Geriatric Balance Assessment, Falls Prevention, and Community Wellness
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Course Description
• Explore the topic of falls among older adults:
  – risk factors and prevention of falls, patient specific outcome measures, and associated health care costs.
• Learn how to select and implement appropriate balance assessment tools based on patient function and practice setting, and identify falls risk stratification.
• Learn how to implement an evidence-based balance and mobility training programs for older adults at moderate to high risk for falls in community & residential care settings.

Learning Objectives
• Understand the impact that falls among older adults have on the health care system.
• Identify risk factors for falls and fall associated injuries.
• Identify evidence based falls assessment measures
• Identify the importance of a physical therapists role in community wellness and how to implement balance and falls training in your local community
• **FALL** is an unexpected event in which the person comes to rest on the ground, floor or lower level

• falls usually are the result of interactions between multiple intrinsic and extrinsic risk factors.

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**Falls statistics**

• More than 1/3 of people over the age of 65 years experience one or more falls each year.¹
  – ½ of fallers are recurrent fallers.²
• Individuals who have fallen have a 3x increased risk of falling again.³
• More than ½ of people living in institutions fall each year.³
• Approximately 1 in 10 falls results in a serious injury, such as hip fracture, other fracture, subdural hematoma, other serious soft tissue injury, or head injury.⁴,⁵

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**Falls statistics**

• 20-30% of fallers whom sustain a hip fracture die within 1 year of fracture.⁶
• Falls account for approximately 10 percent of visits to the ED among elderly persons.⁷
• Forty percent of hospital admissions among people over the age of 65 years are reported to be the result of fall-related injuries.⁸
Falls statistics

• Falls in the elderly cost the US health system $28.2 bn in 2010.\(^9\)
• The cost of a fall related injury was more than 1.85x more than implementing a falls prevention program.\(^10\)
• 40-73% of fallers report a fear of falling.\(^11\)
  – Can lead to further decline in mobility and balance secondary to activity limitation.

Complications from Falls

• Musculoskeletal injuries
  – Hip/wrist fracture
  – Muscle strain
• TBI
• Loss of independence
• Pneumonia
• Pressure sores

<table>
<thead>
<tr>
<th>Table 1 Causes of falls in older persons: summary of 12 large studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
</tr>
<tr>
<td>Accident and environment related</td>
</tr>
<tr>
<td>Gait and balance disorders or weakness</td>
</tr>
<tr>
<td>Dizziness and vertigo</td>
</tr>
<tr>
<td>Drop attack</td>
</tr>
<tr>
<td>Confusion</td>
</tr>
<tr>
<td>Postural hypotension</td>
</tr>
<tr>
<td>Visual disorder</td>
</tr>
<tr>
<td>Syncope</td>
</tr>
<tr>
<td>Other specified causes(^9)</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
</tbody>
</table>

Summary of 12 studies\(^10\); 3628 reported falls.
\(^9\) Mean percent calculated from the 3628 reported falls.
\(^9\) Ranges indicate the percentage reported in each of the 12 studies.
\(^9\) This category includes arthritis, acute illness, drugs, alcohol, pain, epilepsy, and falling from bed.

Rubenstein, 2006.
Risk Factors

• Risk factors are multi-factorial
  – Interaction of the biological, behavioral and environmental risk factors
• Impairment in balance, gait, or muscle strength, previous falls, among many others; and the use of four or more prescription medications
  – The likelihood of falling increases exponentially as the # of risk factors increases
• Risk factor identification is a promising first step in developing effective fall-prevention programs

Risk Factors for falls identified in 16 studies examining multiple risk factors: results of univariate analysis

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Significance</th>
<th>Mean RR-OR</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower extremity weakness</td>
<td>10/11</td>
<td>4.4</td>
<td>1.5-10.3</td>
</tr>
<tr>
<td>History of falls</td>
<td>12/13</td>
<td>3.0</td>
<td>1.7-7.0</td>
</tr>
<tr>
<td>Gait deficit</td>
<td>10/12</td>
<td>2.9</td>
<td>1.3-5.6</td>
</tr>
<tr>
<td>Balance deficit</td>
<td>8/11</td>
<td>2.8</td>
<td>1.6-5.4</td>
</tr>
<tr>
<td>Use assistive device</td>
<td>8/8</td>
<td>2.6</td>
<td>1.2-4.6</td>
</tr>
<tr>
<td>Visual deficit</td>
<td>6/12</td>
<td>2.5</td>
<td>1.0-3.5</td>
</tr>
<tr>
<td>Arthritis</td>
<td>3/7</td>
<td>2.4</td>
<td>1.9-2.9</td>
</tr>
<tr>
<td>Impaired ADL</td>
<td>8/9</td>
<td>2.3</td>
<td>1.5-3.1</td>
</tr>
<tr>
<td>Depression</td>
<td>3/6</td>
<td>2.2</td>
<td>1.7-2.5</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td>4/11</td>
<td>1.8</td>
<td>1.0-2.3</td>
</tr>
<tr>
<td>Age &gt;80 y</td>
<td>5/8</td>
<td>1.7</td>
<td>1.0-2.5</td>
</tr>
</tbody>
</table>

