise so that they can continue to do the things they need, like and want to do in life. Therefore, it is also important to understand what activities they currently enjoy and what activities they have had to give up due to declining levels of fitness and function. This could include anything from an occupation, volunteer work, sport (golf, tennis, soccer, etc.), recreational activity (hiking, gardening, swimming, etc.), or family activity (e.g. playing with grandchildren). For example, one client was motivated to start

exercising because of an upcoming trip to the Galapagos Islands with her husband. In order to enjoy the trip, she was told that she would need to be able to walk at least 1 mile at a time over uneven terrain outdoors. She knew that in her current state she could not do it since she had early-stage Parkinson's disease, was overweight, unfit and in her 70's. She trained for several months and was able to complete the trip successfully and had a great time. In addition, the experience motivated her to stay active and she continued to train regularly for many years afterwards which improved her functional ability, managed her Parkinson's symptoms and extended her life. This type of goal is somewhat common among older adults.

Screening and assessment/testing should follow the health history evaluation. Screening is a process for evaluating the possible presence of a particular problem. The outcome is normally a simple yes or no. Assessment is a process for defining the nature of that problem, determining a diagnosis, and developing specific treatment recommendations for addressing the problem or diagnosis. However, screening and assessment tools are often used interchangeably depending on the situation and the purpose of the evaluation. Many of these tools are appropriate for performing in large group settings, such as at community events, because they are quick, easy to conduct and require minimal equipment. By doing these in large group settings it is possible to screen a lot of people in a short amount of time. Individuals that fail a screening can then be tagged for follow up to conduct more in-depth assessments.

Functional assessment is an extremely useful tool that should be a standard part of the client intake process. Testing can help the trainer identify strengths and weaknesses (deficits), develop appropriate training programs, motivate the client, 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 screening tools and assessments for their older clients based on three basic criteria: 1) the functional level 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) many have either floor or ceiling effects that limit their use to clients within certain ranges of functional capacity. A floor effect occurs when a person scores a “0” or the lowest possible score on a test and it fails to measure any further decline. A ceiling effect occurs when a person scores the maximum possible on a test and it fails to measure any further improvements. For example, during a chair stand test a person may not be able to stand up even one time although they can partially rise from the chair. Because they cannot stand up once they receive a score of zero on the test. A few months later the same person cannot even attempt to rise from the chair. The individual is obviously worse off at the second time point compared to earlier but they would still receive the same score of zero. This is a floor effect.

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, muscle strength, flexibility or even vertical jump performance. 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. 1RM testing has been found to be safe for older adults as long as they are able to perform the test using proper technique and do not have an underlying joint condition that could be aggravated by the testing. Another alternative is to do the Senior Athlete Fitness Exam (SAFE). The SAFE includes higher level functional tasks appropriate for older adults that are at a higher level of fitness and will be described in more detail later in this section.

For the lower or higher independent adult 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 can be used. Multiple repetition maximum tests of muscular strength are commonly used as a safer alternative to 1RM testing for this group although predicting maximal strength with older populations is not as accurate and may therefore yield unreliable results. Higher level functional tests should also be used as their specific functional deficits vary widely.

Functional fitness testing should be the focus for the frail and pre-frail individuals. This could 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. The purpose is to identify those who have lost a significant amount of function or are at high-risk of functional decline so that an appropriate intervention (exercise program) can be tailored to meet their needs.

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.

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. In the following section a number of valid and reliable screening tools and assessments will be described that focus on multiple domains of function (according to FAI's 6 Domain Model).

Screening Tools

Mobility: The WHO ICOPE guidelines recommend the Five Times Sit to Stand (5xSTS) as a screening for mobility impairments. To perform the 5xSTS have the client sit in a standard height chair (17 in/43-45cm) and follow these directions:

1. Client sits with arms folded across chest and their back against the chair.
2. Patient Instructions: "I want you to stand up and sit down 5 times as quickly as you can when I say 'Go'."
3. Timing begins at "Go" and ends when the buttocks touches the chair after the 5th repetition
4. Provide one practice sit to stand (one repetition) before starting the test.
5. Inability to complete five repetitions without assistance or use of upper extremity support indicates failure of test.

6. Instruct patient to stand fully between repetitions of the test and not to touch the back of the chair during each repetition. It is OK if the patient touches the back of the chair but it is not recommended.
7. Try NOT to talk to the patient during the test as this may decrease their speed.

Per ICOPE guidelines, if an individual take > 14 seconds to perform the 5xSTS then they fail the screen and a follow-up assessment using the Short Physical Performance Battery is recommended.

It should be noted that the 5xSTS is used in other testing batteries which may use different cutoff scores for identifying individuals at risk.

Mobility: The Timed Up and Go (TUG) test is a widely used screen for mobility limitations. Have the client sit in a standard height chair (45cm). Time how quickly they are able to stand up, walk to a line 3 meters from the front edge of the chair, turn around and walk back to the chair. They are to walk at their usual walking speed. Start the timer when you say “Go”. Stop the timer when their buttocks touch the seat when they sit back down. Demonstrate the test for the client and then have them perform a practice trial before the actual testing. A normal time is less than 10 seconds. Greater than 15 seconds indicates a significant mobility impairment and an increased risk of falls (although some sources recommend a cutoff score of 13.5 seconds). Between 10 and 15 seconds indicate potential mobility decline (Waldron, Hill and Barker (2012). Falls prevention and assessment in older adults: Assessment and management; Australian Family Physician Vol 41, No 12.).

