From Fit-To-Frail: Applying the Principles of Fallproof Across the Continuum of Function

Presenter: Debbie Rose, PhD
Center for Successful Aging, California State University, Fullerton
International Council on Active Aging Pre-Conference Workshop, 2014
Today’s Schedule:
• Attendees complete a quiz!
• Screening and Assessing Balance Across the Functional Continuum
• Tailoring and Progressing the Exercise Program
• Designing Programs Across the Functional Continuum: Identifying Priorities
• Changing attitudes, and risk-taking behaviors
Multi System Approach to Evaluation

- Knowing who is at risk for falls is only the first step.
- Balance is complex
- Can better identify underlying postural control systems that may be contributing to balance disorder
- Results can be used to better tailor rehabilitation to identified impairments and functional limitations
Biomechanical Constraints

Postural Responses

Sensory Orientation

Stability Limits/Verticallity

Anticipatory Postural Adjustments

Stability in Gait

(Horak, 1997; 2010)
Assessing Balance Across the Functional Continuum

Clients at High Risk?
- ✓ Self-Assessment
- ✓ Short Physical Performance Battery
- ✓ Tinetti POMA
- ✓ Qualitative Evaluation

Clients at Moderate Risk?
- ✓ Self-Assessment
- ✓ Short BBS
- ✓ BESTest
- ✓ Mini-BESTest
- ✓ Fullerton Advanced Balance Scale
Assessing Balance Across the Functional Continuum

Clients at Low Risk?
- Self-Assessment
- Fullerton Advanced Balance Scale
- BESTest
- Mini-BESTest
## Short Physical Performance Battery (SPPB)

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(Guralnik et al., 1994)
Performance Oriented Mobility Assessment (POMA)

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Berg Balance Scale (BBS)

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Hohtari-Kivimaki et al. (2012)
## System Sub-Scales

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Horak, Wrisley, & Frank (2009)
## Mini-BESTest

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Franchignoni et al. (2010)
### Fullerton Advanced Balance Scale

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Rose, Lucchese, & Wiersma (2006)
Core Principles of Fallproof!

- Balance is multidimensional
- Multiple systems contribute to balance and mobility
- Assessment drives programming
- Challenge must be systematically introduced and progressed on an individual basis
- The individual’s capabilities must be carefully matched to the demands of the task and the environment
Biomechanical Constraints

Sensory Orientation

Anticipatory Postural Adjustments

Postural Responses

Stability Limits/Verticality

Stability in Gait

(Horak, 1997; 2010)
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<th><strong>System</strong></th>
<th><strong>Program Component</strong></th>
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<td>Strength/Flexibility</td>
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<td>Stability Limits/Verticality</td>
<td>Center of Gravity (COG) Control Training</td>
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<td>Sensory Orientation</td>
<td>Multisensory Training</td>
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<td>Center of Gravity Control (COG) Training</td>
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<td>Postural Responses</td>
<td>Postural Strategy Training</td>
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<tr>
<td>Stability in Gait</td>
<td>Gait Pattern Enhancement &amp; Variation</td>
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</table>
Strength
Sensory Loss
Medical Conditions

Flexibility

Individual

Cognition

Task

Environment

Surface Type
Visual Flow

Seated
Standing
Moving

Single
Multiple

Lighting
Manipulating Task Demand

The Motor System is responsive to the manipulation of task demands
Center of Gravity Control

Sample Progressions:

Seated Position:
  Maintain balance (with and without arm/leg movements)
  Trunk leaning in multiple directions
  Weight shifts in multiple directions

Task Demands:
  Hand position
  Level of surface compliance/stability
  Added cognitive or manual task
  Base of Support
  Varied Pacing
Center of Gravity Control

Sample Progressions:

Standing Position:
- Maintain balance (with altered BOS variations)
- Weight shifts in multiple directions
- With/without hand support
- Varied pacing
- Base of Support
- Added manual or cognitive task
Culminating Group Activities

“Hot Potato”
Reinforce trunk leans, rotations (with arms movements)

“Line Passing”
Reinforce standing trunk leans, rotations, weight shifts (with arm movements)

“Standing Soccer”
Reinforce weight shifts and transfers in RBOS
COG: Anticipatory Postural Control

Involves preparing the body, in advance, for a change in position

Sample Activities:

- Reaching for objects in space – seated, standing, moving
- Pushing and pulling objects of different weights
- Adopting different body positions – one-legged stance, tandem walk
Postural Responses

Recovering balance after an unexpected perturbation – can be internally or externally applied.

Sample Activities:

- Unexpected loss of balance during performance of activity
- External application of force intended to displace body position
- Increasing attentional load by introducing a second task
Increasing the Challenge: Environmental Constraints!