• Number of studies with significant odds ratio or relative risk ratio in univariate analysis
• Mean number of studies that included each factor.
• Relative risk ratio (RR) calculated for prospective studies. Odds ratio (OR) calculated for retrospective studies.


Age associated changes in sensory systems

• Somatosensory
  – Loss of plantar sensation due to diabetes or peripheral neuropathy
• Vision
  – Decreased visual acuity, depth perception and peripheral vision
• Vestibular:
  – Loss of the receptor hair cells
Falls Assessment

- It is important to assess a person's balance and mobility in order to:
  - Identify specific nature of balance and mobility problems
  - Establish an appropriate starting point
  - Individualize and progress exercises based on client needs

Falls Assessments

- Berg Balance Assessment
  - Measures multiple dimensions of balance in a medium/low functioning population
  - Commonly used for community programs
  - Static and dynamic balance
  - 16 items, 4pts each
  - <47 = falls risk
  - Ceiling effect for higher functioning individuals

Berg, 1992

Falls Assessments

- Fullerton Advanced Balance Scale (FAB)
  - Measures multiple dimensions of balance in a high functioning population
  - Static and dynamic balance; somato-sensory, vision, and vestibular functions
  - Commonly used for community programs
  - 10 items, 4pts each
  - <25 = increased risk for falls

Hernandez, 2008
Falls Assessments

- BESTest and mini-BESTest
  - Differentiates balance into 6 underlying systems: Biomechanical, Stability Limits, Postural Responses, Anticipatory Postural Adjustments, Sensory Orientation, and Dynamic Balance during Gait and Cognitive Effects
  - BESTest=36 items; Mini-BESTest=14 items; 2 pts each
  - Norms have not yet been established

Horak, 2009

Falls Assessments

- Mini BESTest Items:
  - Sit<>stand, rise to toes, SLS, compensatory step correction in forward, back, and lateral directions, narrow stance with EO on firm, eyes closed on foam, incline eyes closed, change in gait speed, walk with horizontal head turns, pivot turns, step over obstacles, TUG with dual task.

Falls Assessments

- Tinetti POMA
  - Balance and gait assessment for older/frail
  - Max score of 12 for gait component, 16 for balance (28 total)
  - <19=high falls risk; <24=medium falls risk
  - Ceiling effect
  - Greatly effected by AD use
  - Limited dimensions of balance assessed

Tinetti, 1986
Falls Assessments

• Dynamic Gait Index (DGI)
  – Gait and balance assessment with vestibular component
  – 8 items, 3pts each
  – <20/24 = increased falls risk
  – <12/24 = high falls risk

  Shumway-Cook 1997

Falls Assessments

• Functional Gait Assessment (FGA)
  – Assesses postural stability during various walking tasks; 10 items
  – Altered DGI to limit ceiling effect
    • 7 items from the DGI
    • 3 additional/more difficult items
      – gait with narrow base of support, ambulating backwards, and gait with eyes closed
  – <22/30 predicts falls in community-dwelling older adults

  Faller 19

Falls Assessments

• Modified Clinical Test of Sensory Interaction in Balance (M-CTSIB):
  – Evaluates if sensory input (vision, vestibular, somato-sensory) is normal or abnormal
  – 4 conditions
    • firm surface with EO (somato and vision)
    • firm surface with EC (somato)
    • Foam surface with EO (vision)
    • Foam surface EC (vestibular)
  – Max score of 120" (30 each condition)
Falls Assessments

• 5x sit<>stand
  – Assesses LE strength and power
  – Leg strength is predictive of fall risk
  – >15 seconds =falls risk
  • No hands for push off
  • Alternative is 30” chair stand test

Falls Assessments

• Timed up and Go (TUG)
  – Great initial screening tool; assesses general functional mobility
  – Preferred speed, can use an AD
  – >14 seconds indicates higher fall risk
• 8 Foot Up and Go
  – performed at max speed, and no AD used
  – >8.5 seconds indicates higher fall risk