Balance: The Single Leg Stance (SLS) test can be used to quickly screen for potential balance issues. Have the client stand on one leg for up to 30 seconds with their arms crossed over their chest and eyes looking forward. Tell the client to not allow their lifted leg to rest against their stance leg. Start the timer when they lift their leg and stop the timer when they either lose their balance; remove their arms; or their lifted leg touches the floor or their other leg. Repeat the test

on the other leg. Give the client up to 3 trials on each leg. If they cannot achieve at least 10 seconds on both legs then further balance assessment is recommended (Waldron, Hill and Barker (2012). Falls prevention and assessment in older adults: Assessment and management; Australian Family Physician Vol 41, No 12.). The SLS is also a part of the Short Physical Performance Battery.

Balance and Vestibular Function: The Modified Clinical Test of Sensory Interaction in 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 is not intended to diagnose any sensory issues. It is best used to screen for vestibular dysfunction since it is estimated that about 70% of 70+-year-olds have this to some degree.

There are four conditions to this test. For conditions 1 (eyes open) and 2 (eyes closed) the client stands on the floor with their shoes on. For conditions 3 (eyes open) and 4 (eyes closed) the client stands on top of two high density foam pads with their shoes on. In both conditions, the person should stand tall, look straight ahead and cross their arms over their chest. 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. It is condition four that is used as the screen for vestibular dysfunction but the entire test must be conducted in order to obtain valid results.

Begin timing each trial using a stopwatch. Start the stopwatch on your command of “begin”. 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, or (d) they reach the maximum time of 30 seconds. Provide three trials per condition unless they achieve the maximum time in which case you can proceed immediately to the next condition. It is HIGHLY recommended that you perform this test in the corner of a room (client’s back to the corner) without any other equipment or objects nearby.

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
1 – Eyes Open, Firm Surface (3/3 systems available)	1. Poor gaze stabilization 2. Poor use of surface cues 3. Lower body weakness	Teach visual “spotting” Balance activities with reduced/occupied/absent vision
2 – Eyes Closed, Firm Surface	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
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.

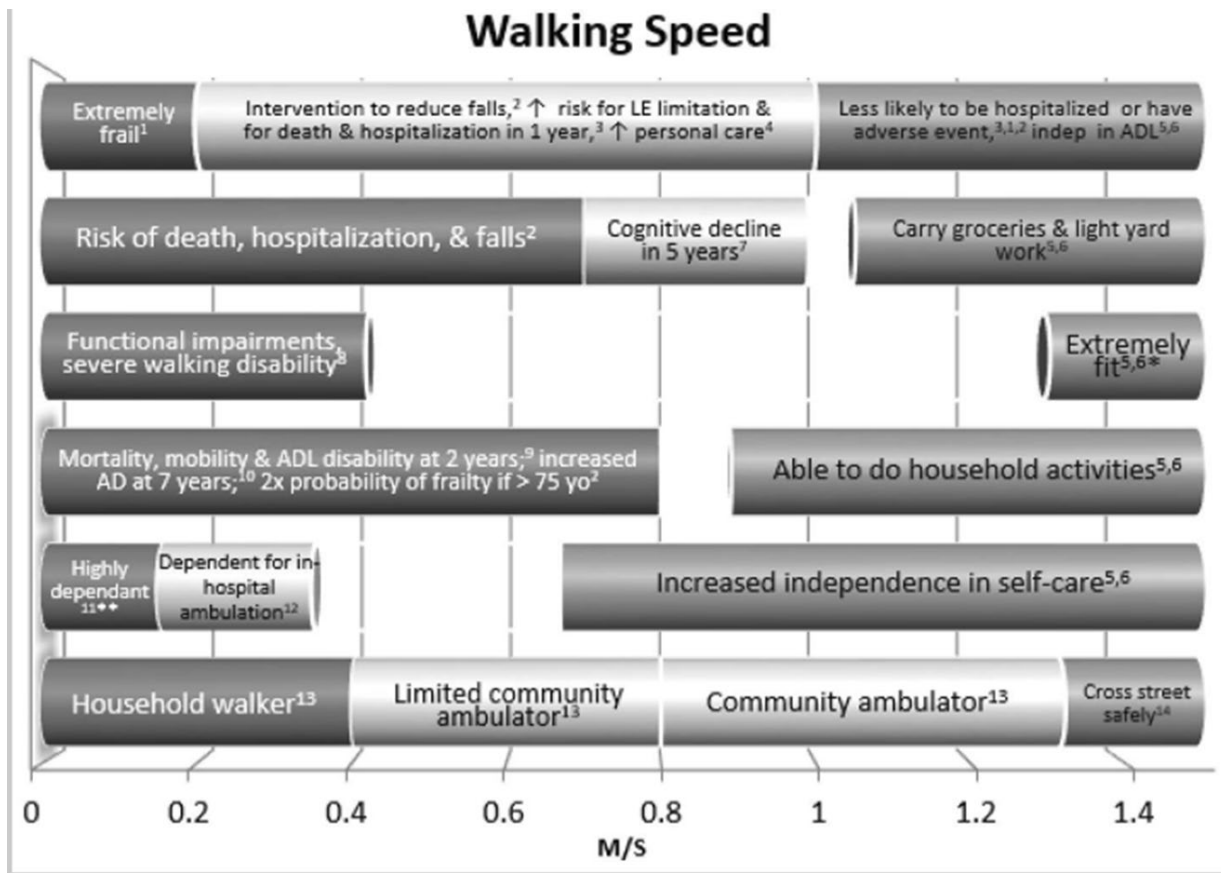
Falls: The STEADI program by the U.S. CDC recommends three questions for all adults 65 and older to screen for potential fall risk. These are:

1. Have you fallen in the past year? (If so how many times?)
2. Do you feel unsteady when standing or walking?
3. Do you worry about falling?

