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An Evidence-Based Approach to Fall Risk Assessment

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Learner Outcomes

- Operationally define a fall
- Describe the evidence-based practice process for fall risk assessment with elderly clients
- Identify intrinsic and extrinsic risk factors for falls and 5 evidence-based assessments to quantify these

Falls Defined

- An untoward event which results in the patient coming to rest unintentionally on the ground or other lower surface

(Morris & Isaacs)

Falls Defined

- "A fall is a sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, or the ground, other than as a consequence of sudden onset of paralysis, epileptic seizure, or overwhelming external force."

(Tinetti)

Falls Defined

- "Unintentional change in position coming to rest on the ground, floor or onto the next lower surface (e.g., onto a bed, chair or bedside mat). The fall may be witnessed, reported by the resident or an observer or identified when a resident is found on the floor or ground…Falls are not a result of an overwhelming external force (e.g., a resident pushes another resident."

(CMS RAI Version 3.0, pg J-27)

Falls Defined

- "An intercepted fall occurs when the resident would have fallen if he or she had not caught him/herself or had not been intercepted by another person – this is still considered a fall."

(CMS RAI Version 3.0, pg J-27)

Scope of the Problem

- One in three adults aged 65 and older falls each year
- Of those who fall, 20% to 30% suffer moderate to severe injuries
- Older adults are hospitalized for fall-related injuries five times more often than other causes
- ER addresses 2.5 million nonfatal fall injuries annually

Centers for Disease Control, 2013 (www.cdc.gov)

Scope of the Problem

- Fall-related injuries caused > 2 million ED visits costing $7 billion (AHRQ, 2009)
- Of the 1.6 million residents in U.S. nursing facilities, approximately half fall annually, and of those, about 65,000 suffer a hip fracture (AHRQ, 2010)

Scope of the Problem

- Typical nursing home reports 100 to 200 falls
- Between ½ and ¾ of SNF residents fall each year
- Average falls per year = 2.6
- 1,800 SNF residents die from falls each year

Centers for Disease Control, 2013 (www.cdc.gov)

Falls Classification

- Accidental
  - Patient falls unintentionally
- Unanticipated physiologic
  - Cause of fall not reflected in patient's risk factors for falls
- Anticipated physiologic (78%)
  - Patient's score on risk assessment tool indicated he/she is at risk for falls

Causes of Falls

- Falls are not part of normal aging process
- Due to interaction of underlying physical dysfunction, cognitive deficit overlay, medications and environmental hazards
- The task of IDT to seek out, evaluate and thoroughly consider effects of many factors which contribute to falls

Common Reasons for Falls

- Muscle weakness, gait/walking problems (24% of falls)
- Environment hazards (16% - 27% of falls)
- Acute and chronic immobility
- Medications
- Other
  - Poor foot care/shoes
  - Walking aids
  - Transfer status

Age-Related Changes in Body Systems

- Aging accompanied by "normal" decline in nearly all body systems
- Often considered "normal" until decline causes clinically significant disability

Medications and Side Effects

- Sedatives
  - Muscle in-coordination, lethargy, vertigo, confusion, depression
- Anti-anxiety medications
  - Decreased alertness, drowsiness, confusion, slowed reaction time, unsteady gait
- Psychotropic medications
  - Postural hypotension, confusion, drowsiness, tremor, gait disturbance, blurred vision, aggressive behavior

Medications and Side Effects

- Anti-depressants
  - Fatigue, tremor, confusion, ataxia, insomnia, anxiety, orthostatic hypotension
- Diuretics
  - Electrolyte imbalance, fatigue, confusion, weakness, orthostatic hypotension
- Anti-hypertensive agents
  - Weakness, orthostatic hypotension, dizziness
- Aspirin
  - Loss of sensation, amnesia, muscle relaxation, decreased reflexes

Balance Control

- Cognitive Processes
  - Safety, judgment, visual-perceptual disorders, dementia
- Musculoskeletal System
  - Strength, ROM, balance reactions, posture
- Sensorimotor System
  - Visual, vestibular, somatosensory

