2 minute Step Test

(Rikli, Jones 1999)

1. Take resting vital signs
2. Have patient/client stand next to a wall. Measure the height of the iliac crest and patella and mark it on the wall. Then place a piece of tape on the wall half the distance between the two.
3. On the signal "go" the patient/client begins stepping (not running) in place, raising each knee to the mark on the wall, for as many times as possible in the 2 minute period.
4. Only count the number of times the right knee reaches the required height. That is the score.
5. If the proper knee height cannot be maintained, ask the participant to slow down, or to stop until they can regain the proper form, but keep the stopwatch running.
6. At the end of the test, provide a cool down by asking the patient/client to walk slowly for a minute.
7. A person with impaired balance may use the back of a chair as a touch-hold for stability. Note this modification in your documentation
8. One trial.
9. Take post exercise vital signs.

Range of scores between the 25% and 75% percentiles		
Age	**Number of steps – Women**	**Number of steps – Men**
60 - 64	75-107	87-115
65 - 79	73-107	86-116
70 - 74	68-101	80-110
75 - 79	68-100	73-109
80 - 84	60-90	71-103
85 - 90	55-85	59-91
90 - 95	44-72	52-86

Scores less than 65 were associated with lower levels of functional ability

Population:

- community residing older adults ages 60-94
- n = 7,183 5,048 women, 2,135 men
- years education: 14.5
- chronic conditions: 1.7
- medications: 1.6
- performed moderate exercise ≥3 times/week: 65%

Exclusion criteria:

- advised not to exercise by physician
- CHF, joint pain, chest pain, dizziness, angina during exercise
- BP > 160/100

Rikli RE, Jones CJ (1999). Functional fitness normative scores for community residing older adults ages 60-94. Journal of Aging and Physical Activity, 7, 160-179.

Six-Minute Walk Test

American Thoracic Society (2002). Guidelines for the Six-Minute Walk Test. American Journal of Respiratory and Critical Care Medicine. 166:1, 111-117.

Description: The 6-Minute Walk test is a **sub maximal measure of aerobic capacity**. The person may use an ambulation aid and oxygen if they do so normally.
"The 6MWT is a useful measure of **functional capacity** targeted at people with at least moderately severe impairment. The test has been widely used for preoperative and postoperative evaluation and for measuring the response to therapeutic interventions for pulmonary and cardiac disease." (ATS, 2002)

Equipment: stethoscope, BP cuff, Borg RPE, dyspnea scale, stopwatch, tape measure, portable chair

Absolute contraindications:

- unstable angina during the previous month
- myocardial infarction during the previous month.

Relative contraindications:

- Resting HR > 120
- SBP > 180 mm Hg
- DBP > 100 mm Hg

Terminate exercise if:
Angina, light-headedness, confusion, ataxia, staggering unsteadiness, pallor, cyanosis, nausea, marked dyspnea, unusual fatigue, claudication or other significant pain, facial expressions signifying distress.
Notify physician if test is terminated for any of the above reasons.

Instructions to the Participant:

"The object of this test is to **walk as far as possible** for 6 minutes. You will walk back and forth in this hallway. Six minutes is a long time to walk, so you will be exerting yourself. You will probably get out of breath or become exhausted. You are permitted to slow down, to stop, and to rest as necessary. You may lean against the wall while resting, but resume walking as soon as you are able.
You will be walking back and forth around the cones. You should pivot briskly around the cones and continue back the other way without hesitation. Now I'm going to show you. Please watch the way I turn without hesitation." (ATS, 2002) We will avoid having a conversation so that you can save your wind for walking. You can begin when I say 'go'.

Guidelines for the Tester:

Do not walk with the patient, however if balance is an issue, the tester may walk behind and to the side. After the first minute, tell the patient the following (in even tones): "You are doing well. You have 5 minutes to go." Repeat this message at every minute (4,3,2,1). Do not use other words of encouragement (or body language to speed up).

"If the patient stops walking during the test and needs a rest, say this: 'You can lean against the wall if you would like; then continue walking whenever you feel able.' Do not stop the timer. If the patient stops before the 6 minutes are up and refuses to continue (or you decide that they should not continue) … the chair over for the patient to sit on, discontinue the walk, and note on the worksheet the distance, the time stopped, and the reason for stopping prematurely." (ATS, 2002)

At the end of the 6 minutes:

- Have participant sit down (portable chair)
- Immediately take vital signs, starting with HR (because it drops more quickly than SBP)
- Have patient rate their Borg Rate of Perceived Exertion (RPE), and dyspnea
- Calculate and record the distance walked.
- Ask: "What, if anything, kept you from walking farther?" (ATS, 2002)

Safety: Monitor vital signs before after the test. If there is an unexpected vital sign response, continue monitoring and documenting every 5 minutes until SBP and HR returns to within about 10-20 of pre-exercise values. Note heart rhythm, especially if it changes from a regular rhythm in pre-exercise to an irregular rhythm in post-exercise.

If participant has **congestive heart failure** profile (ankle edema, dyspnea at rest or with minimal exertion): auscultate the lung bases for new or increased crackles, and also auscultate the heart apically to see if you detect an S3 heart sound.

Aging of the Cardiovascular system:

- Resting HR in the elderly does not vary significantly from resting HR in normal, young population.
- In the elderly population, HR response to exercise can be less brisk, and also will not rise to as high of a maximal HR (compared to young normal),
- For the person with cardiac risk factors, if graded exercise stress test results are not available (the gold standard for establishing a target HR), keep the peak exercise HR under 120-130 bpm. Alternatively, only allow a HR rise of 20 bpm.
- If participant is taking a BETA BLOCKER it will blunt their HR response to exercise, therefore HR is not a reliable measure. Rely on RPE and dyspnea scales and their BP response.

