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Promoting academic and professional excellence in health care to meet the challenges of aging in Sri Lanka

Fall risks assessment tools

Practical guidelines

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Content

Practical guideline: Fall risks assessment tools

Healthy Aging and Management in Older Adults for Physiotherapists

Objective:

- To train students in administering falls risk assessments tools, interpreting results, and designing targeted interventions for older adults' population.

Pre-class preparation:

Materials and equipment needed:

1. **Hard copies/soft copies of common falls risks assessment tools**
   - Timed Up-And-Go
   - 6 Meter Walk Test
   - Near Tandem Stand Test
   - Alternate Step Test
   - Sit To Stand Test
   - Hill Step Test
   - Romberg Test

2. **Equipment:**
   - Stopwatch
   - Chair (For TUG) with back support and no armrest
   - Gait Pathway
   - Mirror
   - 6 -Meter Walkway
   - Cones
   - Step-Block
   - (2.5 X 2.5 Cm) Square Shaped Piece of Papers

3. **Two Case studies of patients with varying fall risks**

Case 1:

Mrs Anders is a 70-year-old female with a history of bilateral knee Osteo Arthritis (OA) for 20 years. After a knee replacement surgery (TKR), she has stopped walking and rarely goes out of the house.

She is finding it harder to do her housework, feels wobbly when reaching for things.

Perform appropriate tests to assess her functional mobility and balance.

Case 02:

Mrs Snow is a 71-year-old female living with her husband. She has arthritis in both her knees and spine. She has difficulty in climbing stairs to her 2nd floor apartment and she is worried about tripping and falling while going down.

Perform appropriate tests to assess her lower limb strength and gait speed.

4. **Student Pre-Reading: References:**

- Risk factors for recurrent falls in older adults: A systematic review with meta-analysis (Jehu, 2021).
- Validated Fall Risk Assessment Tools for Use with Older Adults: A Systematic Review (Ruggieri, 2017)
- Podsiadlo, D. and Richardson, S. (1991). "The timed "Up & Go": a test of basic functional mobility for frail elderly persons." J Am Geriatr Soc 39(2): 142-148.
- Bohannon RW. Comfortable and maximum walking speed of adults aged 20-79 years: reference values and determinants. Age Ageing. 1997 Jan;26(1):15-9. doi: 10.1093/ageing/26.1.15. PMID: 9143432.
- CDC STEADI Guidelines (for fall risk assessment).

1. TIMED-UP- AND-GO TEST **(derived from Podsiadlo and Richardson, 1991)**

The Timed Up and Go (TUG) Test is a widely used functional mobility test that assesses balance, gait speed, and fall risk in older adults and individuals with neurological or musculoskeletal conditions.

Test-retest reliability: Intraclass correlation coefficient for intra- and inter-rater reliability were 0.98 and 0.99 (Podsiadlo, 1991)

The timed "Up & Go" test measures, in seconds, the time taken by an individual to stand up from a standard arm chair (approximate seat height of 46 cm, arm height 65 cm), walk a distance of 3 meters, turn, walk back to the chair, and sit down again.

1. 1 Indications

- Screening for **fall risk** (especially in elderly or neurological patients).
- Assessing **functional mobility** (e.g., post-stroke, Parkinson's, hip fractures).
- Monitoring **rehabilitation progress** (pre/post-intervention).

1.2 **Equipment Needed**

- Standard armchair (~46 cm seat height)
- Stopwatch
- Measuring tape
- Cone or marker (3 meters away from the chair)
- Clear, unobstructed walkway

1.3 **Test Procedure**

Step 1: Setup

- Place a chair against a wall (for stability).
- Mark a **3-meter (10 ft) distance** from the chair with a cone or tape.