Volitional Postural Control

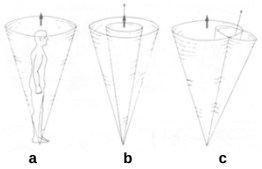
- Volitional postural control involves conscious shifting of weight from the COG to achieve an objective
  - "Sway"
- CNS establishes "limits of stability" so we can move safely in our environment
  - Mechanical limits of stability
  - Internal representation of stability

Age-Related Postural Changes

- Increased postural sway
- Slower distal muscle, postural and volitional muscle responses
- Decreased anticipatory responses

Limits of Stability

- Sway envelope 12° ant-post and 16° laterally
- If COG alignment is forward, backward , to either side, small sway envelope is tolerated
- Sudden falls occur because small oscillations are sufficient to extend the COG beyond the limits of stability (c)



Movement Strategies

- Four primary movement strategies:
  - Ankle: used for small perturbations
  - Hip: used in response to larger LOB
  - Suspension: lowers COG
  - Stepping: LOB exceeds limits of stability

Prediction Tools

- Ease and speed of completion
- Small number of items
- Transparent
- Simple
- Evidence based scoring
- Good inter-rater reliability
- Valid

Prediction Tools

- Must 'value add'
  - Be better than routine clinical judgement of staff
  - Identifying high risk has to lead to action to modify that risk or it is meaningless

Evidence-Based Assessment Guidelines

- There is evidence that falls can be prevented by screening to detect risk factors.
- Screening should include:
  - History and context of falls over the previous 12 months
  - At least one question about the patient's perception of difficulty with balance or walking

Avin, et al., 2015

Evidence-Based Assessment Guidelines

- For each patient who reports a fall, therapist should observe for gait or balance impairment
- Positive findings when
  - Patient reports multiple falls
  - Patient reports one fall, and a balance or gait impairment is observed

Evidence-Based Assessment Guidelines

- Individualized therapy multifactorial assessment of falls and fall risk
  - Medication review
  - Medical history
  - Body functions and structure
  - Activity and participation
  - Environmental factors
  - Personal factors

AGS Guidelines for Fall Management

- Older individuals asked about falls in last year
- Asked about frequency and circumstances
- Asked about walking or balance difficulties
- Multifactorial fall risk assessment
- Single fall evaluated for gait and balance

AGS Guidelines for Fall Management

- Use one of the available evaluations
- If cannot complete a standardized test, use a multifactorial fall risk assessment
- Unsteadiness indicates a multifactorial fall risk assessment
- A single fall w/o/ difficulty or unsteadiness does not indicate a fall risk assessment
- Multifactorial fall risk assessment performed by a clinician with appropriate skills and training

Fall Risk Assessment Elements

- Falls History
  - Any falls in past year?
  - Worries about falling or feels unsteady?
- Medical Conditions
  - Problems with heart rate and/or rhythm
  - Cognitive impairment
  - Incontinence
  - Depression
  - Foot problems

Fall Risk Assessment Elements

- Medications
  - Psychoactive medications, anticholinergic or sedating side effects
- Gait, Strength & Balance
  - Timed Up and Go (TUG) Test
  - 30-Second Chair Stand Test
  - 4-Stage Balance Test Full tandem stance

Fall Risk Assessment Elements

- Vision
  - Acuity <20/40 OR no eye exam in >1 year
- Postural Hypotension
  - A decrease in systolic BP ≥20 mm Hg or a diastolic bp of ≥10 mm Hg

Risk Factors for Falls

- History of falls within last 6 months is the single most predictive factor of a future fall
- Likelihood to fall increases with age
  - Age 65+, fall risk 30%
  - Age 85+, fall risk 42 - 49%
  - Age 100+, fall risk 83%

Timed Up and Go Test

- Standard chair with arms, wearing customary, and using usual walking aid
- No physical assistance is given
- Starts with back against the chair, arms resting on the arm rests, walking aid at hand
- On the word "GO," get up and walk 3 meters away, turn, return to the chair, and sit down
- Falls prediction, 87% sensitivity & specificity

Timed Up and Go Test Age-Adjusted Norms

Age	Range
60-69	7.1-9.0 seconds
70-79	8.2-10.2 seconds
80-99	10.0-12.7 seconds

Performance exceeding upper limit of confidence intervals are considered to have high risk for falls
(Bohannon, 2006)

Cognitive TUG

Elderly subjects who completed the cognitive TUG in 15" were classified as fallers with an overall correct prediction rate of 87%

30-Second Chair Stand Test

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.