Prognosis:

- Prediction formula for VO_2 Max: **Peak VO_2** = 0.03 x distance (in meters) + 3.98
  Cahalin L.P. (1996). The six minute walk test predicts peak oxygen uptake and survival in patients with advanced heart failure. Chest 110, 325-332
- CHF: 6MW distances of **< 300 meters** (984') have both a poorer short term and long term survival rate.
  Bittner, V. (1993). Prediction of mortality and morbidity with a 6-minute walk test in patients with left ventricular dysfunction. JAMA 270: 1702-1707.

Norms for 6 Minute Walk Distances: 3 studies

Brown M. (unpublished). Exercise Specificity in Physical Frailty.

Mean age of frail elder participants: 84; Number of participants: n = 95

- Excluded subjects if scored > 30 on the Modified Physical Performance Test (mPPT)
- Also excluded if blind, dementia, progressive neurological disease

6 minute walk distance: Mean: 264 m., (865 ft.) SD: 95 m., (313 ft.)

Lusardi M. (2003). Functional Performance in Community Living Older Adults. Journal of Geriatric *Physical Therapy* 26;3;14-22

Participants: 76 (22 men, 54 women); mean age: 83 ± 8

Exclusion criteria: unstable angina; cardiac event, cardiac surgery last 6 mo; use of O2 or inhalers; neuro disease

6 minute walk distances:

Age	Gender (N)	Mean	SD
60-69	Male (1)	498 m 1634 ft.	-
	Female (5)	405 m 1329 ft.	110 m
70-79	Male (9)	475 m 1558 ft.	93 m
	Female (10)	406 m 1332 ft.	95 m
80-89	Male (9)	320 m 1050 ft.	80 m
	Female (24)	282 m 922 ft.	123 m
	No Assist Device (24)	328 m 1076 ft.	102 m
	Assist Device (9)	197 m 646 ft.	82 m
90-101	Male (2)	296 m 971 ft.	15 m
	Female (15)	261 m 856 ft.	81 m
	No Assist Device (7)	324 m 1063 ft.	70 m
	Assist Device (10)	224 m 735 ft.	51 m

Steffen T.M. (2002). Age and Gender Related Test Performance in Community-Dwelling Elderly People: 6MW Test, BBS, TUG, and Gait Speed. *Physical Therapy*, Vol.82, No.2, Feb, 2002

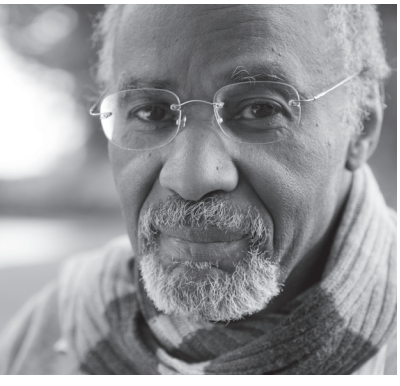
- Subjects **included** needed to be able to walk 6 minutes without shortness of breath, chest pain, or joint pain in the legs, neck, or back that would limit 6MW.
- Subjects were **excluded** if: smokers, history of dizziness, used an assistive device

6 minute walk distances:

Age	Gender (N)	Mean	SD	Normal Range (2SD)
60-69	Male (15)	572m (1,877 ft.)	92 m	388-756 m
	Female (22)	538 m (1.765 ft.)	92 m	354-722 m
70-79	Male (14)	527 m (1.729 ft.)	85 m	357-697 m
	Female (22)	471 m (1,545 ft.)	75 m	321-621 m
80-89	Male (8)	417 m (1,368 ft.)	73 m	271-563 m
	Female (15)	392 m (1.286 ft.)	85 m	222-562 m

Patient: Date: Time: AM/PM

The 30-Second Chair Stand Test



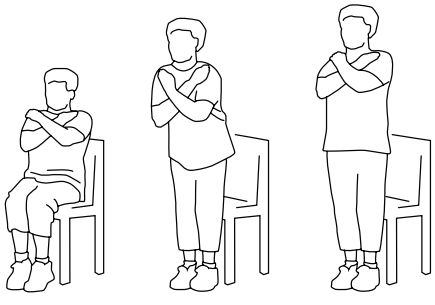
Purpose: To test leg strength and endurance

Equipment:

- A chair with a straight back without arm rests (seat 17" high)
- A stopwatch

Instructions to the patient:

1. Sit in the middle of the chair.
2. Place your hands on the opposite shoulder crossed at the wrists.
3. Keep your feet flat on the floor.
4. Keep your back straight and keep your arms against your chest.
5. On **"Go,"** rise to a full standing position and then sit back down again.
6. Repeat this for 30 seconds.



On **"Go,"** begin timing.

If the patient must use his/her arms to stand, stop the test. Record "0" for the number and score.

Count the number of times the patient comes to a full standing position in 30 seconds.

If the patient is over halfway to a standing position when 30 seconds have elapsed, count it as a stand.

Record the number of times the patient stands in 30 seconds.

Number: _____ **Score** _____ **See next page.**

A below average score indicates a high risk for falls.

Notes:

For relevant articles, go to: **www.cdc.gov/injury/STEADI**

Centers for Disease Control and Prevention
National Center for Injury Prevention and Control

STEADI Stopping Elderly Accidents, Deaths & Injuries

Chair Stand—Below Average Scores

Age	Men	Women
60-64	< 14	< 12
65-69	< 12	< 11
70-74	< 12	< 10
75-79	< 11	< 10
80-84	< 10	< 9
85-89	< 8	< 8
90-94	< 7	< 4

Arm Curl (Bicep) Test

The Arm Curl test is a test of upper body strength, and is part of the Senior Fitness Test (SFT) and the AAHPERD Functional Fitness Test, and is designed to test the functional fitness of seniors. There are slight differences between the protocols for the Senior and AAHPERD tests, such as the weight used for women. The differences are indicated below. See also the maximum bicep curl test.