Step 2: Instructions to the Patient

*"When I say 'Go,' please:

1. Stand up from the chair.
2. Walk at your normal pace to the cone (3 meters away).
3. Turn around.
4. Walk back to the chair.
5. Sit down again."*

- The subject wears his/her regular footwear.
- If participant usually uses an assistive device such as cane or walker, (s)he can use that during the test.
- No physical assistance is given.

Step 3: Conducting the Test

- Patients start seated with back against the chair, arms on armrests.
- Begin timing when the patient **starts to rise** (say "Go").
- Stop timing when the patient's **buttocks touch the seat** upon return.
- **Perform 1 practice trial + 3 timed trials** (record average time).

1.4 Interpretation

Table 1: Mean TUG values for different elderly age categories

Age category (years)	Mean TUG value (95%CI) (s)
60-69	8.1 (7.1-9.0)
70-79	9.2 (8.2-10.2)
80-99	11.3 (10.0-12.7)

(Source: Bohannon RW,2006)

≤ 10 seconds = normal

≤ 20 seconds = good mobility, can go out alone, mobile without gait aid

≤ 30 seconds = problems, cannot go outside alone, requires gait aid

* A score of ≥ 14 seconds has been shown to indicate high risk of falls

Age Matched Norms:

Timed Up and Go	Age in years	Mean in seconds
	60-69	7.9 +/- 0.9
	70-79	7.7 +/- 2.3
	80-89	No device: 11.0 +/- 2.2 With device: 19.9 +/- 6.4
	90-101	No device: 14.7 +/- 7.9 With device: 19.9 +/- 2.5

References:

- **Original TUG test reference value:**

Podsiadlo, D. and Richardson, S. (1991). "The timed "Up & Go": a test of basic functional mobility for frail elderly persons." J Am Geriatr Soc 39(2): 142-148. https://doi.org/10.1111/j.1532-5415.1991.tb01616.x

- Centers for Disease Control and Prevention (CDC). *"Stopping Elderly Accidents, Deaths & Injuries (STEADI) Initiative."* https://www.cdc.gov/steadi/pdf/STEADI-Brochure-TUG-508.pdf
- Anne Shumway-Cook, Sandy Brauer, Marjorie Woollacott, Predicting the Probability for Falls in Community-Dwelling Older Adults Using the Timed Up & Go Test, *Physical Therapy*, Volume 80, Issue 9, 1 September 2000, Pages 896–903, https://doi.org/10.1093/ptj/80.9.896.
- Clinical and pathologic presentation in Parkinson's disease by apolipoprotein e4 allele status, Monsell, Sarah E. et al. Parkinsonism & Related Disorders, Volume 20, Issue 5, 503 – 507; https://doi.org/10.1016/j.parkreldis.2014.02.001.
- Bohannon RW. Reference values for the timed up and go test: a descriptive meta-analysis. J Geriatr Phys Ther. 2006;29(2):64-8. doi: 10.1519/00139143-200608000-00004. PMID: 16914068.

2. 6m (Meter) WALK TEST

2.1 Indications:

- Assess gait speed and functional mobility
- Monitor progress in rehabilitation
- Predict fall risk and functional decline
- Evaluate interventions (e.g., physical therapy, assistive devices)

2.2 Equipment Needed

- Measuring tape or marked 6-meter walkway
- Stopwatch
- Cones or tape for start/end points
- Assistive device (if patient uses one, e.g., cane, walker)
- Chair (for resting before/after, if needed)

2.3 Procedure for test:

1. Setup

- Mark a **6-meter (20 ft) straight path** with clear start and end lines.
- Add **1-meter (3.3 ft) acceleration and deceleration zones** at each end (total distance: 8 meters).

2. Instructions to Patient

- *"Walk at your normal, comfortable pace to the other end."*
- *"You may use your assistive device if needed."*
- *"Stop when you pass the end line."*

3. Conducting the Test

- Patient starts with both feet behind the start line.
- Begin timing when the first foot crosses the start line.
- Stop timing when the first foot crosses the 6-meter end line.
- Record time (in seconds) and any observations (e.g., unsteadiness, use of assistive device).