30-Second Chair Stand Test 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

4-Stage Balance Test

- Stand with your feet side by side
- Place the instep of one foot so it is touching the big toe of the other foot
- Place one foot in front of the other, heel touching toe
- Stand on one foot

An older adult who cannot hold the tandem stance for at least 10 seconds is at increased risk of falling

Orthostatic Blood Pressure

- Have the patient lie down for 5 minutes
- Measure blood pressure and pulse rate
- Have the patient stand
- Repeat blood pressure and pulse rate measurements after standing 1 and 3 minutes

A drop in bp of ≥20 mm Hg, or in diastolic bp of ≥10 mm Hg, or experiencing lightheadedness or dizziness is considered abnormal

(Centers for Disease Control, 2015)

Intrinsic Risk Factors for Falls

- Advancing age, especially if older than 75
- History of a recent fall
- Specific comorbidities (e.g., dementia, hip fracture, type 2 DM, Parkinson's, arthritis, and depression)
- Functional disability
- Cognitive impairment
- Acute and/or chronic illness

Intrinsic Risk Factors for Falls

- Gait, balance, or visual impairment
- High risk medications (Chang et al., 2004)
- Urge UI (Brown et al., 2000)
- Physical restraint use (Capezuti et al., 2002)
- Bare feet or inappropriate shoe wear
- Anticoagulant use and osteoporosis (Resnick, 2003)
- Dehydration

Peripheral Neuropathy

- Peripheral neuropathy irrespective of cause interferes with postural control and fall incidence
- Affects AP sway, ML sway, sway velocity, and sway area in quiet standing

(De Mettelinge et al., 2013)

Extrinsic Risk Factors for Falls

- Floor surfaces
- Lighting
- Furniture in good repair
- Grab rails/bars
- Assistive devices improper or inadequate
- Bed rails
- Tripping hazards
- Bathtubs and toilets
- Design of furnishings
- Condition of ground surfaces
- Type and condition of footwear

Post-Fall Assessment

- Following a patient fall to identify possible causes
- Because of delayed complication of falls, observe all patients for about 48 hours after an observed or suspected fall (ECRI, 2006; GrayMiceli et al., 2006; AGS/BGS, 2011)

Screening Tools for Fall Risk

http://www.rehabmeasures.org

Activities-Specific Balance Confidence Scale

- Self-administered or via interview
- For each activity, a level of confidence to (0-100%) complete the activity w/o LOB is indicated
- 11-point scale
- Total ratings and divide by 16 for the ABC score

ABC Scale

- 80% = high level of physical functioning
- 50-80% = moderate level of physical functioning
- < 50% = low level of physical functioning (Myers, 1998)
- < 67% = older adults at risk for falling; predictive of future fall (LaJoie, 2004)

Five Time Sit to Stand

- Sit in standard height chair, back against chair, arms crossed on chest for entire test, feet comfortable per patient
- Stand up and sit down 5 times as quickly and safely as you can, when I say "GO"
- Stand up completely between repetitions.

Five Time Sit to Stand

- Age-Related Norms
- 60-69 year olds -- 11.4 seconds
- 70-79 year olds -- 12.6 seconds
- 80-89 year olds -- 14.8 seconds

(Whitney et al., 2005)

Stroke Assessment of Fall Risk

- Scored using clinical documentation from the first 72 hours of inpatient rehab admission
- Four impairments
  - Impulsivity, hemi-neglect, static, dynamic sitting balance
- Three functional limitations
  - Transfers, problem solving, and memory
- Uses 7-point scale for each measure
  - 0 = low risk of falls
  - 49 = highest risk of falls

Single Leg Stance (SLS)