- **purpose:** This test measures upper body strength and endurance.
- **equipment required:** 5 pound weight (women, SFT), 8 pound weight (for men). A chair without armrests, stopwatch
- **procedure:** The aim of this test is to do as many arm curls as possible in 30 seconds. This test is conducted on the dominant arm side (or stronger side). The subject sits on the chair, holding the weight in the hand using a suitcase grip (palm facing towards the body) with the arm in a vertically down position beside the chair. Brace the upper arm against the body so that only the lower arm is moving (tester may assist to hold the upper arm steady). Curl the arm up through a full range of motion, gradually turning the palm up (flexion with supination). As the arm is lowered through the full range of motion, gradually return to the starting position. The arm must be fully bent and then fully straightened at the elbow. The protocol for the AAHPERD test describes the administrator's hand being placed on the biceps, and the lower arm must touch the tester's hand for a full bicep curl to be counted. Repeat this action as many times as possible within 30 seconds.
- **scoring:** The score is the total number of controlled arm curls performed in 30 seconds. Below is a table showing some recommended ranges for this test based on age groups (from Jones & Rikli, 2002).

Men's Results

Age	below average	average	above average

60–64	< 16	16 to 22	> 22
65–69	< 15	15 to 21	> 21
70–74	< 14	14 to 21	> 21
75–79	< 13	13 to 19	> 19
80–84	< 13	13 to 19	> 19
85–89	< 11	11 to 17	> 17
90–94	< 10	10 to 14	> 14

Women's Results

Age	below average	average	above average
60–64	< 13	13 to 19	> 19
65–69	< 12	12 to 18	> 18
70–74	< 12	12 to 17	> 17
75–79	< 11	11 to 17	> 17

80–84	< 10	10 to 16 > 16
85–89	< 10	10 to 15 > 15
90–94	< 8	8 to 13 > 13

- **target population:** the aged population which may not be able to do traditional fitness tests.
- **comments:** It's important that the upper arm is stable throughout the test, and doesn't swing.
- **references:**
  - Anna Różańska-Kirschke, Piotr Kocur, Małgorzata Wilk, Piotr Dylewicz, *The Fullerton Fitness Test as an index of fitness in the elderly*, **Medical Rehabilitation** 2006; 10(2): 9-16.
  - Jones C.J., Rikli R.E., Measuring functional fitness of older adults, The Journal on Active Aging, March April 2002, pp. 24–30.

Berg Balance Scale

The Berg Balance Scale (BBS) was developed to measure balance among older people with impairment in balance function by assessing the performance of functional tasks. It is a valid instrument used for evaluation of the effectiveness of interventions and for quantitative descriptions of function in clinical practice and research. The BBS has been evaluated in several reliability studies. *A recent study of the BBS, which was completed in Finland, indicates that a change of eight (8) BBS points is required to reveal a genuine change in function between two assessments among older people who are dependent in ADL and living in residential care facilities.*

Description:
14-item scale designed to measure balance of the older adult in a clinical setting.

Equipment needed: Ruler, two standard chairs (one with arm rests, one without), footstool or step, stopwatch or wristwatch, 15 ft walkway

Completion:

Time: 15-20 minutes

Scoring: A five-point scale, ranging from 0-4. "0" indicates the lowest level of function and "4" the highest level of function. Total Score = 56

Interpretation:
41-56 = low fall risk
21-40 = medium fall risk
0 –20 = high fall risk

A change of 8 points is required to reveal a genuine change in function between 2 assessments.

Berg Balance Scale

Name: _____ Date: _____

Location: _____ Rater: _____

ITEM DESCRIPTION	SCORE (0-4)
Sitting to standing	_____
Standing unsupported	_____
Sitting unsupported	_____
Standing to sitting	_____
Transfers	_____
Standing with eyes closed	_____
Standing with feet together	_____
Reaching forward with outstretched arm	_____
Retrieving object from floor	_____
Turning to look behind	_____
Turning 360 degrees	_____
Placing alternate foot on stool	_____
Standing with one foot in front	_____
Standing on one foot	_____

Total _____

GENERAL INSTRUCTIONS

Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:

- the time or distance requirements are not met
- the subject's performance warrants supervision
- the subject touches an external support or receives assistance from the examiner

Subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be a reasonable height. Either a step or a stool of average step height may be used for item # 12.

Berg Balance Scale

SITTING TO STANDING
INSTRUCTIONS: Please stand up. Try not to use your hand for support.
( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aid to stand or stabilize
( ) 0 needs moderate or maximal assist to stand

STANDING UNSUPPORTED
INSTRUCTIONS: Please stand for two minutes without holding on.
( ) 4 able to stand safely for 2 minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported
( ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL
INSTRUCTIONS: Please sit with arms folded for 2 minutes.
( ) 4 able to sit safely and securely for 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds

STANDING TO SITTING
INSTRUCTIONS: Please sit down.
( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assist to sit

TRANSFERS
INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.
( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely definite need of hands
( ) 2 able to transfer with verbal cuing and/or supervision
( ) 1 needs one person to assist
( ) 0 needs two people to assist or supervise to be safe

STANDING UNSUPPORTED WITH EYES CLOSED
INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.
( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays safely
( ) 0 needs help to keep from falling

STANDING UNSUPPORTED WITH FEET TOGETHER
INSTRUCTIONS: Place your feet together and stand without holding on.
( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand 1 minute with supervision
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 15 seconds feet together
( ) 0 needs help to attain position and unable to hold for 15 seconds

Berg Balance Scale continued…

REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)
( ) 4 can reach forward confidently 25 cm (10 inches)
( ) 3 can reach forward 12 cm (5 inches)
( ) 2 can reach forward 5 cm (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/requires external support

PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up the shoe/slipper, which is in front of your feet.
( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently
( ) 1 unable to pick up and needs supervision while trying
( ) 0 unable to try/needs assist to keep from losing balance or falling

TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. (Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.)
( ) 4 looks behind from both sides and weight shifts well
( ) 3 looks behind one side only other side shows less weight shift
( ) 2 turns sideways only but maintains balance
( ) 1 needs supervision when turning
( ) 0 needs assist to keep from losing balance or falling

TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.
( ) 4 able to turn 360 degrees safely in 4 seconds or less
( ) 3 able to turn 360 degrees safely one side only 4 seconds or less
( ) 2 able to turn 360 degrees safely but slowly
( ) 1 needs close supervision or verbal cuing
( ) 0 needs assistance while turning

PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.
( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps in > 20 seconds
( ) 2 able to complete 4 steps without aid with supervision
( ) 1 able to complete > 2 steps needs minimal assist
( ) 0 needs assistance to keep from falling/unable to try

STANDING UNSUPPORTED ONE FOOT IN FRONT
INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)
( ) 4 able to place foot tandem independently and hold 30 seconds
( ) 3 able to place foot ahead independently and hold 30 seconds
( ) 2 able to take small step independently and hold 30 seconds
( ) 1 needs help to step but can hold 15 seconds
( ) 0 loses balance while stepping or standing

STANDING ON ONE LEG
INSTRUCTIONS: Stand on one leg as long as you can without holding on.
( ) 4 able to lift leg independently and hold > 10 seconds
( ) 3 able to lift leg independently and hold 5-10 seconds
( ) 2 able to lift leg independently and hold ≥ 3 seconds
( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
( ) 0 unable to try of needs assist to prevent fall

( ) TOTAL SCORE (Maximum = 56)

Chair Sit and Reach Test

The Chair Sit and Reach test is part of the Senior Fitness Test Protocol, and 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.
- **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. See also video demonstrations of the Sit and Reach Test.
- **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 (from Jones & Rikli, 2002).

Men's Results

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's Results

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

- **target population:** the aged population which may not be able to do traditional fitness tests.
- **advantages:** Does not require the subjects to get up and down from the floor as does the traditional test.
- **disadvantages:** only one leg is usually measured, which will not show any differences between sides.
- **reliability:** The reliability of this test will depend on the amount of warm-up prior to testing. If retesting, the you must ensure the same procedures are used each time, and the order of tests should also be standardized.
- **contraindications:** This test should not be done if you have severe Osteoporosis.
- **other comments:** This is a variation of the standard sit and reach test adapted for the elderly population. Read the review of the sit and reach test for a list of other test variations.
- **references:**

- Anna Różańska-Kirschke, Piotr Kocur, Małgorzata Wilk, Piotr Dylewicz, *The Fullerton Fitness Test as an index of fitness in the elderly*, **Medical Rehabilitation** 2006; 10(2): 9-16.
- Jones C.J., Rikli R.E., Measuring functional fitness of older adults, The Journal on Active Aging, March April 2002, pp. 24–30.

Dynamic Gait Index (original 8-item test)

Description:
Developed to assess the likelihood of falling in older adults. Designed to test eight facets of gait.
Equipment needed: Box (Shoebox), Cones (2), Stairs, 20' walkway, 15" wide
Completion:
Time: 15 minutes
Scoring: A four-point ordinal scale, ranging from 0-3. "0" indicates the lowest level of function and "3" the highest level of function.
Total Score = 24
Interpretation: **< 19/24 = predictive of falls risk in community dwelling elderly**

1. Gait level surface _____
Instructions: Walk at your normal speed from here to the next mark (20')
Grading: Mark the lowest category that applies.
(3) Normal: Walks 20', no assistive devices, good sped, no evidence for imbalance, normal gait pattern
(2) Mild Impairment: Walks 20', uses assistive devices, slower speed, mild gait deviations.
(1) Moderate Impairment: Walks 20', slow speed, abnormal gait pattern, evidence for imbalance.
(0) Severe Impairment: Cannot walk 20' without assistance, severe gait deviations or imbalance.

2. Change in gait speed _____
Instructions: Begin walking at your normal pace (for 5'), when I tell you "go," walk as fast as you can (for 5'). When I tell you "slow," walk as slowly as you can (for 5').
Grading: Mark the lowest category that applies.
(3) Normal: Able to smoothly change walking speed without loss of balance or gait deviation. Shows a significant difference in walking speeds between normal, fast and slow speeds.
(2) Mild Impairment: Is able to change speed but demonstrates mild gait deviations, or not gait deviations but unable to achieve a significant change in velocity, or uses an assistive device.
(1) Moderate Impairment: Makes only minor adjustments to walking speed, or accomplishes a change in speed with significant gait deviations, or changes speed but has significant gait deviations, or changes speed but loses balance but is able to recover and continue walking.
(0) Severe Impairment: Cannot change speeds, or loses balance and has to reach for wall or be caught.

3. Gait with horizontal head turns _____
Instructions: Begin walking at your normal pace. When I tell you to "look right," keep walking straight, but turn your head to the right. Keep looking to the right until I tell you, "look left," then keep walking straight and turn your head to the left. Keep your head to the left until I tell you "look straight," then keep walking straight, but return your head to the center.
Grading: Mark the lowest category that applies.
(3) Normal: Performs head turns smoothly with no change in gait.
(2) Mild Impairment: Performs head turns smoothly with slight change in gait velocity, i.e., minor disruption to smooth gait path or uses walking aid.
(1) Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down, staggers but recovers, can continue to walk.
(0) Severe Impairment: Performs task with severe disruption of gait, i.e., staggers outside 15" path, loses balance, stops, reaches for wall.

4. Gait with vertical head turns _____

Instructions: Begin walking at your normal pace. When I tell you to "look up," keep walking straight, but tip your head up. Keep looking up until I tell you, "look down," then keep walking straight and tip your head down. Keep your head down until I tell you "look straight," then keep walking straight, but return your head to the center.