If the client answers “yes” to any of the three questions, they are considered at increased risk of falling and further assessment is recommend. The STEADI algorithm recommends either the Timed Up and Go test, 30-second Chair Stand test or the 4-Stage Balance test for follow-up balance assessment.

Gait: Gait speed (walking speed) has been referred to as “the almost perfect measure” and recommended as the “sixth vital sign” because it is highly reliable; correlates with functional ability; and is predictive of future issues such as functional decline, hospitalization and even mortality (Fritz and Lusardi, 2009). It is also very quick and easy to assess. To assess gait speed mark off a distance of 20 meters in an open hallway or room by placing tape on the floor. Mark the floor with tape at the 5- and 15-meter marks as well. Position the client at the first piece of tape (the 0-meter position) and tell them to walk at their usual walking speed (“comfortable pace”) to the last piece of tape. Start the timer when they cross the 5-meter mark and stop the timer when they cross the 15-meter mark so that you are only timing the middle 10-meters. To increase accuracy, it is recommended that you allow the person to rest for a minute or two and then have them do it again and then average the results. There have been a wide variety of protocols used in the literature that have been shown to be valid and reliable (such as the 3- or 4-meter gait speed test that is part of the Short Physical Performance Battery) that may suit your facility’s space capabilities better.

A gait speed of less than 1.0 m/s is considered a risk factor for falls, frailty and future disability while a speed of less than 0.8 m/s indicates the individual is going to have difficulty walking safely within their community and will have much more difficulty navigating obstacles like curbs ramps and stairs. A score of less than 0.6 m/s indicates an individual will need help with activities of daily living. Other score ranges have also been developed that are associated with different levels of functional ability and adverse outcomes (see image below). A decline in gait speed is indicative of declining function and should be taken seriously. Many older adults would benefit from an annual or even semi-annual assessment of gait speed in order to detect any changes which may put them at risk of falls and other adverse outcomes.



Middleton A, Fritz SL, Lusardi M. Walking speed: the functional vital sign. J Aging Phys Act. 2015 Apr;23(2):314-22.

Strength: A simple handgrip strength test using a dynamometer is a quick screen for overall muscle strength as the two are highly correlated in older populations. A standardized positioning for this test has been recommended:

- Subject is seated with back, pelvis and knees as close to 90 degrees as possible
- Shoulder is adducted (arm by their side), elbow flexed at 90 degrees, forearm neutral
- The arm is not supported by the examiner or armrest and the dynamometer is presented vertically and in line with the forearm
- Maximum grip is the mean of three trials

According to the U.S. Centers for Disease Control criteria the following levels of muscle strength are in the chart below:

	Men	Women
Normal	>32 kg	>20 kg
Intermediate	26-31.9 kg	16-19.9 kg
Weak	< 26 kg	< 16 kg

The Functional Movement Screen: This is a movement screening system designed to identify deficits in joint mobility, motor control and movement proficiency that has been widely used among athletes, military personnel, fire fighters and other high-demand occupations to determine injury risk. It is also used by fitness professionals working with a wide variety of clientele including older adults. The system includes the following 7 tests: Overhead Squat, Hurdle Step, Inline Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-Up and Rotary Stability. There are additional clearing tests and breakout screens that are also part of the system. The screening results provides useful information for determining what types of exercises a person should or should not do and how to correct any deficiencies that have been identified. See the assessment table for images of each screening test. For more information visit www.functionalmovement.com.

Functional Movement Screen (Higher Ind, Semi-Fit, Fully Fit, Elite)		
Overhead Squat	Functional Pattern	 A person performing an overhead squat, holding a barbell above their head with both hands.
In Line Lunge	Functional Pattern	 A person performing an in-line lunge, stepping forward with one leg and holding a barbell behind their back.
Hurdle Step	Functional Pattern	 A person performing a hurdle step, stepping over a hurdle with one leg while holding a barbell.
Shoulder Mobility	Shoulder Mobility	 A close-up of a person's shoulder being measured with a goniometer.
Active Straight Leg Raise	Hip Mobility	 A person performing an active straight leg raise, lying on their back and lifting one leg straight up.
Trunk Stability Push Up	Core Stability and Motor Control	 A person performing a trunk stability push-up, lying on their stomach with arms extended forward.
Rotary Stability	Core Stability and Motor Control	 A person performing a rotary stability test, lying on their side with one leg bent and the other extended.

Cognitive Screen: The WHO ICOPE guidelines recommend screening for cognitive decline in three steps:

1. Ask the client to remember three unrelated words (flower, door, rice, for example)
2. Ask the client to state the current date, time and place
3. Ask the client to repeat the three words

If they cannot recall all three words then they would fail the screening and an assessment of cognitive capacity would be warranted. There are many cognitive assessments available but the WHO recommends either the Mini-Cog, Montreal Cognitive Assessment (MoCA), Mini Mental State Examination (MMSE) or the General Practitioner Assessment of Cognition (GPCOG). The MMSE is very widely used, easy to administer and requires no formal training to be able to administer properly. The MoCA is a newer tool that is growing in usage but it is a little more difficult to administer properly and its usage requires that the person administering the test pass an online training program first.

