FALL RISK ASSESSMENT AND MANAGEMENT

Meridee Danks DPT, NCS
University of North Dakota
Department of Physical Therapy
Geriatric teleECHO Series
December 13, 2022

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Objectives

Be able to:

- Identify appropriate fall risk screening and assessments that can be used in the elderly population.
- Describe ways to intervene to allow older adults to move safely in order to maintain function & participation in what matters to them.
- List the benefits of promoting fall prevention with the older individual.

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The **4Ms**: What Matters, Medication, Mentation & Mobility (+ Multi-complexity)

- Evidence-based practices that incorporate the 4Ms together to provide age-friendly care
- Focuses on "What Matters" to:
  - the older adult and family caregivers
- 5th "M" = Multi-complexity (Molnear/Huag/Tinetti)
  - Helping older adults manage a variety of health conditions and assessing living conditions

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Major **Mobility** Concern = "Fall Risk"

- Falls are the leading cause of injury & injury related deaths in adults 65+ (CDC, 2019)
  - Between 2007–2016, fall death rates increased **31%** (Burns, 2018)
  - 30 million falls/year (Florence, 2018); a fall death every 20 min
- Economic impact of falls = $50 billion medical costs/yr
- Falls can lead to decrease in health, social interactions & mobility. Falls -> Fear of Falling -> decrease Mobility

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Fear of falling

↓

Reduced mobility/activity

↓

Deconditioning

↓

Increased Risk of Falls

↓

Falls

↻

*The highest risk factor of falling is a **previous fall**!

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CDC **STEADI**

Stopping
Elderly
Accidents,
Deaths &
Injuries

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Coordinated Care Plan to Prevent Older Adult Falls

- Fall prevention start-up in primary care
- Clinical fall prevention program components:
  - **Screen -> Assess -> Intervene**

- Follow-Up and Care Coordination (Eckstrom, 2019)

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Case Study #1 – Mrs. Parker (CDC STEADI)

An outgoing 81-year-old woman who lives in an assisted living facility. She has come in with her son for a routine follow-up visit. Her son reports that she was just seen in the hospital's emergency room a week ago because she fell when she was getting out of the shower.

- **Medical History:**
  - **What do you want to know?**

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Mrs. Parker – Medical History

- Type 2 diabetes
- Coronary artery disease/MI
- Paroxysmal atrial fibrillation
- Congestive heart failure
- Hypertension
- Hypertriglyceridemia
- Depression
- Osteoarthritis of hips/knees
- Macular degeneration
- Rotator cuff syndrome
- Sciatica
- Diverticulosis
- Osteopenia
- Gastroesophageal reflux di
- Cognitive disorders (not Dx)

What are your concerns regarding Mrs. Brown's medical history in relation to her recent fall?

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Fall-Risk Screening

What would be an appropriate question to ask to screen for fall-risk?

Identify a self-assessment screening tool you might incorporate into her wellness visit to screen for fall risk?

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Screening for Fall Risk

- **Three (3) key questions**: a **"yes"** response indicates that a person may be at increased risk of falling but, will need to be assessed further to identify specific fall risk factors (postural hypotension, medication, co-morbidities, etc.)
  - **Have you fallen in the past year? (How often? How did it happen?)**
    - ***YES;*** *Mrs. Parker's son reports in the past year his mother has had "too many falls to count." Mrs. Parker agrees she falls a lot but states "Old people fall, that's just how it is." She has fallen:*
      - *tripping on a rug,*
      - *losing her balance turning/walking,*
      - *rolling out of bed,*
      - *at night when getting up to go to bathroom.*
  - **Do you feel unsteady when standing or walking?** ***YES;*** *She reports uses a 4-wheeled walker for short distances*
  - **Are you worried about falling?** ***YES;*** *Mrs. Parker states she hardly ever goes outside as she is afraid of falling and breaking a hip.*

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Self-Assessment of Fall Risk

(Rubenstein 2011)

- **CDC's *Stay Independent Fall Risk Checklist***
  - ***4 or > "yes"*** *responses may indicate* ***> risk of falls***
  - ***If not at risk*** *->* ***Intervene****: educate in fall prevention, refer to community exercise program i.e., Senior Center or fall prevention program i.e., Stepping On.*
    (CDC, 2019)