2.4 **Scoring**

- **Gait speed (m/s) = Distance (6 meters) / Time (seconds)**
- A gait speed of **<0.8 m/s** is often associated with increased risk of adverse health outcomes.
- Compare to normative values (e.g., healthy older adults: ~1.2–1.4 m/s; slower speeds may indicate higher fall risk).

- Speed values of **6-Meter Walk Test (6MWT)** are based on established research and clinical guidelines.

References:

- Bohannon RW. Comfortable and maximum walking speed of adults aged 20-79 years: reference values and determinants. Age Ageing. 1997 Jan;26(1):15-9. doi: 10.1093/ageing/26.1.15. PMID: 9143432.
- CDC STEADI Guidelines (for fall risk assessment).
- RICHARD W. BOHANNON, Comfortable and maximum walking speed of adults aged 20—79 years: reference values and determinants, *Age and Ageing*, Volume 26, Issue 1, January 1997, Pages 15–19, https://doi.org/10.1093/ageing/26.1.15
- Fritz, Stacy PT, PhD1; Lusardi, Michelle PT, PhD2. White Paper: "Walking Speed: the Sixth Vital Sign". Journal of Geriatric Physical Therapy 32(2):p 2-5. (DOI: 10.1519/00139143-200932020-00002)
- Studenski S, Perera S, Patel K, et al. Gait Speed and Survival in Older Adults. *JAMA.* 2011;305(1):50–58. doi:10.1001/jama.2010.1923

Additional Resources

- **World Health Organization (WHO) Falls Prevention Guidelines** (uses TUG for risk stratification).
- **American Geriatrics Society (AGS) Guidelines** on mobility assessment in elderly.

3. NEAR TANDEM STAND TEST

The Near Tandem Stand Test (NTST) is a simple, clinical balance assessment used to evaluate static standing balance and fall risk, particularly in older adults and individuals with neurological conditions (e.g., stroke, Parkinson's). It is a modified version of the Tandem Stand Test, making it easier for frail or balance-impaired patients.

The test can be initially conducted with eyes open and can be progressed to eyes closed.

3.1 Indications

✓ Screening for **balance impairment** and **fall risk**
✓ Assessing **static postural control** (e.g., vestibular disorders, stroke recovery)
✓ Monitoring **rehabilitation progress** (e.g., pre/post-physical therapy).

3.2 Equipment Needed

- **Non-slip surface** (e.g., firm floor)
- **Chair or wall** (for safety/support if needed)
- **Stopwatch**
- **Tape or line marking** (optional for foot placement guidance).
- **2.5 cm * 2.5 cm square paper**

3.3 Test Procedure

Step 1: Instructions to the Patient

*"Stand with your feet in a semi-tandem position: Place the heel of one foot beside the big toe of the other foot, with about **1–2 inches (2.5–5 cm) between heel and toe**. Keep your arms at your sides or crossed over your chest. Hold this position for **30 seconds** without moving your feet or holding onto anything."*

This is a measure of balance and ankle strength and involves testing whether the patient can stand with feet in a near tandem position for a period 30 seconds with eyes open and 10 seconds with eyes closed.

Step 2: Conducting the Test

1. **Positioning**:

- The patient stands **near a wall or chair** (for safety but **no touching** unless they lose balance).
- Feet are placed in **near-tandem stance** (heel of one foot beside the big toe of the other).

2. **Timing**:

    - Start the stopwatch when the patient is steady.
    - Stop timing if the patient:
        - Moves their feet
        - Needs arm support
        - Takes a step
        - Exceeds **30 seconds (eyes open)/ 10 seconds (eyes closed)** (successful completion).

3.4 Scoring:

- Record the **maximum time held (up to 30 sec/ 10 sec respectively)**.
- **3 trials** allowed (use best score).