Assessment

There are a wide variety of assessments that are used through the health and fitness industries. Any assessment 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. Many common tests are listed in the tables below and some of the more highly recommended assessment protocols are described in more detail. The interpretation of the assessment scores will vary depending on the test. Some have defined cut-off scores, which are

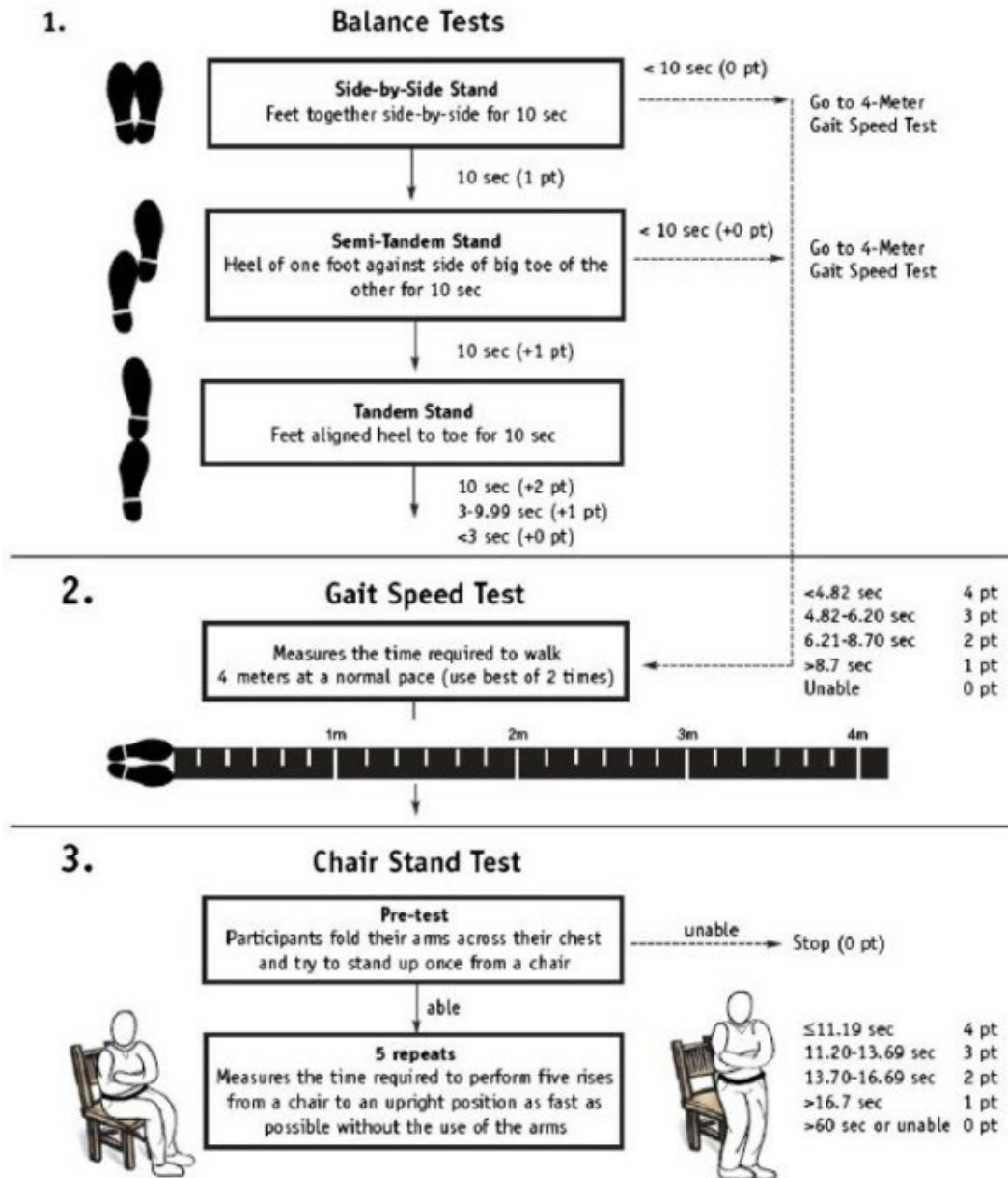
presented here, while others show a range of scores that may signify the need for further assessment or intervention. All of these can be used to document progress, lack of progress, or regression with a client over time.

Common Functional Tests		
Performance-Oriented Mobility Assessment (POMA)	Static and Dynamic Balance and Gait	Composite score of a variety of functional tasks involving balance and gait.
Short Physical Performance Battery (SPPB)	Mobility, Gait and Static Balance	3 Components: 1 – Ability to stand for 10 sec with feet in 3 different positions (together side by side, semi-tandem and tandem) 2 – Two timed trials of a 3 or 4m walk 3 – Time to rise from a chair five times
Dynamic Gait Index (DGI)	Gait and Dynamic Balance	Composite score of several higher-level gait-related tasks such as walking with head turns; stepping over obstacles; and stair-climbing.
Senior Fitness Test Battery (SFT)	6 tasks including lower body strength, upper body strength, lower body flexibility, upper body flexibility, endurance, and mobility	Each item is scored individually and compared to population-based norms. It can be performed individually or with larger groups.
Senior Athlete Fitness Exam (SAFE)	A series of tasks assessing strength, flexibility (including posture), endurance, balance and gait speed	This is designed specifically for higher level individuals. It can be performed individually or with larger groups.