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Mrs. Parker's Fall Risk Score = 9

Check Your Risk for Falling

Circle "Yes" or "No" for each statement below			Why it matters
Yes (2)	No (0)	I have fallen in the past year.	People who have fallen once are likely to fall again.
Yes (2)	No (0)	I use or have been advised to use a cane or walker to get around safely.	People who have been advised to use a cane or walker may already be more likely to fall.
Yes (1)	No (0)	Sometimes I feel unsteady when I am walking.	Unsteadiness or needing support while walking are signs of poor balance.
Yes (1)	No (0)	I steady myself by holding onto furniture when walking at home.	This is also a sign of poor balance.
Yes (1)	No (0)	I am worried about falling.	People who are worried about falling are more likely to fall.
Yes (1)	No (0)	I need to push with my hands to stand up from a chair.	This is a sign of weak leg muscles, a major reason for falling.
Yes (1)	No (0)	I have some trouble stepping up onto a curb.	This is also a sign of weak leg muscles.
Yes (1)	No (0)	I often have to rush to the toilet.	Rushing to the bathroom, especially at night, increases your chance of falling.
Yes (1)	No (0)	I have lost some feeling in my feet.	Numbness in your feet can cause stumbles and lead to falls.
Yes (1)	No (0)	I take medicine that sometimes makes me feel light-headed or more tired than usual.	Side effects from medicines can sometimes increase your chance of falling.
Yes (1)	No (0)	I take medicine to help me sleep or improve my mood.	These medicines can sometimes increase your chance of falling.
Yes (1)	No (0)	I often feel sad or depressed.	Symptoms of depression, such as not feeling well or feeling slowed down, are linked to falls.
Total		Add up the number of points for each "yes" answer. If you scored 4 points or more, you may be at risk for falling.	

This checklist was developed by the Greater Los Angeles VA Geriatric Research Education Clinical Center and affiliates and is a validated fall risk self-assessment tool (Rubenstein et al. J Safety Res; 2011: 42(6)493-499). Adapted with permission of the authors.

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Mrs. Parker Self-Assessment Results

- STEADI Fall Risk Checklist - Mrs. Parker checked **"yes"** to:
  - "I have fallen in the past year"
  - " I use or have been advised to use a cane or walker to get around safely."
  - "I am worried about falling"
  - "I need to push with my hands to stand up from a chair."
  - "I have some trouble stepping up onto a curb."
  - "I often have to rush to the toilet"
  - "I take medication to help me sleep or to improve my mood"
- **Fall Risk Score = 9; indicating a > risk of falling**

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Assess: Physical Exam

- **What should be included in her physical examination during the follow-up visit?**
- **What other factors should be assessed regarding Mrs. Brown's fall risk and balance?**
- **Identify an easy-to-use standardized assessment that could be used to assess Mrs. Parker's mobility and/or balance?**

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Assess Fall Risk & Mobility

https://www.cdc.gov/steadi/pdf/STEADI-Poster-Integrating-508-2019.pdf

- Early identification of mobility limitations is **key**! As loss of mobility is often preventable or treatable!
- Fall history - circumstances of the fall - **where/when/how?**
- Identify medications that may increase fall risk
- Assess Vitamin D intake
- Environmental assessment
  - https://www.cdc.gov/steadi/pdf/STEADI-Brochure-CheckForSafety-508.pdf
- Check vision acuity - ? bifocals
- Assess feet and footwear; posture
- Identify comorbidities that increase fall risk
  - cognitive, orthostatic hypotension, depression, etc.
- *Gait, strength, & **balance/mobility** tests
  - https://www.cdc.gov/steadi/pdf/STEADI-Form-RiskFactorsCk-508.pdf

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Primary Care Quick Screen of Mobility