- Compliant or moving surface
- Vision engaged, reduced, distracted, or absent
- Busy visual environment
- Increased visual flow
Manipulating the Environment

The Sensory Systems are responsive to the manipulation of environmental constraints
Sensory Orientation

Optimize the functioning of each of the three sensory systems that contribute to balance:

- **Vision** – gaze stabilization in static and dynamic environments.
- **Somatosensory** – disadvantage vision
- **Vestibular** – disadvantage somato and vision
1. **Optimize** function by stimulating or forcing the use of sensory systems that are intact or when impairment is temporary

2. **Compensate** for sensory impairments that are permanent or progressive
Stimulate Use of Somatosensory System

Disadvantage Vision on Stable Surface

- Engage vision
  - Reach for Objects
  - Read text
- Reduce or Remove vision
  - Add dark glasses
  - Eyes closed activities
- Distract Vision
  - Add busy Background
Stimulate Use of Vision

Disadvantage somatosensory – Manipulate Surface

Perform seated, standing, or moving activities with compliant/moving surface below feet
Engage/distract/remove vision

Reaching for or catching objects
Balance activities on altered surface with eyes closed
Introduce busy background or visual flow during balance activities
Stability in Gait

Manipulate Task Demands:

- Base of support
- Varied Pacing
- Obstacle negotiation
- Added cognitive or manual task

Manipulate Environmental Demands:

- Surface type
- Amount of vision and/or visual flow
Case study # 1: Thelma

- Thelma is 83 years old and resides alone in an affordable housing complex.
- She has had 3 falls in the past year; 1 required hospitalization for a right hip fracture.
- She currently uses a four-wheeled walker when moving about in the community.
- She is VERY concerned that she will fall again.
- She has CVD; sensory neuropathy in both feet; osteoarthritis in both knees; and takes 4 medications.
Case Study #1: Thelma

- Her Screening and Assessment revealed the following:
- Stay Independent Questionnaire – Score of 6
- Short Physical Performance Battery
  - Total Score: 3/12
  - Balance: 2
  - Gait: 1
  - Chair Stand: 0
Louise is 79 years old and lives independently with her spouse in a retirement community.

She has had two falls in the previous year; both non-injury falls.

She is SOMEWHAT concerned about falling.

She does use a single-point cane occasionally or when she is in unfamiliar environments.

She has Type II diabetes; hypertension; a left hip replacement (2008); takes 3 medications.
Case Study #2: Louise

- Her Screening and Assessment revealed the following:
  - Stay Independent Questionnaire – Score of 4
  - Fullerton Advanced Balance Scale
    - Total Score: 26/40
    - Scored poorly on test items 5, 6, 7, 9, 10
  - Up and Go Test Score: 9.4 seconds
  - 30-Second Chair Stand Score: 14
Case Study #3: Colin

- Colin is 82 years old and lives in a condo with his daughter.
- He has had no falls in the previous year but is beginning to notice some changes in his balance.
- He is NOT concerned about falling.
- He does not use an assistive device and walks 3-5 times a week for about 40 minutes.
- He has high blood pressure; cataracts; takes 2 medications.
Case Study #3: Colin

- His Screening and Assessment revealed the following:

- Stay Independent Questionnaire – Score of 1

- Fullerton Advanced Balance Scale
  - Total Score: 34/40
  - Scored poorly on test items 5, 6, 7
  - Up and Go Test Score: 8.3 seconds

- 30-Second Chair Stand Score: 11
Program Design

- Identify the key test results for each case study that will influence the program you design based on the information provided.

- Thelma
- Louise
- Colin
Applying Fallproof Principles to High-Risk Clients

“Building Better Balance”

3 Core Components:
Build Me Up!
Skill Me Up!
Keep Me Up!

“Stay Well At Home”
# Build Me Up!

## Lesson #1

### Warm-Up

1. Chest Press
2. Back & Arm Extensions
3. Side Bends
4. Bicep Curls
5. Seated Leg Abduction
6. Seated Leg Adduction
7. Leg Extensions
8. Point & Flex

### Strength

- **1.** Seated Press-Ups
- **2.** Leg Extensions
- **3.** Seated Leg Adduction
- **4.** Point & Flex
- **5.** Squats
- **6.** Lateral Leg Lifts
- **7.** Leg Flexion/Extension
- **8.** Heel Raises

### Culminating Activity

1. Choice of Hot Potato, Fast Feet, Down the Line Ball Pass, or Parachute Play

### Flexibility

1. Assisted Neck Side Stretch
2. Shoulder Rolls
3. Chest Stretch
4. Spinal Stretch
5. Trunk Rotations
6. Hamstring Stretch
7. Ankle Circles

## Lesson #8

### Warm-Up

1. Seated Press-Ups
2. Leg Extensions
3. Seated Leg Adduction
4. Point & Flex
5. Squats
6. Lateral Leg Lifts
7. Leg Flexion/Extension
8. Heel Raises

### Strength

- **1.** Seated Press-Ups
- **2.** Leg Extensions
- **3.** Seated Leg Adduction
- **4.** Point & Flex
- **5.** Squats
- **6.** Lateral Leg Lifts
- **7.** Leg Flexion/Extension
- **8.** Heel Raises

### Culminating Activity

1. Choice of Hot Potato, Fast Feet, Down the Line Ball Pass, or Parachute Play

### Flexibility

1. Shoulder Rolls
2. Arm Circles
3. Spinal Stretch
4. Side Stretch
5. Trunk Rotations
6. Hamstring Stretch
# Skill Me Up!