Falls Assessments

• Functional reach test
  – Assesses dynamic weight shifting
  – <10”=2x more likely to fall
  – <6”=4x more likely to fall
• Lateral Reach test
  – >8” is normal
• Seated functional reach
  – Norm for males 60-79 yo=14.4”
  – Norm for females 60-79 yr=13.2”
Falls Assessments

• Static balance assessments
  – One leg balance test
    • <5" = increased risk for injurious fall
  – Romberg
    • Assesses equilibrium/propioreception and static balance
    • 1. Feet together with eyes open; 2. Feet together with eyes closed, 1 minute each
  – Tandem Romberg
    • <10" predicts increased falls risk

Falls Assessments

• 4 square step test
  – Timed test assessing multi-directional stepping
  – >15" identifies multiple fallers

Falls Assessments

• Alternate Step test
  – Assesses dynamic balance and COG control
  – 130% increased falls risk if 8 steps>10"
• 360 degree Turn
  – Assesses dynamic balance/COG control, vestibular?
  – >3.8 seconds=falls risk
Other Assessments

- Elderly Mobility Scale
  - Assess mobility in frail adults. Good for Acute hosp
  - locomotion, balance and key position changes
  - 7 items, max of 20pts
  - Ex: supine<>sit, sit<>stand, gait, functional reach
  - <10=dependent in mobility and needs help with basic ADL's; home care or LTC discharge likely
  - 10-13: will likely require some help
  - >14=independent with basic ADL's, safer to return home

Other Assessments

- Walkie Talkie Test
  - open ended question while walking
  - Assess ability to effectively dual task
  - + test=client stops walking to answer

Other Assessments

- Gait speed
  - One of the best predictors of functional decline and mortality
  - >0.8m/s=community mobility, >1.2m/s=normal
  - <0.55m/s= risk for recurrent falls
Patient Perceived Function

- **Activities Specific Balance Confidence Scale (ABC)**
  - Level of self confidence on 16 items
  - Client self rates each item from 0-100%
  - Ex: walk around house, sweep the floor, walk in a crowd
  - <67%= increased falls risk
  - <50%=low functional level; likely homebound
  - >80%=high functional level
  - ABC short form
    - 6 items, well correlated with ABC

Patient Perceived Function

- **Falls efficacy scale**
  - Self assessment of 10 daily activities
  - 1-10 scale with 1 being most confident
  - Suited for frail individuals, home care, LTC
  - >70 indicates a fear of falling

Patient Perceived Function

- **Composite Physical Function (CPF)**
  - Older adult’s perceived level of physical function
  - 12 or lower=low functioning
  - Greater than 12=high functioning
What to choose?

- **Patient functional level**
  - Subjective examination, comorbidities, functional status, living situation/independence etc
- **Practice setting**
  - Acute, TCU/SNF, Home health, Outpatient, Community based
- **Feasibility**
  - Space, equipment, training, time

What to choose?

- **Things to consider**
  - Patient functional level
  - Practice setting
  - Multi-dimensional
  - Evidence based
  - Psychometric properties
    - Valid and reliable, ceiling effect, sensitive to change

What to choose?

- **Practice setting**
  - Acute Care
    - Very limited space, medically unstable?, tubes/lines, limited time for retest
      - Romberg, Elderly mobility scale, 5x sit-to-stand, Tinetti, TUG, one leg balance, functional reach, MCTSIB
What to choose?

- **Practice setting**
  - Transitional Care/SNF
    - Often very weak, debilitated
      - Berg, Tinetti, DGI?, TUG, 5x sit->stand, Romberg, MCTSIB, functional reach, Walkie-talkie, Elderly mobility scale

What to choose?

- **Practice setting**
  - Home health
    - Limited space, often homebound, limited equipment
      - Berg, Tinetti, TUG, 5x sit->stand, MCTSIB, Functional reach, one leg balance, Romberg, 4 square step test, alternate step test, 360 turn, walkie-talkie

What to choose?

- **Practice setting**
  - Outpatient
    - Ample space, often higher functioning, improved equipment, more controlled environment
      - FAB/Berg, BESTest, FGA/DGI, MCTSIB, 4 square step test, 8’ walk, gait speed, walkie-talkie
What to choose?

• Practice setting
  – Community
    • Highest function; often need to screen/assess many individuals in a short period of time, wide range of abilities
    • FAB/Berg, 8’ up and go /TUG, 5x sit<>stand, CPF

What to choose?