- 1. **For health or physical reasons, do you have difficulty climbing up 10 steps or walking a ¼ of a mile?**
  - *Mrs. Parker – answered "Yes, I use to go to exercise class but stopped about 5 years ago due to my knee pain."*
- 2. **Because of underlying health or physical reasons, have you modified the way you climb 10 steps or walk ¼ mile?**
  - *Mrs. Parker – answered "Yes, I use a 4-wheeled walker"*
- If **yes**, referral to healthcare for further **assessment and intervention** to address loss of mobility
  - PT – strength, balance, mobility & assistive devices
  - OT – daily living activities & living environment
  - Social support – to deal with lack of transportation/mobility barriers (Hardy, 2011)

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Mrs. Parker's Medications

MEDICATION	DOSE	TIMING
Novolog	3 units subcutaneously	before meals and at bedtime
Lantus	20 units subcutaneously	at bedtime
Lisinopril	20 mg	daily
Metoprolol Succinate ER	200 mg	daily
Spironolactone	12.5 mg	daily
Furosemide	20 mg	daily
Potassium Chloride	20 mEq	daily
Digoxin	125 mcg	daily
Fluoxetine	40 mg	daily
Clonazepam	1 mg	at bedtime as needed for sleep
Atorvastatin	10 mg	at bedtime
Aspirin	81 mg	daily

What are your concerns with these meds?

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Mrs. Brown – Physical Exam

- **Vitals** (BP,HR) - Supine – 129/53, 59; Sitting – 103/40, 60; Standing – 101/51, 62. BMI 18.5. Reports lack of energy.
- **Head** – Contusion with resolving ecchymosis and swelling at posterior occiput on right side. Reports hearing difficulties
- **Posture/Balance** – marked kyphosis, forward head; Height 5'7"; unstable balance
- **Vision** – wears bifocals, acuity R 20/30, L 20/70; reports blurry vision at times
- **CV** – regular rate & rhythm
- **Respiratory** – clear to auscultation
- **GI** – normal bowel sounds, soft, non-tender, non-distended
- **GU** – reports hx of bladder infections, urinary frequency/incontinence; nocturia x4
- **Musculoskeletal** – LE decreased strength; Knee pain due to OA
- **Neurology** – Tone/DTR's normal; diminished sensation/proprioception in feet;
- **Psych** - PHQ – 2 = 6/6; Cognitive screen 0/3 items recalled; reports feeling "blue"

What are your concerns re: assessment results ?

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Identified Fall Risk Factors

- Self-Assessment Fall Risk score = 9
- Fear of falling
- Orthostatic blood pressure / Postural Hypotension
  - Taking 4 meds to < BP: Lisinopril, metoprolol, spironolactone, and furosemide
- Vison issues
- Bladder issues (incontinence/frequency/nocturia)
- Decrease sensation/proprioception and feet
- Decreased lower body strength
- Serious impairments in gait and balance
- Cognitive impairment and depressive symptoms
  - Taking 2 psychoactive meds: fluoxetine & clonazepam (? Effectiveness)
- Others ?

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Mobility/Fall Risk Standardized Assessments

- **Timed Up & Go** (TUG) test
- **30-Second Chair Stand Test** (30sCST or 30sSTS)
  - (or) 5-times Sit to Stand Test (5xSTS/FTSTS)
- **4-Stage Balance Test** (FSBT) - standing
  - Feet together, semi-tandem, tandem and single leg stance

https://www.cdc.gov/steadi/materials.html

- **10-meter Walk Test (10MWT)**
  - Gait speed (m/sec) – "The 6th vital sign"

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Timed Up and Go (TUG) Test

- Purpose: To assess mobility (Gait/Balance)
- Patient is asked to sit in a chair (17-18" in height), stand up, walk 10 ft (3m), turn around, walk back to the chair, and sit down. https://www.cdc.gov/steadi/pdf/STEADI-Assessment-TUG-508.pdf
- TUG instructional video on CDC STEADI site
  - https://youtu.be/BA7Y_oLElGY
- Tester times the activity & observes movement quality
  - **12 seconds or >** indicates increased risk of falls
  - 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.
- Barry (2015) – more useful to "rule in" falls than "rule out"

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ASSESSMENT

Timed Up & Go (TUG)

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.

① **Instruct the patient:**

NOTE: Always stay by the patient for safety.

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.