Short Physical Performance Battery (SPPB) – (Frail, Pre-Frail, Lower Ind)

The SPPB is a common assessment tool that has been widely researched and recommended for a variety of settings including medical clinics (e.g. WHO ICOPE). It consists of assessing 3 primary areas: Mobility/Strength; Balance; and Gait. Balance is tested by determining if an individual can stand in 3 different foot positions for 10 seconds each and in the following order: side-by-side; semi-tandem; and tandem. Gait speed is assessed next by timing how long it takes the person to walk a distance of four meters. The final test is the Five Times Sit to Stand. Each of the three tests is scored from 0-4 points giving a maximum possible of 12 points.

The SPPB is more appropriate for lower functioning individuals since the tests are relatively easy and it has a strong ceiling effect. A score lower than 10 indicates a mobility limitation and is predictive of all-cause mortality. In the WHO ICOPE guidelines the chair stand test is performed first as a screening tool so if they fail and the SPPB is performed they do not have to repeat the chair stand test. The complete testing algorithm is detailed in the image below.



Senior Fitness Test Battery (SFT) – (Frail, Pre-Frail, Lower Ind, Higher Ind, Semi-Fit)

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. The 30 second chair stand and the 8' up and go are two of the most widely used assessments in the 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. 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. However, an abbreviated scoring chart for each of these is included here (with permission) so that you can get a good feel for the range of scores.

Senior Fitness Test Battery (Pre-Frail, Lower Ind, Higher Ind, Semi-Fit)		
8' Up and Go	Agility; Dynamic Balance	How quickly a person can walk around a cone 8 feet away from, and returning to, a sitting position
30 Second Chair Stand	Lower-Body Strength	How many times a person can stand up from a seated position in 30 seconds.
2-minute Step Test	Cardiorespiratory Endurance	How many times a person can step in place in 2 minutes.
6-minute Walk	Cardiorespiratory Endurance	How far a person can walk in 6 minutes.
Back Scratch	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.
Sit and Reach	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.
30-second Arm Curl	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.

SFT - 30 second Chair Stand Test (CST)

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 (43 cm). It is best to use a chair that has a hard seat without a cushion. 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 (not slouching or leaning back against the chair), feet flat on the floor shoulder width apart 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 for Administration:

- 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.
- The client may rest during the test but the clock will keep running.

Normative Table for the 30 Second Chair Stand (Partial)

	Women				Men			
% Rank	60-64	65-69	70-74	75-79	60-64	65-69	70-74	75-79
90	20	18	18	17	22	21	20	20
80	18	16	16	16	20	19	18	18
70	17	15	15	14	19	18	17	16
60	16	14	14	13	17	16	16	15
50	15	14	13	12	16	15	14	14
40	14	13	12	12	15	14	13	13
30	12	12	11	11	14	13	12	12
20	11	11	10	9	13	11	11	10
10	9	9	8	8	11	9	9	8

SFT - 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 separated by a period of 1-2 minutes. 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 for Administration:

- 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.

Normative Table for the 8' Up and Go (Partial)

	Women				Men				
% Rank	60-64	65-69	70-74	75-79	60-64	65-69	70-74	75-79	
90	3.7	4.1	4.0	4.3	3.0	3.6	3.6	3.5	
80	4.2	4.6	4.7	5.0	3.6	4.1	4.2	4.3	
70	4.6	5.0	5.2	5.5	4.0	4.5	4.6	4.9	
60	4.9	5.3	5.6	5.9	4.4	4.8	5.0	5.4	
50	5.2	5.6	6.0	6.3	4.7	5.1	5.3	5.9	
40	5.5	5.9	6.4	6.7	5.0	5.4	5.6	6.4	
30	5.8	6.2	6.8	7.1	5.4	5.7	6.0	6.9	
20	6.2	6.6	7.3	7.6	5.8	6.1	6.4	7.5	
10	6.7	7.1	8.0	8.3	6.4	6.6	7.0	8.3	

Senior Athlete Fitness Exam (SAFE) – (Higher Ind, Semi-Fit, Fully Fit, Elite)

The SAFE is a battery of tests used to assess physical capacity and health risks in high functioning aging athletes. It was developed and refined by Becca Jordre, DPT at the University of South Dakota by testing thousands of senior athletes at the National Senior Games competitions, state senior games competitions and other places. Dr. Jordre's published research and experience using the SAFE has yielded valuable insights into this growing population. The testing battery is appropriate for older adults who are Semi-Fit, Fully Fit or Elite on the Hierarchy of Functional Aging model.

The SAFE was originally intended to be used by physical therapists so some of the skills that are required of the assessor, such as goniometry and taking a blood pressure, may be foreign to many fitness professionals. However, with a little training and practice a fitness professional should be able to become proficient with these skills. The battery is portable as it requires very little equipment which is rather inexpensive: stopwatch, goniometer, treatment table (or something similar), foam pad, blood pressure cuff and stethoscope, retractable tape measure, pulse oximeter (optional), calculator, hand grip dynamometer, chair, and masking tape (to mark the walkway for gait speed). The battery can be performed on large groups by setting up individual testing stations and having athletes rotate through them.

Senior Athlete Fitness Exam (SAFE) – (Higher Ind, Semi-Fit, Fully Fit, Elite)		
Cardiovascular	Waist circumference, waist to hip ratio, blood pressure, oxygen saturation, heart rate	Assesses cardiovascular risk
Strength	Handgrip strength, chair stand test	Grip Strength: Use a dynamometer and record the best of 3 trials in kg. Chair Stand: Time how quickly they can stand up and sit down five times.