3.5 Interpretation:

Tandem Stance Test values

Category	Description
Low	Held tandem stance position less than 10 seconds.
Medium	Held tandem stance position between 10 and 29 seconds.
High	Achieved maximum hold time (30 seconds), considered a ceiling effect.

(Source: Hile et al., 2012)

References

- Elizabeth S. Hile, Jennifer S. Brach, Subashan Perera, David M. Wert, Jessie M. VanSwearingen, Stephanie A. Studenski, Interpreting the Need for Initial Support to Perform Tandem Stance Tests of Balance, *Physical Therapy*, Volume 92, Issue 10, 1 October 2012, Pages 1316–1328, https://doi.org/10.2522/ptj.20110283

4. ALTERNATE STEP TEST

(Test-retest reliability: 0.99) (Chung, 2014)

The Alternate Step Test (AST) is a dynamic balance assessment that evaluates lower limb coordination, weight shifting, and fall risk by timing how quickly a person can alternately step onto a raised platform. It is commonly used for older adults, stroke patients, and those with neurological conditions.

4.1 Indications

- Assess dynamic balance and motor planning
- Screen for fall risk (especially in elderly)
- Monitor rehabilitation progress (e.g., post-stroke, Parkinson's)
- Evaluate functional lower limb strength

4.2 Equipment needed

- A step or stool (standard height: 18 cm / 7 inches)
- Stopwatch
- Non-slip surface (for safety)
- Handrail or wall (optional, for support if needed)

4.3 Test Procedure

Step 1: Setup

- Place the step securely against a wall or stable surface.
- Ensure the patient wears flat, non-slip footwear.

Step 2: Instructions

"Place one foot fully on the step, then the other, alternating as quickly as possible for 8 full steps (4 per foot). Use the handrail only if necessary."

Step 3: Conducting the Test

- Patient stands facing the step.
- Start timing when the first foot touches the step.
- Count 8 steps (up and down = 1 step).
- Stop timing when the 8th step is completed.
- Record time (seconds) and note:

Step 4: Scoring

- Normal: <10 seconds (healthy adults)
- Mild impairment: 10–15 seconds
- Moderate impairment: 15–20 seconds
- Severe impairment: >20 seconds or inability to complete

4.4 Interpretation & Fall Risk

Time (Seconds)	Interpretation	Fall Risk
<10 sec	Normal dynamic balance	Low
10–15 sec	Mild impairment	Moderate
15–20 sec	Significant impairment	High
>20 sec	Severe impairment	Very High

(Source: Chung et al., 2014)

Population-Specific Cutoffs:

- **Stroke Patients**: >15 sec → High risk of falls (Dite & Temple, 2002)
- **Parkinson's Disease**: >12 sec → Correlates with freezing of gait (Mak et al., 2017)

References:

- A clinical test of stepping and change of direction to identify multiple falling older adults Dite, Wayne et al. Archives of Physical Medicine and Rehabilitation, Volume 83, Issue 11, 1566 – 1571; https://doi.org/10.1053/apmr.2002.35469
- Centers for Disease Control and Prevention. (2023). *"STEADI - Stopping Elderly Accidents, Deaths & Injuries."* *https://www.cdc.gov/steadi/pdf/STEADI-Algorithm-508.pdf*.
- Chung, M. M. L., Chan, R. W. Y., Fung, Y.-K., Fong, S. S. M., Lam, S. S. L., Lai, C. W. K., & Ng, S. S. M. (2014). Reliability and validity of Alternate Step Test times in subjects with chronic stroke. *Journal of Rehabilitation Medicine, 46*(10), 969–974. https://doi.org/10.2340/16501977-1877

5. SIT TO STAND TEST (STS)

A. 5 Repetitions STS: Test-retest reliability: 0.9 (Muñoz-Bermejo, 2021)

B. 30 second sit to stand: 0.737 (McAllister, 2020)

The **Sit-to-Stand Test (STS)** evaluates **lower limb strength, balance, and functional mobility** by measuring how many times a person can stand up from a chair in a set time (typically **30 seconds or 5 repetitions**). It is widely used for **older adults, stroke patients, and individuals with musculoskeletal disorders**.