Grading: Mark the lowest category that applies.

(3) Normal: Performs head turns smoothly with no change in gait.

(2) Mild Impairment: Performs head turns smoothly with slight change in gait velocity, i.e., minor disruption to smooth gait path or uses walking aid.

(1) Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down, staggers but recovers, can continue to walk.

(0) Severe Impairment: Performs task with severe disruption of gait, i.e., staggers outside 15" path, loses balance, stops, reaches for wall.

5. Gait and pivot turn _____

Instructions: Begin walking at your normal pace. When I tell you, "turn and stop," turn as quickly as you can to face the opposite direction and stop.

Grading: Mark the lowest category that applies.

(3) Normal: Pivot turns safely within 3 seconds and stops quickly with no loss of balance.

(2) Mild Impairment: Pivot turns safely in > 3 seconds and stops with no loss of balance.

(1) Moderate Impairment: Turns slowly, requires verbal cueing, requires several small steps to catch balance following turn and stop.

(0) Severe Impairment: Cannot turn safely, requires assistance to turn and stop.

6. Step over obstacle ____

Instructions: Begin walking at your normal speed. When you come to the shoebox, step over it, not around it, and keep walking.

Grading: Mark the lowest category that applies.

(3) Normal: Is able to step over the box without changing gait speed, no evidence of imbalance.

(2) Mild Impairment: Is able to step over box, but must slow down and adjust steps to clear box safely.

(1) Moderate Impairment: Is able to step over box but must stop, then step over. May require verbal cueing.

(0) Severe Impairment: Cannot perform without assistance.

7. Step around obstacles _____

Instructions: Begin walking at normal speed. When you come to the first cone (about 6' away), walk around the right side of it. When you come to the second cone (6' past first cone), walk around it to the left.

Grading: Mark the lowest category that applies.

(3) Normal: Is able to walk around cones safely without changing gait speed; no evidence of imbalance.

(2) Mild Impairment: Is able to step around both cones, but must slow down and adjust steps to clear cones.

(1) Moderate Impairment: Is able to clear cones but must significantly slow, speed to accomplish task, or requires verbal cueing.

(0) Severe Impairment: Unable to clear cones, walks into one or both cones, or requires physical assistance.

8. Steps _____

Instructions: Walk up these stairs as you would at home, i.e., using the railing if necessary. At the top, turn around and walk down.

Grading: Mark the lowest category that applies.

(3) Normal: Alternating feet, no rail.

(2) Mild Impairment: Alternating feet, must use rail.

(1) Moderate Impairment: Two feet to a stair, must use rail.

(0) Severe Impairment: Cannot do safely.

TOTAL SCORE: ___ / 24

References:

1. Herdman SJ. ***Vestibular Rehabilitation***. 2nd ed. Philadelphia, PA: F.A.Davis Co; 2000.
2. Shumway-Cook A, Woollacott M. *Motor Control Theory and Applications*, Williams and Wilkins Baltimore, 1995: 323-324

Functional Reach
& Multidirectional Reach

Functional Reach is item #8 in the Berg Balance Scale

Directions:

Using a yardstick mounted on the wall at shoulder height, ask the subject to position themselves close to, but not touching the wall with their arm outstretched and hand fisted. Take note of the starting position by determining what number the MCP joints line up with on the yardstick. Have the subject reach as far forward as possible in a plane parallel with the measuring device.

Instructions: "Reach as far forward as you can without taking a step, keeping your feet flat on the floor, and keeping your hand at the level of the ruler."

They are free to use various reaching strategies. Take note of the end position of the MCP joints against the ruler, and record the difference between the starting and ending position numbers. If they move their feet, that trial must be discarded and the trial repeated. Guard the subject as the task is performed to prevent a fall. Subjects are given two practice trials, and then their performance on an additional three trials is recorded and averaged. *HINT: to prevent a starting position with the scapula protracted, have the person hold both arms out horizontally. If the fingers match, they are not protracting. Then lower the non-testing arm and begin the test.*

Scores **less than 6 or 7 inches indicate limited functional balance**.
Most health individuals with adequate functional balance can reach **10 inches** or more.

Instructions to the patient:

Please reach as far forward as you can without losing your balance. Keep your feet on the floor. You are not allowed to touch the wall or the ruler as you reach. You will have two practice trials and then I will record the distance that you reach forward.

Criteria to stop the test:

The patient's feet lifted up from the floor or they fell forward. Most patients fall forward with this test. The therapist should guard from the front as that is the direction that you reach forward.

Duncan P, Weiner D, Chandler J, et al. Functional reach: a new clinical measure of balance. *J of Gerontol* 1990; 45: M192-197.

Multidirectional Reach

1. Forward (same as Functional Reach)
2. **Backward**: the starting position is the same as the Functional Reach. Keep the elbow extended and the arm reaching forward (along the yardstick), however the person leans backward as far as possible.
3. **Sideway to the right**: stand with back to wall, and right elbow extended with arm reaching along the level of the yardstick (without touching yardstick or the wall). Lean to the right as far as possible.
4. **Sideways to the left**.

Reference Values: (mean age in study was 74)

- Forward 8.9 $\pm$ 3.4
- Backward 4.6 $\pm$ 3.1
- Right 6.2 $\pm$ 3.0 Left 6.6 $\pm$ 2.8

Newton R. (2001). Validity of the multidirectional reach test: A practical measure for limits of stability in older adults. *J Gerontol Med Sci* 56A: M248

Gait Speed (self selected)

Test Protocol: Measure and mark a standard distance, e.g. 5 meters (16.4 feet).
Then measure and mark 5 feet before the start, and 5 feet after the middle 5 meter section.