② **On the word "Go," begin timing.**
③ **Stop timing after patient sits back down.**
④ **Record time.**

Time in Seconds: _____

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

CDC's STEADI tools and resources can help you screen, assess, and intervene to reduce your patient's fall risk. For more information, visit www.cdc.gov/steadi

Patient _____

Date _____

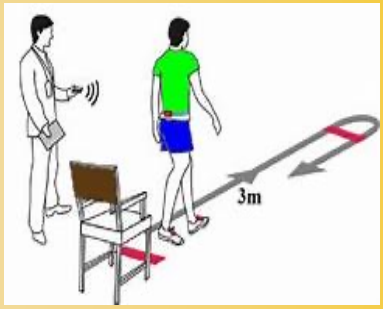
Time ☐ AM ☐ PM

OBSERVATIONS

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

Check 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

These changes may signify neurological problems that require further evaluation.



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2017

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30-second Chair Stand Test

- Purpose: To quantify functional leg strength/endurance & transfer skill.
- Individual is asked to sit in middle of a chair without arms (17" seat height), with feet flat on floor, cross arms on chest, when tester says "go" the person stands fully up & sit down repeatedly until the tester says "stop."
- The tester counts number of stands in 30 sec. If the individual is unable to stand with arms crossed the score = 0. A score below age norms is considered a fall risk. Instructional video - https://youtu.be/Ng-UOHjTejY

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

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ASSESSMENT

30-Second Chair Stand

Purpose: To test leg strength and endurance

Equipment: A chair with a straight back without arm rests (seat 17" high), and a stopwatch.

NOTE: Stand next to the patient for safety.

① **Instruct 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, then sit back down again.
6. Repeat this for 30 seconds.

② **On the word "Go," begin timing.**

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

③ **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.

④ **Record the number of times the patient stands in 30 seconds.**

Number: _____ Score: _____

CDC's STEADI tools and resources can help you screen, assess, and intervene to reduce your patient's fall risk. For more information, visit www.cdc.gov/steadi

Patient _____

Date _____

Time ☐ AM ☐ PM

SCORING

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

A below average score indicates a risk for falls.

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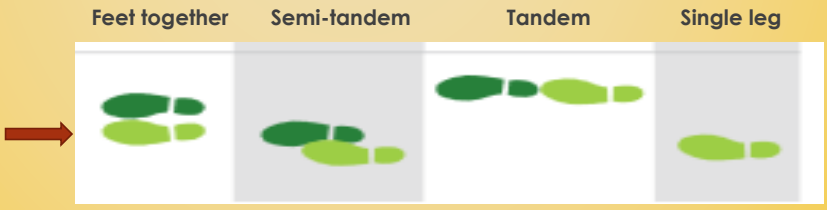
Four Stage Balance Test (FSBT)

- Purpose: To assess static standing balance
- Individual is instructed to stand in four different positions (feet together, semi-tandem, tandem & one-legged stance) for 10 seconds each. The foot positions are in a progressive fashion, so testing can be stopped if the individual is unable to hold a position for the 10 seconds. Instructional video - https://youtu.be/3HvMLLIGY6c
- An older person that is unable to hold a Tandem position for 10 sec is at an increased risk of falling.



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ASSESSMENT

The 4-Stage Balance Test

Purpose: To assess static balance

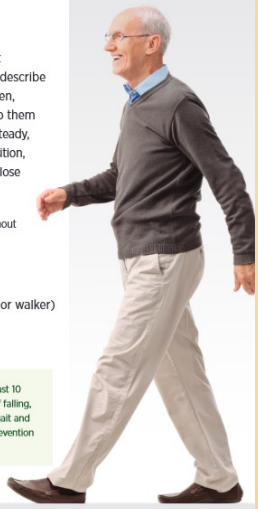
Equipment: A stopwatch

Directions: There are four standing positions that get progressively harder to maintain. You should describe and demonstrate each position to the patient. Then, stand next to the patient, hold their arm, and help them assume the correct position. When the patient is steady, let go, and time how long they can maintain the position, but remain ready to assist the patient if they should lose their balance.

- If the patient can hold a position for 10 seconds without moving their feet or needing support, go on to the next position.
- If not, **STOP** the test.