1. Indications

- Assess **functional leg strength** and **dynamic balance**
- Screen for **fall risk** (especially in elderly)
- Monitor **rehabilitation progress** (e.g., post-hip surgery, stroke recovery)
- Evaluate **frailty and sarcopenia**

2. Equipment Needed

- **Standard armless chair** (seat height **43–47 cm / 17–18.5 inches**)
- **Stopwatch**
- **Wall or sturdy surface** (for safety, if needed)

3. Test Procedure

A. 30-Second Sit-to-Stand (30s STS)

1. **Setup**:
    - Chair against a wall for stability.
    - Patient sits with **back straight, arms crossed over chest**, feet flat on the floor.
2. **Instructions**:

- *"Stand up fully and sit down as many times as possible in 30 seconds. Keep your arms crossed."*

3. **Scoring**:
    - Count **full stands** (buttocks must touch the chair each time).
    - Record the **total number of stands in 30 seconds**.
    -

B. 5-Repetition Sit-to-Stand (5xSTS) – For Frail Patients

1. **Instructions**:
    - *"Stand up and sit down 5 times as quickly as possible."*
2. **Scoring**:
    - Record **time (seconds)** to complete 5 stands.

4. Interpretation & Fall Risk

30-Second STS Norms (Number of Stands)

Age Group	Men (Reps)	Women (Reps)	Fall Risk
60–69 yrs	≥14	≥12	Low
70–79 yrs	≥12	≥11	Moderate
80+ yrs	≥10	≥9	High

(Source: Jones CJ et al., 1999)

5xSTS Time-Based Cutoffs

Time (Seconds)	Interpretation	Fall Risk
<10 sec	Normal strength	Low
10–15 sec	Mild impairment	Moderate

Time (Seconds)	Interpretation	Fall Risk
>15 sec	Severe impairment	High
>30 sec	Critical weakness	Very High

(Source: Bohannon 2006)

References:

- Rikli, R. E., & Jones, C. J. (1999). Functional Fitness Normative Scores for Community-Residing Older Adults, Ages 60-94. *Journal of Aging and Physical Activity*, *7*(2), 162-181. Retrieved Jun 5, 2025, from https://doi.org/10.1123/japa.7.2.162.
- Bohannon RW. Reference values for the five-repetition sit-to-stand test: a descriptive meta-analysis of data from elders. Percept Mot Skills. 2006 Aug;103(1):215-22. doi: 10.2466/pms.103.1.215-222. PMID: 17037663.
- Buatois, S., et al. (2008). *"Five times sit-to-stand test is a predictor of recurrent falls in healthy community-living subjects aged 65 and older."*
  Journal of the American Geriatrics Society, 56(8), 1575–1577.
  DOI: 10.1111/j.1532-5415.2008.01777.x
- Muñoz-Bermejo, L., Adsuar, J. C., Mendoza-Muñoz, M., Barrios-Fernández, S., Garcia-Gordillo, M. A., Pérez-Gómez, J., & Carlos-Vivas, J. (2021). Test-retest reliability of the Five Times Sit to Stand Test (FTSST) in adults: A systematic review and meta-analysis. *Biology*, *10*(6), Article 510. https://doi.org/10.3390/biology10060510
- McAllister, L. S., & Palombaro, K. M. (2020). Modified 30-second sit-to-stand test: Reliability and validity in older adults unable to complete traditional sit-to-stand testing. *Journal of Geriatric Physical Therapy*, *43*(3), 153–158. https://doi.org/10.1519/JPT.0000000000000227.
- Jones CJ, Rikli RE, Beam WC. A 30-s chair-stand test as a measure of lower body strength in community-residing older adults. Res Q Exerc Sport. 1999 Jun;70(2):113-9. doi: 10.1080/02701367.1999.10608028. PMID: 10380242.