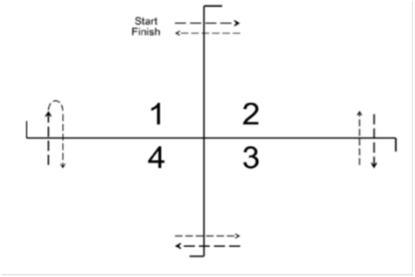
- Stand erect on firm surface, arms folded across chest, head straight, shoes off
- Raise one leg and keep the leg raised as long as possible without touching the other leg, uncrossing arms, or using balance support
- Age-related norms
  - 60-69: 27.0 sec
  - 70-79: 17.2 sec
  - 80-99: 8.5 sec

(Bohannon, 2006)

Four Step Square Test

- The patient is instructed to stand in square
- Step as fast as possible into each square
- Requires the patient to step forward, backward, and sideway to the right and left
- 2 trials are performed and the best is selected
- Timing starts when the right foot contacts the floor in the square (Dite & Temple, 2002)

Four Step Square Test



Four Step Square Test Normative Values

- Older Adults/ Geriatric
  - > 15 second = at risk for multiple falls (Dite & Temple, 2002)
- Vestibular
  - > 12s = at risks for falls (Whitney at al., 2007)

Screening Assessment for Falls Evaluation (SAFE)

- Risk Screening
- Community dwelling with history of falls
- Includes
  - Intrinsic risk factors
  - Extrinsic risk factors, and
  - Activities of daily living tasks and support issues

Falls Risk Screening and Action Plan Tool

- Risk Screening
- Community dwelling clients
- Includes:
  - Action plan
  - Guidelines based on risk factors

Falls and Injury Risk Profile for Unsteady Older Adults

- Falls and falls injury risk assessment
- Rates nine items on a 0-1 or 0-2 scale
- Grades overall risk
  - Low (0-3)
  - Medium (4-6)
  - High (7+)
- Includes a question about osteoporosis
- Includes recommended interventions for each risk factor

Falls Risk for Older People (FROP)

- Assessment tool and guidelines
- Good predictability for falls
- Measures 13 risk factors on a graded 0-3 scale
- Guidelines suggest management options if a specific risk factor is identified

Gait and Balance Assessments

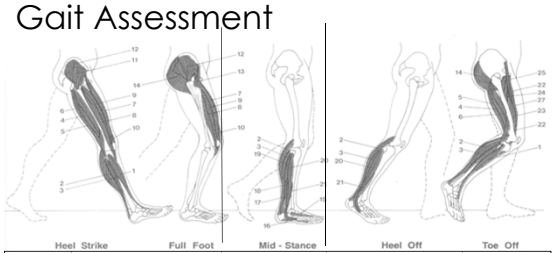
http://www.rehabmeasures.org

Gait Assessment

TURNING 180^{O} WHILE WALKING	NON-FALLERS	FALLERS
Turn Time	$\leq$ 2 sec	> 4 sec
Turn Steps	1-3 steps	$\geq$ 4 steps
Turn Performance	Steady, fluent, non-hesitant	Unsteady, NOT fluent, hesitant
Timed "Up and Go" Test	< 11 sec	> 11 sec

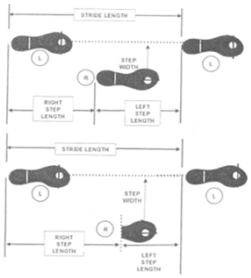
Dite et al, 2002; Thigpen et al, 2000

Gait Assessment



% OF GAIT CYCLE	DOUBLE LEG STANCE 10%	SINGLE LEG STANCE 40%	DOUBLE LEG STANCE 10%	NORMAL
	20%	20%	20%	FALLER

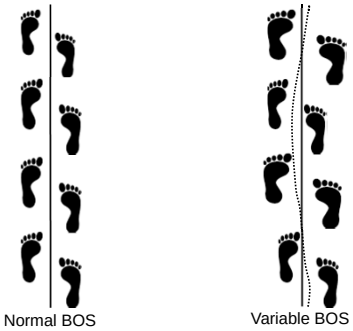
Gait Assessment



Normal Aging Gait Pattern
- Reduced stride length
- Equal step length
- Decreased gait speed

Faller's Gait Pattern
- Reduced stride length
- Increased step width (BOS)
- Unequal step length
- Decreased gait speed