• Patient living situation
  – Independent at home
    • FAB/Berg, BESTest, FGA, M-CTSIB, 8’ walk, 4 square step test
  – Senior apartment
    • Berg/FAB, DGI, 8’walk/TUG, 5x sit<>stand, M-CTSIB, 4 square step test, alternate step test
  – ALF
    • Berg, Tinetti, TUG/8’ walk, functional reach, 5x sit<>stand, alternate step test, 360 degree turn,
  – LTC
    • Tinetti, Romberg, 5x sit<>stand, TUG, functional reach, elderly mobility scale

Continuum

• Highest→lowest functioning

  • BESTest, FGA, FAB, DGI, Berg, Tinetti, single leg balance, 8’ walk test, 4 square step test, alternate step test, M-CTSIB, 360 degree turn, TUG, Functional reach, Romberg, 5x sit<>stand, Elderly mobility scale
  – Underlined=multidimensional

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Intervention

- Multi-favorial assessment, followed by interventions targeting the identified risk factors\(^{30}\)
  - reduces falling by 25 to 39\%\(^{31,32,33}\)
- Home safety assessment
  - Up to 20\% reduction in falls risk \(^{13}\)
  - I.e; removal of rugs, footwear, nonslip bathmats, night light, stair rails

Intervention

- Pt specific balance and gait training
  - Focus on deficient areas from balance assessment
- Postural assessment and training
- Center of Gravity training
- Strength and ROM
- Home safety assessment
- Footwear, medication, eyewear, medical education

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Estimated Risk Reduction</th>
<th>No. of Trials with Positive Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health care-based strategy</td>
<td>(14-27)</td>
<td>2 of 3</td>
</tr>
<tr>
<td>Balance and gait training and strengthening exercise</td>
<td>(9-13)</td>
<td>1 of 3</td>
</tr>
<tr>
<td>Reduction in home hazards after hospitalization</td>
<td>(30-75)</td>
<td>3 of 3</td>
</tr>
<tr>
<td>Discontinuation of psychotropic medication</td>
<td>(25-39)</td>
<td>3 of 3</td>
</tr>
<tr>
<td>Multifactorial risk assessment with targeted management</td>
<td>(20-49)</td>
<td>2 of 3</td>
</tr>
<tr>
<td>Community-based strategy</td>
<td>Specific balance or strength exercise programs</td>
<td>(29-49)</td>
</tr>
</tbody>
</table>

Tinetti, 2003
Group based exercise

- Effective for falls prevention, quality of life enhancement and balance improvement\(^{34}\)
- Socialization and self efficacy contribute to higher adherence rate

Group based exercise

- 2x/wk for 6 months for optimal results\(^{35}\)
- Provide moderate/high challenge for\(^{35}\)
- Administered by a PT=best outcomes\(^{36}\)
- Must provide a HEP\(^{35}\)

Fall proof

- A comprehensive, evidence based, and multisensory training program for community dwelling older adults
- Incorporates balance assessment and individualized dosing
- Multisensory, COG, and postural strategy training; gait pattern enhancement and variation training; strength, flexibility, and endurance training
- Group based

Rose, 2003
Case Studies

- Given the patient functional level and practice setting, which balance assessments are the most appropriate?

Case Study #1

- Polly Poorbalance
  - 74 yo female living alone in a senior apartment referred to home health PT for balance and gait training
  - Amb with a SEC
  - Falls 2-3x/month
  - Often falls in dim lighting, when trying to carry objects, or when turning in a circle
  - CFP=11/24

Case Study #2

- Tyler Tripsalot
  - 66yo male living at home, referred to OP PT
  - Falls 2x/6 months “on accident”
    - Most often tripping on rugs or other household hazards.
  - No AD
  - CFP=20/24
Case Study #3

- Rachel Rehospitalized
  - 72 yo female, lives in an ALF
  - Hospitalized 3x in past 6 months for falls. She falls 3x/month
  - Often loses balance while reaching into cupboards and she stumbles when leaving walker aside
  - Ambulates with a FWW
  - CFP=8/24

Professional responsibility

- “Consumers will have direct access to physical therapists in all environments for patient/client management, prevention, and wellness services.”
- Increases community awareness about PT
  - May Trigger referrals?
- With and increased pop of older adults, the treatment and prevention of falls has emerged as a central topic for PT
  - PT’s are the experts in exercise and movement

How to initiate a Community Wellness Program?

- Contact your local community centers/health clubs
- Advertise at your clinic
- Recommend class to discharged patients
- Attend health fairs/community events
- Contact local senior living facilities
Common battery of tests for community program

- FAB or Berg (CFP >12/24=FAB, <12=Berg)
- 8' walk or TUG
- 5x sit<>stand
- ABC or FES

Take home message

- Select the most appropriate battery of tests based on patient risk factors, patient functional level, and practice setting
  - Multi-dimensional assessments are superior
- Individualize treatment based on examination
- Reassess frequently to determine progress

Questions?