Patients should not use an assistive device (cane or walker) and they should keep their eyes open.

An older adult who cannot hold the tandem stand for at least 10 seconds is at increased risk of falling. To reduce their risk of falling, you might consider referring them to physical therapy for gait and balance exercises, or refer them to an evidence-based fall prevention program, such as Tai Chi.



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ASSESSMENT CONTINUED

The 4-Stage Balance Test

Patient _____

Date _____

Time _____ ☐AM ☐PM

Instructions to the patient:

- I'm going to show you four positions.
- Try to stand in each position for 10 seconds.
- You can hold your arms out, or move your body to help keep your balance, but don't move your feet.
- For each position I will say, **"Ready, begin."** Then, I will start timing. After 10 seconds, I will say, **"Stop."**

① **Stand with your feet side-by-side.**	Time: _____seconds
② **Place the instep of one foot so it is touching the big toe of the other foot.**	Time: _____seconds
③ **Tandem stand: Place one foot in front of the other, heel touching toe.**	Time: _____seconds
④ **Stand on one foot.**	Time: _____seconds

Notes:

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For more information, visit www.cdc.gov/steadi

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10-Meter Walk Test (10MWT)

- Purpose: to assess walking speed over a short distance (m/sec)
- Individual walks without assistance 10 meters (32.8 ft), time is measured for middle 6m (19.7 ft) allowing 2m for acceleration & deceleration, timing starts when lead foot crosses 2m mark and stops when lead foot cross 8m mark.
- Assistive devices can be used but should be kept consistent & documented test to test; no physical assistance given
- Preferred &/or fast walking speed can be tested. Collect 3 trials & calculate the average walking speed; 6m/avg sec
- Cutoff Scores (Healthy older adults): **< 0.7 m/s** is indicative of increased risk of adverse events (fall, hospitalization, etc.)
- **3-meter Walk Test (10ft)** if space is limited

(Montero-Odasso, 2005/Studenski, 2011/Guralmk,1994)

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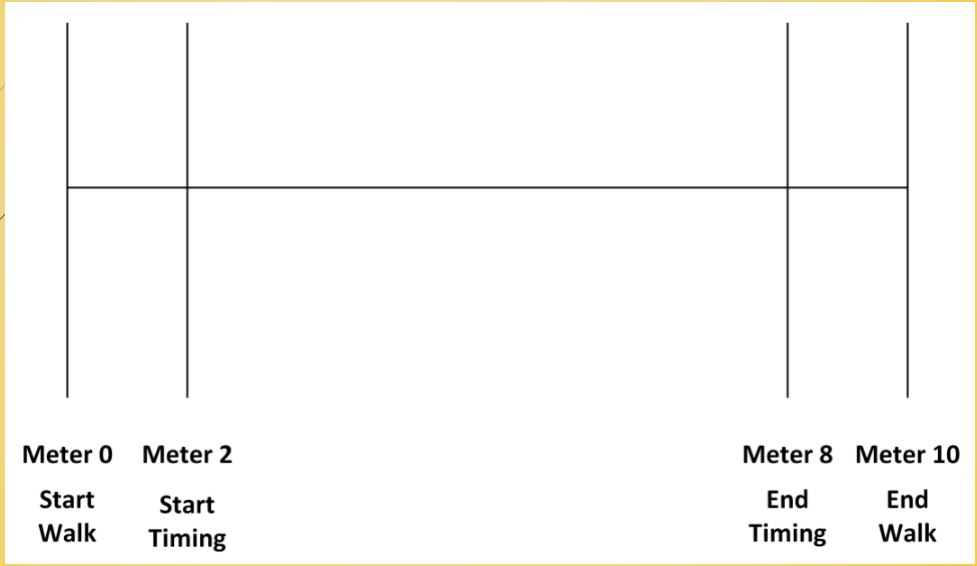
10MWT Layout



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10MWT
Norms for Healthy Older Adults (Bohannon, 2011)

Decade	Men	Women
60s	1.34	1.24
70s	1.26	1.13
80's/90s	0.97	0.94

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Case Study: Mrs. Parker's Test Results

- **TUG score** = 18 sec with 4-WW; wide-base of support
- **30-sec Chair Stand Test** = 0, unable to do without arms
  - Modified 30-secCST = 5
- **FSBT**: Single-limb Stance = 0 sec; Tandem Stance = 0 sec; Semi-tandem = 4 sec; & Feet Together = 10 sec
- **10 MWT** = 0.6 m/sec with 4-wheeled walker

Identify test results that would indicate fall risk for Mrs. Parker?