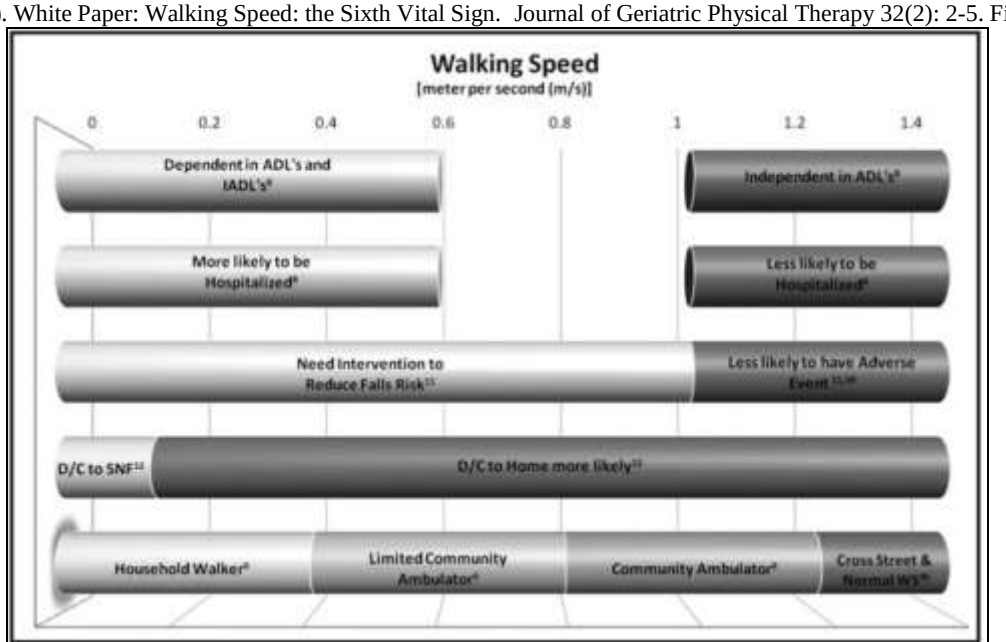
5 feet	**5 meters (16.4 feet)**	5 feet
← Starting line	← begin timing stop timing →	Finish line →

Instructions: "Walk at a comfortable pace". Have the person perform 3 repetitions and calculate the average time.

Gait Speed = distance / time e.g. 5 meters / __ sec.

Quick estimates: 10 sec = 0.5 m/s, 7 sec = 0.7 m/s, 5 sec = 1.0 m/s, 4 sec = 1.25 m/s, 3 sec = 1.7 m/s

Fritz S. Lusardi M. (2010). White Paper: Walking Speed: the Sixth Vital Sign. Journal of Geriatric Physical Therapy 32(2): 2-5. Figure 1.



0 mph	0.4 mph	0.9 mph	1.3 mph	1.8 mph	2.2 mph	2.7 mph	3.1 mph
10 meter walk time	50 sec	25 sec	16.7 sec	12.5 sec	10 sec	8.3 sec	7.1 sec
10 foot walk time	15.2 sec	7.6 sec	5 sec	3.8 sec	3 sec	2.5 sec	2.2 sec

ADL: activities of daily living; IADL: instrumental ADLs; D/C: discharged; WS: walking speed; mph: miles per hour; sec: seconds

Figure 1. A collection of walking speed times that are linked to dependence, hospitalization, rehabilitation needs, discharge locations, and ambulation category.

Table 2. Comfortable Gait Speed: Means, Standard Deviations, and Confidence Intervals by Age, Gender, and Use of Assistive Device (in Meters per Second)

Age (y)	Group	N	Mean	SD	CI
60-69	Male	1	1.26	—	0.84 – 1.67
	Female	5	1.24	0.12	1.05 – 1.42
	Overall	6	1.24	0.10	1.13 – 1.35
70-79	Male	9	1.25	0.23	1.11 – 1.39
	Female	10	1.25	0.18	1.11 – 1.38
	Overall	19	1.25	0.20	1.15 – 1.34
80-89	Male	10	0.88	0.24	0.75 – 1.01
	Female	24	0.80	0.20	0.72 – 0.89
	No Device	24	0.91	0.16	0.84 – 0.98
	Device	10	0.63	0.17	0.52 – 0.74
	Overall	34	0.82	0.21	0.75 – 0.90
90-101	Male	2	0.72	0.14	0.43 – 1.02
	Female	15	0.71	0.23	0.60 – 0.82
	No Device	7	0.88	0.23	0.76 –1.01
	Device	10	0.59	0.10	0.48 – 0.70
	Overall	17	0.71	0.22	0.60 – 0.82

Table 3. Fast Gait Speed: Means, Standard Deviations, and Confidence Intervals by Age, Gender, and Use of Assistive Device (in Meters per Second)

Age (y)	Group	N	Mean	SD	CI
60-69	Male	1	1.96	—	1.37 – 2.56
	Female	5	1.81	0.17	1.55 – 2.08
	Overall	6	1.84	0.17	1.67 – 2.02
70-79	Male	9	1.94	0.26	1.74 – 2.14
	Female	10	1.80	0.26	1.61 – 1.99
	Overall	19	1.86	0.27	1.73 – 1.99
80-89	Male	10	1.29	0.38	1.10 – 1.48
	Female	24	1.20	0.29	1.08 – 1.33
	No Device	24	1.38	0.22	1.28 – 1.47
	Device	10	0.88	0.23	0.73 – 1.03
	Overall	34	1.23	0.32	1.12 – 1.34
90-101	Male	2	1.27	0.13	0.85 – 1.69
	Female	15	1.05	0.32	0.90 – 1.21
	No Device	7	1.29	0.33	1.11 – 1.47
	Device	10	0.93	0.20	0.78 – 1.08
	Overall	17	1.08	0.31	0.92 – 1.24

Lusardi, M.M. (2003). Functional Performance in Community Living Older Adults. *Journal of Geriatric Physical Therapy*, 26(3), 14-22.