Gait Assessment



Normal BOS

Variable BOS

Characteristics of Fallers

- Usually stop walking when talking
- Fear of falling results in shorter single leg stance and decreased stride length reducing forward momentum and allowing more time for balance recovery
- Increased step width
- Stride to stride variability

Balance Evaluation – mCTSIB

Modified Clinical Test of Sensory Integration in Balance – Helps to assess relative influence of vestibular, visual and somatosensory inputs on postural control

- Quantitatively tests static balance control under 4 conditions (time each for 30 sec)
- Identifies functional strengths and weaknesses and patient's tendencies toward usage of a particular system of balance

Berg Balance Scale

- Static and dynamic activities
- Scores range from 0 to 4
- Maximum score of 56

Berg Balance Scale

- 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

Berg Balance Scale

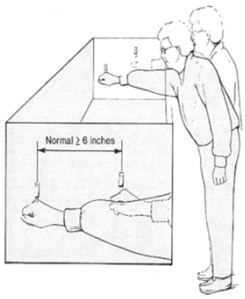
- 41-56 Low Fall Risk
- 21-40 Medium Fall Risk
- 0-20 High Fall Risk

≤ 36 indicates 100% probability of a fall in the next 6 months

Functional Reach

- Stand close to wall
- Arm at 90 degrees shoulder flexion with a closed fist
  - Starting position at 3rd MC head
- Reach as far as you can forward without taking a step
- Complete 3 trials with the last 2 averaged for a score

Functional Reach



- A functional reach > 10 inches is normal

Less than 6 inches, the person is four times more likely to fall

Functional Reach Age-Related Norms

Age	Men	Women
20-40 years	16.7" +/- 1.9"	14.6" +/- 2.2"
41-69 years	14.9" +/- 2.2"	13.8" +/- 2.2"
70-87 years	13.2" +/- 1.6"	13.2" +/- 1.6"

(Duncan et al., 1990)

Functional Reach

- <6 inches indicates a high risk of falls
- 6-9.9 inches indicates moderate risk
- >10 inches indicate a low risk for falls

(Duncan et al., 1990)

Dynamic Gait Index (DGI)

- Marked distance of 20 feet
- With or without an assistive device
- 4-point scale
  - 3=no gait dysfunction
  - 2=minimal impairment
  - 1=moderate impairment
  - 0=severe impairment
- Highest score = 24 (20 for patients using an assistive device)

Dynamic Gait Index (DGI)

- Change in gait speed
- Gait with horizontal head turns
- Gait with vertical head turns
- Gait level surface
- Gait and pivot turn
- Step over obstacle
- Step around obstacles
- Steps

Scores <u>≤</u>19 indicate a risk of falls

Tinetti POMA

- Balance and gait impairment
- 6 items – 9 are balance and 7 are gait
- 3-point scale; higher score = greater independence

- Total balance score = 16
- Total gait score = 12
- Total test score = 28

Tinetti POMA

- 25-28 = low fall risk
- 19-24 = medium fall risk
- < 19 = high fall risk

Fullerton Advanced Balance Scale

- Static and dynamic balance active older adults
- 10 performance-based activities
- 5-point ordinal scale
- Score of 0-40
  - Higher scores are better

Fullerton Advanced Balance Scale

- Score of 25/40 produces highest sensitivity for predicting fall risk
  - In 7 out of 10 cases an individual who scores 25 or lower is at a high risk for falls

(Hernandez and Rose, 2008)

BESTest: Balance Evaluation Systems Test

- Biomechanical Constraints
- Stability Limits/Verticality
- Transitions/Anticipatory
- Reactive
- Sensory Orientation
- Stability in Gait

BESTest: Balance Evaluation Systems Test

- 69% cut off score differentiated fallers from non-fallers (Duncan & Leddy, 2013)
- Detects retrospective fallers and predicting 6 month prospective fallers
  - Does not predict 12 month prospective falls

(Padgett & Jacobs, 2012)

Brunel Balance Assessment

- Assesses functional balance
- 12 point hierarchical ordinal scale
- Score ranges from 0 - 12
- Individual can pass or fail each item
- 3 chances to pass each item
  - If unable to pass, test is complete

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Questions?

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