Walking Speed	Usual speed, fast speed, calculate reserve	Time how quickly they walk 20m at their usual speed and “as quickly as they can” and calculate speed in m/s. Calculate reserve by subtracting usual speed from fast speed.
Flexibility	Shoulder, calf, hip flexors, posture	Posture: Foam pillow test; Shoulder Flexion; Measured in supine using a goniometer. Calf: Measure ankle dorsiflexion using a goniometer. Hip Flexors: Assess as pass/fail using the Thomas Test.
Balance	Single leg stance with eyes closed, Single leg stance on foam	Time how long they can stand (max 30 sec) on their dominant leg with arms crossed over the chest with eyes closed while standing on the floor and with eyes open while standing on a foam pad.

Balance Assessments

Since balance and fall risk is a major concern among older adults there have been numerous balance assessments developed and validate to assess fall risk. These range from single item tests to multiple item test batteries. Each of the following assessments have been used extensively with older adults and have widely recognized cut-off scores to identify those that are at high risk of falling. These are in addition to the balance, mobility and fall-risk screening tools that have already been described. Some of these assessments are very brief while others can take up to 20+ minutes to perform. The test must be matched to the functional level of the individual since some have ceiling effects.

Balance-Specific Tests		
One-Leg Stand (Single Leg Stance)	Static Balance	How long a person can stand on one leg (up to 30 seconds) with eyes open and arms crossed over chest. Do not let the raised leg touch the stance leg.
Berg Balance Scale	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.
Fullerton Advanced Balance Scale	Static and Dynamic Balance	Composite score of 10 functional tasks such as tandem walk, stand on one leg, and two-foot jump.
Functional Reach Test	Limits of Stability	How far a person can reach forward in a standing position
Multi-Directional Reach Test	Limits of Stability	How far a person can lean to the front, sides and rear in a standing position.
Mini BEST Test	Multiple Balance Components	36-item assessment across 6 balance areas: Biomechanical constraints; Stability limits/verticality; Anticipatory postural adjustments; Postural responses; Sensory orientation; Stability in gait
Four Stage Balance Test	Static Balance	Assess standing in 4 different foot positions: side by side; semi-tandem; tandem; single leg

Berg Balance Scale (BBS) – (Frail, Pre-Frail, Lower Ind)

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. The BBS is one of the most widely used and researched balance tools. The tasks progress from easier to more challenging but even the most challenging tasks are not that difficult for higher independent and fit individuals so there is a strong ceiling effect. Therefore, this test is best used on lower functioning older adults. The 14 tasks are as follows:

1. Sitting unsupported
2. Change of position: sitting to standing
3. Change of position” standing to sitting
4. Transfers
5. Standing unsupported
6. Standing with eyes closed
7. Standing with feet together
8. Tandem standing
9. Standing on one leg
10. Turning trunk (feet fixed)
11. Retrieving objects from floor
12. Turning 360 degrees
13. Stool stepping
14. Reaching forward while standing

Each task is scored from 0-4 points giving a maximum possible score of 56. Different cutoff scores have been reported in the literature. A score <45 is associated with an increased risk of falls while a score <40 is associated with 100% fall risk and indicates the individual needs assistance with walking (cane, walker, etc.). From an exercise training perspective, the total score is less valuable than their performance on the individual tasks. Since the tasks are so diverse it is possible to get a better understanding of what types of movements the person struggles with allowing the trainer to target those types of movements in their exercise program. For example, the individual may score higher than 45 but exhibit great difficulty with “Turning 360 degrees” indicating that this may be an area that needs to be practiced (i.e. trained).

Fullerton Advanced Balance Scale (FABS) – (Lower Ind, Higher Ind, Semi-Fit)

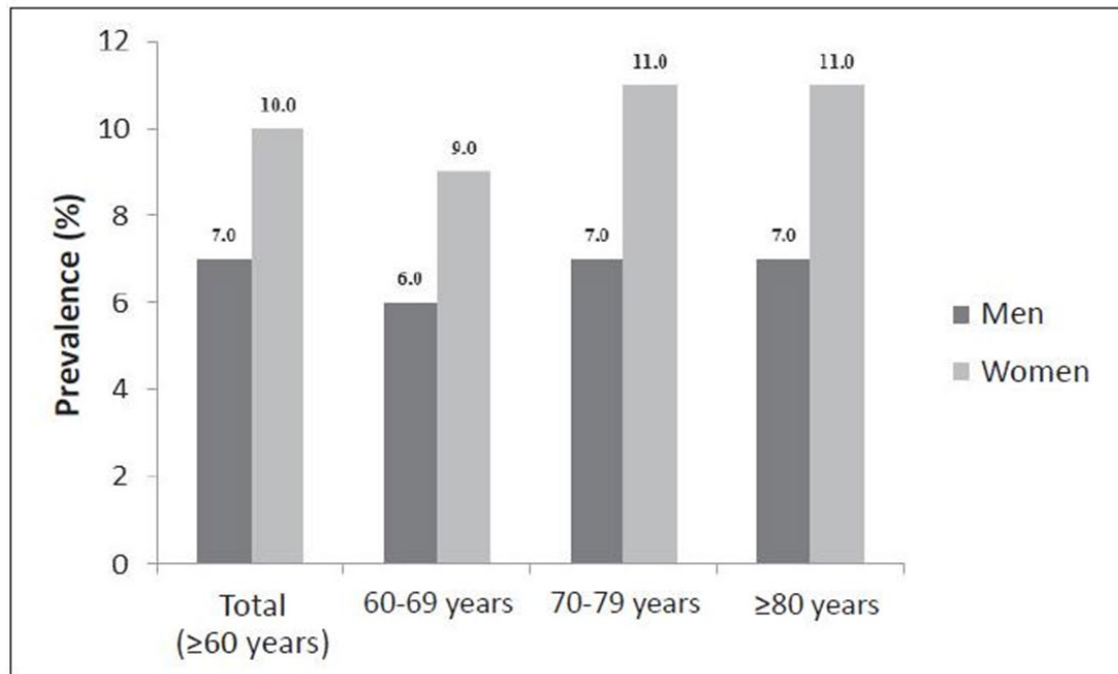
The FABS is designed for higher functioning older adults and is good to use for older adults that max out the BBS (score 56) as it includes tasks that are more difficult. It has 10 tasks that are each scored from 0-4 points for a possible total of 40 points with a higher score indicating better balance. The test can be performed in about 10-12 minutes and requires the following equipment: stopwatch, pencil, two 36-inch rulers, 6-inch-high bench, masking tape, two high-density foam pads, and a metronome. Scores of $\leq 25/40$ indicate a high risk of falling.