<u>Gain of 0.1 m/s</u> is predictor for well-being in those without normal WS. (Purser 2005; Hardy, Perera 2007).
Therefore could use a change of 0.1 m/s for patient goal.

Purser, J. L., M. Weinberger, et al. (2005). "Walking speed predicts health status and hospital costs for frail elderly male veterans." *J Rehabil Res Dev* 42(4): 535-46.
Hardy, S. E., S. Perera, et al. (2007). "Improvement in usual gait speed predicts better survival in older adults." *J Am Geriatr Soc* 55(11): 1727-34.

Name _____, Date _____

Gait Speed (self-selected)

Test Protocol: Measure and mark a standard distance, e.g. 5 meters (16.4 feet).
Then measure and mark 5 feet before the start, and 5 feet after the end.
Put **cones** at the starting line and the finish line.

5 feet	**5 meters (16.4 feet)**	5 feet
← Starting line	← begin timing stop timing →	Finish line →

Gait Speed = distance / time e.g. 5 meters / __ sec.

Instructions: "Walk at a comfortable pace".

Participant's performance: _____ seconds

Calculated gait speed: _____ m/sec

e.g. the person takes 8.5 seconds to walk 5 meters → 5/8.5 = 0.6 m/sec = Limited community ambulator

Quick estimates:

- 10 sec = 0.5 m/s
- 7 sec = 0.7 m/s
- 5 sec = 1.0 m/s
- 4 sec = 1.25 m/s
- 3 sec = 1.7 m/s

Interpretation:

- Less than 0.4 m/sec: Household ambulator
- 0.4 to 0.8 m/sec: Limited community ambulator
- 0.8 to 1.2 m/sec: Community ambulator
- 1.2 m/sec and above: Able to safely cross streets

Narrow Corridor Walk Test

Method: (Simonsick et al., 2001)

1. Preliminary test: record preferred gait speed for 6 meters (20 feet), i.e. "usual" gait. This is done outside the taped lines.

   Time required to walk 6 meters (no lines involved): _____ sec.

2. Narrow Corridor Walk Test:
   1. 6 meters (20 feet) marked with two lines of colored tape placed 20 centimeters (**8 inches**) apart
   2. Patient/client is instructed to walk at usual pace, but to stay between lines of colored tape.
   3. Stepping on or outside of the tape two or more times constitutes a failure.
   4. Up to three trials are allowed to obtain two valid times.
   5. Measure the time taken to complete the 6 meters.

   Time required to walk 6 meters, staying within the 8" lines: _____ sec.

Analysis: (Gimmon et al., 2015)

"Fallers performed more steps, and were slower than non-fallers. There were no significant differences, however, in the number of steps errors."

160 older adults: 61 reported falling in the last year, 99 had not fallen.

Simonsick EM, Newman AB, Nevitt MC, Kritchevsky SB, Ferrucci L, Guralnik JM, Harris T; Health ABC Study Group. (2001). Measuring higher level physical function in well-functioning older adults: expanding familiar approaches in the Health ABC study. J Gerontol A Biol Sci Med Sci. 56(10):M644-9.

Gimmon, Y., Barash, A., Debi, R., Snir, Y., Bar David, Y., Grinshpon, J., & Melzer, I. (2015). Application of the clinical version of the narrow path walking test to identify elderly fallers. Arch Gerontol Geriatr. doi:10.1016/j.archger.2015.10.010

Deshpande N, Metter EJ, Guralnik J, Ferrucci L. (2013). Can failure on adaptive locomotor tasks independently predict incident mobility disability? Am J Phys Med Rehabil. 92(8):704-9.

Romberg Test

Introduction

The Romberg test is an appropriate tool to diagnose sensory ataxia, a gait disturbance caused by abnormal proprioception involving information about the location of the joints. It is also proven to be sensitive and accurate means of measuring the degree of disequilibrium caused by the central vertigo, peripheral vertigo and head trauma. [1] It has been used in clinic for 150 years [2]

Purpose

The Romberg test is used to demonstrate the effects of posterior column disease upon human upright postural control. Posterior column disease involves selective damaging of the posterior column, known as tabes dorsalis neurosyphilis. The Romberg test is used for the clinical assessment of patients with disequilibrium or ataxia from sensory and motor disorders.

Equilibrium is defined as any condition in which all acting forces are cancelled by each other resulting in a stable balanced system. It is maintained through the sensory information from vestibular, somatosensory and visual systems. A patient who has a problem with Proprioception (Somato sensory) can still maintain balance by compensating with vestibular function and vision. In the Romberg test, the patient stands upright and asked to close his eyes. A loss of balance is interpreted as a positive Romberg sign.

The Romberg test was first described in 1846 and was originally described for the condition tabes dorsalis. Before performing the Romberg test, it is necessary to test other aspects of the patient's balance when potential issues with ataxia or disequilibrium are present. Often, proprioceptive challenges are not the first problems faced by this population. Sometimes, it is more simple. It is important to first assess other aspects of balance impairment in order to rule out confounding factors that could lead to a false positive test[3][4].

Clinically Relevant Anatomy

There are three sensory systems that provide input to the cerebellum to maintain truncal stability when the eyes are open:

1. Vision
2. Proprioception
3. Vestibular sense.

Only two of the three systems are needed to maintain balance. When visual input is removed, instability due to lack of vision can be teased apart from other sensory impairments. If there is a more severe proprioceptive or vestibular lesion, or if there is a midline cerebellar lesion causing truncal instability, the patient will be unable to maintain the standing position, even when the eyes are open. Note that instability can also be seen with lesions in other parts of the nervous system, such as the upper or lower motor neurons, or the basal ganglia[5][6].