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Evidence-based Findings:

- Lusardi (2017) – Systematic Review/Meta-Analysis of community-dwellers 65 and older, found **no single test predicted falls**, but use of **history questions, self-reported measures**; **TUG >, Sit to Stand test** and Berg Balance Scale score <50 pts **were the most evidenced supported measures to determine risk of future falls.**

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What would be your recommendations for Mrs. Brown to help her maintain (improve) mobility & prevent future falls?

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Fall Prevention Recommendations

- Reevaluate the use psychoactive meds, medications affecting blood pressure, and evaluate for digoxin toxicity.
- Consider non-pharmacologic options for symptom management.
- Implement strategies to address urinary problems, decreased LE sensation , & depression.
- Recommend at least 800 IU of vitamin D daily to reduce fall risk.
- Educate on self-management of orthostatic hypotension (such as getting up slowly, doing ankle pumps &/or hand clenches for 1 min prior to standing, do not walk if dizzy, etc.) and provide her with **CDC Postural Hypotension** brochure.
- Discuss fall prevention strategies and emphasize that many falls can be prevented.
- Discuss home modifications such as removing tripping hazards (throw rugs) and installing grab bars in her bathroom. Provide with CDC fall prevention brochures – **What Can You Do to Prevent Falls** and **Check for Safety**.

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Fall Prevention Recommendations

- Refer to PT for pain and gait assessment and to increase strength and improve balance through an individual exercise program.
  - Strong evidence supports resistance & balance exercises for improving mobility.
- Refer to OT for a comprehensive assessment of home environment and provide education to reduce her chances of falls.
- Refer to podiatrist or orthopedist to address knee problems.
- Encourage involvement in activities and exercise programs (2-3x/wk) at her assisted living facility.
- Refer to an eye doctor for eye exam & updated prescription. ??getting a pair of single lens distance glasses for walking outside.
- Identify and *set a daily mobility goal* with older adult that supports What Matters; review and support progress toward the goal. Follow up!

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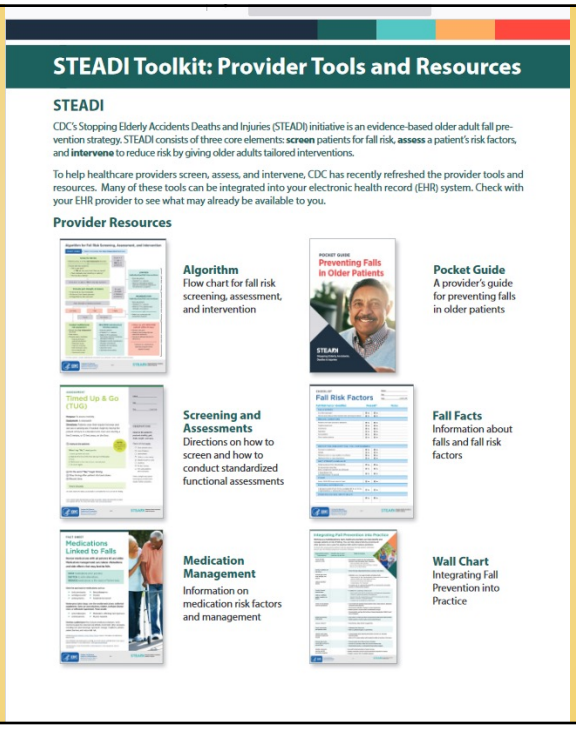

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What are the benefits of encouraging mobility and educating fall prevention to Mrs. Parker?

What are the potential effects of not addressing Mrs. Parker's mobility and fall risk?

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Confidence

↓

Mobility/Physical Activity

↓

Improved Strength/Flexibility

↓

Decreased risk of falling

↓

Less falls

↺

*Multifactorial fall screening/intervention can **reduce falls**!