6. THE HILL STEP TEST

The Hill Step Test (or Step Test) assesses dynamic balance, lower limb strength, and endurance by measuring the ability to repeatedly step onto a raised platform. It is commonly used for older adults, athletes, and rehabilitation patients to evaluate functional mobility and fall risk.

6.1 Indications

- Assess lower limb endurance and coordination
- Screen for fall risk (especially in elderly)
- Monitor rehabilitation progress (e.g., post-knee surgery, stroke)
- Evaluate cardiovascular fitness (modified versions)

6.2 Equipment Needed

- **Step or bench standard height: 7.5cm step**
- **Stopwatch**
- **Handrail or wall (for safety if needed)**

6.3 Test Procedure

A. Standard Hill Step Test (30 Seconds)

1. Setup:
    - Place the step against a wall for stability.
    - Ensure the patient wears non-slip footwear.
2. Instructions:
    - *"Step up and down onto the bench as quickly as possible for 30 seconds, leading with the same foot each time."*
3. Scoring:
    - Count full steps (one step = up + down).
    - Record the total number of steps in 30 seconds.

6.4 Interpretation & Fall Risk

Cut-off Scores for Increased Fall Risk

- <12 steps in 30 sec (70+ yrs) → Higher risk of falls *(Lord et al., 2002)*

References:

- Hill, K., et al. (1996). *"A new test of dynamic standing balance for stroke patients: Reliability, validity and comparison with healthy elderly." Physiotherapy Canada, 48*(4), 257-262. DOI:10.3138/ptc.48.4.257.

- Rikli, R. E., & Jones, C. J. (1999). *"Functional fitness normative scores for community-residing older adults." Journal of Aging and Physical Activity, 7*(2), 162–181. DOI:10.1123/japa.7.2.162.

7. ROMBERG TEST

The Romberg Test is a simple neurological and balance assessment that evaluates proprioception, vestibular function, and cerebellar integrity by challenging static balance with eyes open/closed.

7.1 Indications

- Screen for sensory ataxia (e.g., peripheral neuropathy, spinal cord lesions)
- Assess vestibular dysfunction (e.g., BPPV, Ménière's disease)
- Detect cerebellar disorders (e.g., multiple sclerosis, stroke)
- Fall risk assessment in elderly

7.2 Equipment Needed

- Flat, non-slip surface
- Stopwatch
- Wall or assistant (for safety)

7.3 Test Procedure

Step 1: Standard Romberg (Feet Together)

1. **Positioning:**
    - Patient stands feet together, arms at sides or crossed over chest.
    - Ensure a safe environment (stand close to prevent falls).
2. **Eyes Open (20 sec):**
    - *"Stand still with eyes open for 20 seconds."*
    - Observe for swaying or imbalance.
3. **Eyes Closed (20 sec):**
    - *"Now close your eyes and hold this position for 20 seconds."*
    - Stop timing if: Patient steps, opens eyes, or requires support.

Step 2: Sharpened Romberg (Tandem Stance)

- **More challenging version:**

- Heel-to-toe stance (tandem position).
- Perform eyes open (10 sec), then eyes closed (10 sec).

7.4 Interpretation

Result	Interpretation	Possible Causes
Stable (eyes open/closed)	Normal proprioception and vestibular function	–
Sways only eyes closed	**Positive Romberg** (sensory ataxia)	Peripheral neuropathy, posterior column lesions (e.g., B12 deficiency)
Sways eyes open/closed	**Cerebellar or vestibular dysfunction**	Stroke, MS, Ménière's disease
Falls immediately	**Severe impairment**	Advanced neuropathy, cerebellar lesion

References:

Rogers JH. Romberg and his test. *The Journal of Laryngology & Otology*. 1980;94(12):1401-1404. doi:10.1017/S

002221510009023X.