The 10 tasks are:

1. Stand with feet together and eyes closed
2. Reach forward to retrieve an object (pencil) held at shoulder height with outstretched arm
3. Turn 360 degrees in right and left directions
4. Step up onto and over a 6-inch bench
5. Tandem walk
6. Stand on one leg
7. Stand on foam with eyes closed
8. Two-footed jump
9. Walk with head turns
10. Reactive postural control

Sarcopenia (Frail, Pre-Frail, Lower Ind)

Sarcopenia is a progressive and generalized skeletal muscle disorder that is associated with increased likelihood of adverse outcomes including falls, fractures, physical disability and mortality. As discussed in the Physiology of Aging section it is also a common issue facing many older adults with a prevalence ranging from 7-11% of 60+ year-olds in the US and as high as 20% in Japan with women being affected more than men. Prevalence increases with age affecting the 80+ year-olds more than younger groups.



Source: Janssen 2002. Prevalence of sarcopenia among the elderly: findings from broad cross-sectional studies in a range of countries. <https://doi.org/10.1590/1809-9823.2015.14139>

Sarcopenia is a significant personal, social and economic burden. It increases risk of falls and fractures; impairs ability to perform activities of daily living; is associated with cardiovascular disease and cognitive impairment; leads to mobility disorders; and contributes to long-term care placement and death. Sarcopenia increases risk for hospitalization and increases cost of care during hospitalization. Due to these, and many other issues related to sarcopenia, it is recommended that primary care physicians and other allied health professionals screen for sarcopenia on a routine basis in their older patients. An international working group has created recommendations and guidelines for diagnosing this condition that will be outlined below (Cruz-Jentoft et al. 2019).

The process (see image of complete algorithm below) begins by asking five questions which is referred to as the SARC-F Questionnaire:

1. How much difficulty do you have in lifting and carrying 10 pounds?
2. How much difficulty do you have walking across a room?
3. How much difficulty do you have transferring from a chair or bed?
4. How much difficulty do you have climbing a flight of 10 stairs?
5. How many times have you fallen in the past year?

Each answer is scored the same: None = 0; Some = 1; A lot or unable (or use walking aids for question 2) = 2. A total score ≥ 4 points is predictive of sarcopenia. However, a clinician may suspect sarcopenia even with a score lower than 4 points and may feel compelled to continue on to assessment.

Low muscle strength is the primary parameter of sarcopenia. Muscle strength is presently the most reliable measure of muscle function and can quickly be measured by either a hand grip strength test (dynamometry) or a chair stand test (Five Times Sit to Stand). A handgrip strength ≤ 27 kg in men and ≤ 16 kg in women or >15 seconds on the chair stand test indicate probable sarcopenia. At this point an exercise intervention is recommended even if sarcopenia has not been confirmed.

A sarcopenia diagnosis is confirmed by the presence of low muscle quantity or quality. This is typically done through body composition analysis using either bioelectric impedance analysis (BIA), dual energy x-ray absorptiometry (DXA) or other methods. Body composition using BIA is easily accomplished in a gym or community setting but DXA and other methods are reserved for clinical or research uses.

If sarcopenia is confirmed through muscle quantity/quality assessment then a physical performance test is recommended in order to gauge the severity of sarcopenia. When low muscle strength, low muscle quantity/quality and low physical performance are all detected, sarcopenia is considered severe.

For medical and allied health professionals it is possible to screen, assess and then confirm the presence of sarcopenia. However, fitness professionals do not have the capability of performing muscle quantity or quality measures. Therefore, it is recommended that sarcopenia is assumed until proven otherwise and they should perform the physical performance tests in order to gauge its severity. It is also a good opportunity for fitness professionals to refer their older clients to medical professionals for further evaluation while continuing to train them.

The following tests and cut-off values are recommended in order to identify severe sarcopenia. If the person scores low on any of these assessments then their sarcopenia is considered to be severe.