O'Loughlin (1993)

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Benefits of Encouraging & Promoting Mobility in the Older Population

- Decrease risk of falls
- Improve cardiovascular condition
- Weight control
- Mental health benefits
- Increase social engagement
- Improve flexibility
- Bone density improved
- Improved overall function (i.e., self-care & independence)
- **EBP** – interventions (i.e., exercise), reduced medications & improve home safety. (Syst Rev -Gillespie, 2012/Tricco, 2017)

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References:

- CDC. WISQARS, Atlanta GA: CDC. 2019;[cited January 18, 2019]. Available from: hhtps://www.cdc.gov/injury/wisqars/index.html
- Brown CJ, Flood KL. Mobility Limitation in the Older Patient: A Clinical Review. *JAMA*. 2013;310(11):1168–1177. doi:10.1001/jama.2013.276566
- Burns E, Kakara R. Deaths from falls among persons aged >65 years – US, 207-2016. MMWR Morb Mortal Wkly Rep. 2018:67 (18):509-514
- Gillespie LD, Robertson MC, Gillespie WJ, et al. Interventions for preventing falls in older people living in the community. Cochrane Database Syst Rev. 2012(9):CD007146
- Hardy SE, Kang Y, Studenski SA, Degenholtz HB. Ability to walk 1/4 mile predicts subsequent disability, mortality, and health care costs. *J Gen Intern Med*. 2011;26(2):130-135.
- Tricco AC, Thomas SM, Veroniki AA, et al. Comparisons of interventions for preventing falls in older adults: a systematic review and meta-analysis. JAMA. 2017:318(17):1687-99.
- Eckstrom E, Parker EM, Shakya I, Lee R. Coordinated Care Plan to Prevent Older Adult Falls. Atlanta GA: CDC. 2019. Available from: https://www.cdc.gov/steadi
- Clemson L, Cumming RG, Kendig H, Swann M, Heard R, Taylor K. The effectiveness of a community-based program for reducing the incidence of falls in the elderly: a randomized trial. J Am Geriatr Soc. 2004 Sep;52(9):1487-94. doi: 10.1111/j.1532-5415.2004.52411.x. PMID: 15341550.

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- Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. Physical therapy. 2000 Sep 1;80(9):896-903.
- Barry E, Galvin R, Keogh C, Horgan F, Fahey T. Is the Timed Up and Go test a useful predictor of risk of falls in community dwelling older adults: a systematic review and meta-analysis. BMC Geriatr. 2014 Feb 1;14:14.
- Lusardi MM, Fritz S, Middleton A, Allison L, Wingood M, Phillips E, Criss M, Verma S, Osborne J, Chui KK. Determining Risk of Falls in Community Dwelling Older Adults: A Systematic Review and Meta-analysis Using Posttest Probability. J Geriatr Phys Ther. 2017 Jan/Mar;40(1):1-36.
- Gallo E, Stelmach M, Frigeri F, Ahn DH. Determining Whether a Dosage-Specific and Individualized Home Exercise Program With Consults Reduces Fall Risk and Falls in Community-Dwelling Older Adults With Difficulty Walking: A Randomized Control Trial. J Geriatr Phys Ther. 2018 Jul/Sep;41(3):161-172.
- Bohannon, R. W. Comfortable and maximum walking speed of adults aged 20-79 years: reference values and determinants." Age Ageing. 1997;26(1): 15-9.
- Montero-Odasso M, Schapira M, Soriano ER, et al. Gait velocity as a single predictor of adverse events in healthy seniors aged 75 years and older. J Gerontol A Biol Sci Med Sci. 2005; 60 (10): 1304-1309. Bohannon RW, Andrews AW. Normal walking speed: a descriptive meta-analysis. Physiotherapy. 2011;97: 182-189.
- Buatois, S., Perret-Guillaume, C., et al. (2010). "A simple clinical scale to stratify risk of recurrent falls in community-dwelling adults aged 65 years and older." Physical Therapy 90(4): 550-560.7
- O'Loughlin J et al. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. American journal of epidemiology, 1993, 137:342-54.

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