Technique

The Original Romberg test

The test is performed as follows:

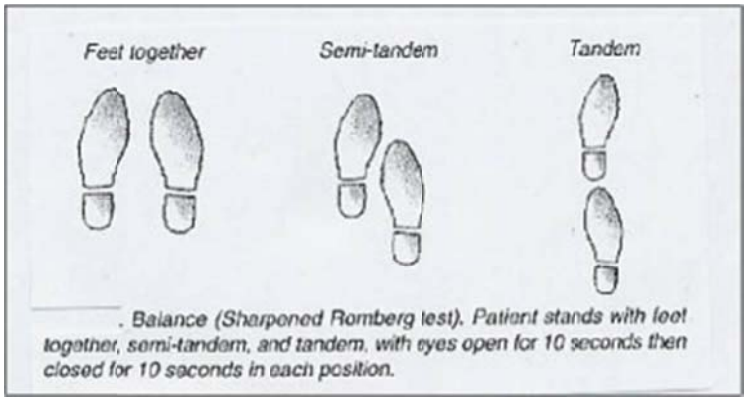
1. The patient is asked to remove his shoes and stand with his two feet together. The arms are held next to the body or crossed in front of the body.
2. The clinician asks the patient to first stand quietly with eyes open, and subsequently with eyes closed. The patient tries to maintain his balance. For safety, it is essential that the observer stand close to the patient to prevent potential injury if the patient were to fall. When the patients closes his eyes, he should not orient himself by light, sense or sound, as this could influence the test result and cause a false positive outcome.
3. The Romberg test is scored by counting the seconds the patient is able to stand with eyes closed.

- The literature does not report alternative methods for scoring a Romberg test.
- To make the Romberg test more difficult, the clinician can attempt to disturb the patient's balance with a perturbation. It is important that the clinician does not exaggerate the perturbation.
- A Romberg test can also be used as follow-up assessment for patients with balance and/or proprioception impairments by comparing several different assessments with each other.
- If the clinician observes that the patient is able to stand for longer periods of time with the eyes closed, it is evident that the patient's balance and proprioceptive deficits have decreased[3][7][4][8].
- The Romberg test is positive when the patient is unable to maintain balance with their eyes closed. Losing balance can be defined as increased body sway, placing one foot in the direction of the fall, or even falling.

The Sharpened or Tandem Romberg test

The Sharpened or Tandem Romberg test is a variation of the original test. The implementation is mostly the same. For this second test, the patient has to place his feet in heel-to-toe position, with one foot directly in front of the other. As with the original Romberg test, the assessment is performed first with eyes open and then with eyes closed. The patient crosses his arms over his chest, and the open palm of the hand lies on the opposite shoulder. The

patient also distributes his weight over both his feet and holds his chin parallel with the floor[7][4].



. Balance (Sharpened Romberg test). Patient stands with feet together, semi-tandem, and tandem, with eyes open for 10 seconds then closed for 10 seconds in each position.

Obese and older individuals may be unable to stand in this position for prolonged periods of time. For these populations, the Romberg test does not exclusively demonstrate propropioceptive impairments in comparison to other confounding factors[3].

Variables

Although a patient with an acute peripheral vestibular lesion is usually inclined to move towards the side of the problem, it has been shown that chronic vestibular damage (at least partial compensation) does not produce deficits in the standard Romberg test. As well, an individual with proprioceptive problems, accessory to tabes dorsalis, would be unable to stand with the eyes closed and feet together[3].

Many believe that the sharpened Romberg test is a better indicator of vestibular impairment than the original Romberg test. The sharpened Romberg test results give an objective measure of postural stability. This can help to quantify ataxia[3].

Subject, sex, and age do not create a statistically significant difference between normal subjects between the ages of 20 and 49 years; only the Romberg sharpened test with eyes open provided a significant difference ($p < 0.05$) between men and women. Greater instability in subjects less than 20 and more than 50 years of age was also exhibited. When comparing a young and an old cohort, there is a significant difference in performance.

Increasing the difficulty of the tandem Romberg test for patients is not helpful because it also makes the tests more difficult to perform for controls with no symptoms of vestibular disease. This would also make it harder to evaluate the test results. Decreased performance times on the modified Romberg is associated with a concomitant rise in the risk of falling[4][9][10].

Reliability and Validity

There is no consensus in the Reliability (Intra and inter) and validity for romberg's in the literature as the test is more of qualitative rather than quantitative(Objective) . However, this test can be used as a quick clinical tool to screen . The introduction of various instrument in the arena of balance assessment and the force plat form usage has given the more objective and accurate measurement.

Limitations[11] [12]

- Not Quantitative
- Low diagnostic sensitivity and specificity
- Low power to determine lesions, predict the risk of falling amd reflect the discomfortand ability to perform daily activities.

1. Computerized posturography is more sensitive than clinical Romberg Test in detecting postural control impairment in minimally impaired Multiple Sclerosis patients.

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Patient: Date: Time: AM/PM

The Timed Up and Go (TUG) Test

Purpose: To assess mobility

Equipment: A stopwatch

Directions: Patients wear their regular footwear and can use a walking aid if needed. Begin by having the patient sit back in a standard arm chair and identify a line 3 meters or 10 feet away on the floor.

Instructions to the patient:

When I say **"Go,"** I want you to:

1. Stand up from the chair
2. Walk to the line on the floor at your normal pace
3. Turn
4. Walk back to the chair at your normal pace
5. Sit down again

On the word **"Go"** begin timing.

Stop timing after patient has sat back down and record.

Time: _____ seconds

An older adult who takes ≥12 seconds to complete the TUG is at high risk for falling.

Observe the patient's postural stability, gait, stride length, and sway.

Circle all that apply: Slow tentative pace ■ Loss of balance ■ Short strides ■ Little or no arm swing ■ Steadying self on walls ■ Shuffling ■ En bloc turning ■ Not using assistive device properly

Notes:

For relevant articles, go to: **www.cdc.gov/injury/STEADI**

Centers for Disease Control and Prevention
National Center for Injury Prevention and Control

STEADI Stopping Elderly Accidents, Deaths & Injuries