- Gait Speed ≤ 0.8 m/s
- Short Physical Performance Battery score ≤ 8 pts
- Timed Up and Go time ≥ 20 seconds
- 400m Walk Test ≥ 6 min or non-completion

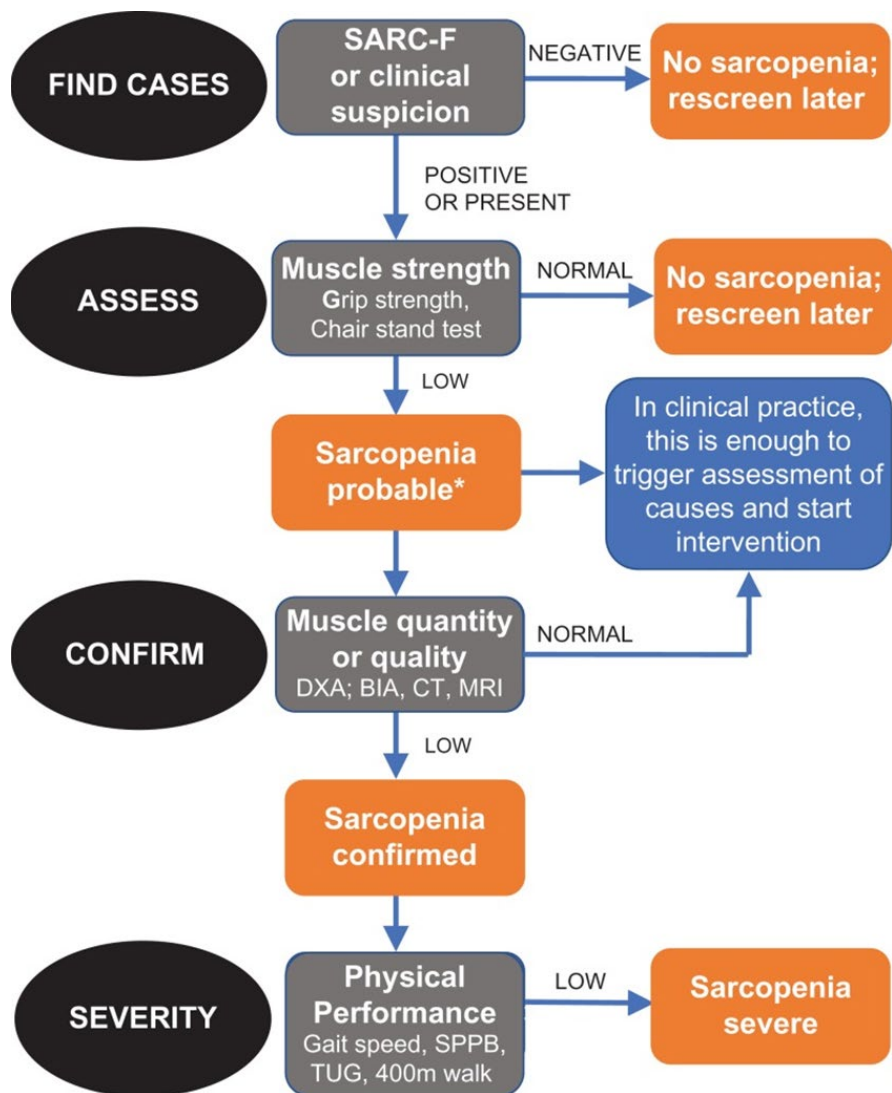


Figure: Sarcopenia Diagnosis Algorithm

Summary

A thorough health history interview coupled with appropriate screening and assessment should provide health and fitness professionals with all of the information they need to develop a safe and effective, individualized exercise program for any older client. The process should reveal specific functional deficits that need to be addressed in order to improve their level of function or fitness. It should also reveal areas of strength that should be maintained with an exercise program. Since clients vary so widely in their abilities and in their functional deficits the program must be individualized. Formal assessments inform the professional on how to best construct a program to maintain their strengths and prioritize their deficits.

This is a fluid process, though, as the assessment process should be continuous. Formal assessments, such as the ones described here, should be repeated at certain time intervals depending on the client's characteristics and the types of assessment being performed. Typically, 3 months is a long enough period of time to see some significant improvements for a client. Repeating selected assessments can provide motivation to the client (to prove progress is being made) and direction for the trainer.

However, qualitative assessment should occur during every exercise at every session that the professional can observe. There is a lot to be learned from simply watching someone move. For example, during the 8' Up and Go test it is valuable to observe each part of the test – standing up, accelerating, navigating the cone, and sitting back down – in addition to timing it. People will struggle with different parts of the test even though they get similar times. One person may accelerate well but navigate the cone very slowly and cautiously while another person moves at a more consistent yet somewhat slower pace.

It has been said that “the test is the exercise and the exercise is the test” and this applies very well to older adults. As you give them new challenges in their exercise movements you will be able to gauge how well they respond which will provide additional insight into areas that still need to be addressed. For example, a 79-year-old client started training because he was planning to hike the world’s longest cave (in Vietnam) with his son-in-law and teenage grandson. The man had been exercising at home regularly for a while so the functional fitness testing showed he was fit and healthy with no glaring functional deficits. His program started with dynamic resistance training, dynamic balance and agility movements that he handled very well.

However, the second week of his program the trainer showed him grapevine-stepping (also called carioche). This is a lateral movement where the person, starting in a shoulder-width stance, steps their right foot across and in front of their left; steps their left foot to the left to return to a shoulder-width stance position; steps their right foot behind and across their left foot; and steps their left foot to the left in order to return to a shoulder-width stance position. This is repeated (in-front, behind; in-front, behind; etc.) as quickly as possible and then repeated in the opposite direction. Once the trainer explained and demonstrated the movement the client attempted it and failed miserably. He could not get the step pattern figured out and moved very slowly with lots of hesitation which frustrated him. This exercise movement challenged his dynamic coordination and revealed a need to work on these types of lower-limb crossover patterns. Once he performed these on a regular basis he quickly learned how to do the pattern very efficiently and quickly. Provide clients with unique and different types of challenges to continuously assess different aspects of their physical capabilities.

In the next section we will cover foundational concepts and principles that will apply to working with older clients of all functional ability levels with and without chronic conditions.