## LESSON #1

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<th>Duration</th>
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<tr>
<td>WARM UP</td>
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<tr>
<td>Maintain Seated Balance</td>
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<td>(Level 1, pg. 111)</td>
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<td>Seated Balance with Voluntary Arm Mvts</td>
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<td>(Level 2, pg. 112)</td>
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<td>Seated Balance with Voluntary Trunk Movts</td>
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<td>(Level 3, pg. 115)</td>
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<td>GPEV</td>
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<td>Walking with Directional Changes and Abrupt Stops (Level 1, pg. 202)</td>
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<td>MST VISUAL (pg. 161)</td>
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<td>Voluntary Arm Movts (Level 2, pg. 112)</td>
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<tr>
<td>STRENGTH</td>
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<tr>
<td>Upper Body/Lower Body</td>
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Applying Fallproof Principles to Moderate-Risk Clients

“Fallproof”

5 Core Components:
- COG Training
- Multisensory Training
- Postural Strategy Training
- Gait Pattern Enhancement & Variation
- Resistance/Flexibility Training
Applying Fallproof Principles to Low-Risk Clients

“Better Balance”

5 Core Components:
Revving Up
Balance Basics
Fine Tuning The Senses
Functional Frolics
Firming Your Muscles
Functional Benefit:

• Improves ability to turn while moving, i.e., turning at a street corner, at the end of the market aisle, or maneuvering through crowds.

Instructions for Activity:

• Stand tall with ears directly above the shoulders and shoulders above the hips.
• Walk at a comfortable speed in a direction that creates the shape of the number 8.

Repetitions:

• 2 times in each direction.

Safety Guidelines:

• Walk close to a wall if support is needed.
• Stop activity if you become dizzy.

Recommended Room Set-up:

• 19

Equipment:

• Small plastic traffic cones

Reinforcing Verbal Cues:

• Keep your body tall with shoulders level, and chin parallel to floor.
• Focus your eyes forward on a vertical target at eye level as you complete the Figure 8.
• Don’t forget to breathe.
• Try to walk smoothly and continuously.
Spiral Walk

**Functional Benefit:**

- Improves ability to turn while moving, i.e., turning at a street corner, at the end of the market aisle, or maneuvering through crowds.

**Instructions for Activity:**

- Stand tall with ears directly above the shoulders and shoulders above the hips.
- Create a gradually decreasing spiral pattern as you walk in smaller and smaller circles on each revolution.
- Pause in the center, and then walk out in a gradually increasing spiral pattern to return to the starting point.
- Perform in the opposite direction.

**Repetitions:**

- 2 times in each direction.

**Safety Guidelines:**

- Allow ample space between students.
- Decrease size of circles as stability permits. Start with wide spiral pattern (more steps) and progress to tighter spiral (fewer steps) after practice.

**Recommended Room Set-up:**

- 2 or 3

**Equipment:**

- None

**Reinforcing Verbal Cues:**

- Keep your body tall with shoulders level, and chin parallel to floor.
- Focus your eyes on a pre-selected visual target at eye level during each revolution of the spiral.
- Don’t forget to breathe.
Rock Hopping

Functional Benefits:

• Improves stability during moving activities.
• Promotes better stability while bending to pick up objects from floor.

Instructions for Activity:

• Begin at one end of the “river” and step from “rock” to “rock” (spots).
• Stop to pick up objects on the “river bed” between the rocks.

To increase the level of difficulty, stability of “rocks” can be altered by substituting “Dyna Discs®” for spots, if available.

Spacing between spots can be increased or decreased to make the activity more or less challenging.

Safety Guidelines:

• Set up the activity near a wall.

Recommended Room Set-up:

• 11

Equipment:

• Colored spots
• Small objects to pick up
• Dyna Discs® (optional)

Reinforcing Verbal Cues:

• Focus your eyes forward on a vertical target at eye level when stepping forward.
• Make sure the belly button moves forward with each step.
Semi-Tandem & Tandem Stance

Reference Balance Basics #19
for instructions regarding foot positions.

**Functional Benefits:**

Activity performed with **eyes closed**.
- Improves stability when in dark or dimly lit environments.

Activity performed with **eyes open**, standing on foam.
- Improves stability when standing on soft or uneven surfaces.

Activity performed with **eyes closed**, standing on foam.
- Improves stability when standing on soft or uneven surfaces in dark environments.

**Safety Guidelines:**

- Position students near chair or wall for added safety.
- Each of the above may not be suitable for all participants. Review standing balance test to determine starting level for each student.
- Place non-slip material under foam pad to prevent it sliding.

**Recommended Room Set-up:**

- 5B and 6B

**Equipment:**

- Airex® foam pads
- Non-slip material to prevent foam slipping on floor
- Chairs

Fine Tuning the Senses # 31

**Reinforcing Verbal Cues:**

- Feel the floor evenly under each foot.
- There should be equal tension in both the left and right leg.

- Focus eyes forward on a vertical target at eye level.

- Sense that your ears are directly above the shoulders which are directly above the hips.
- Imagine that you can still “see” a vertical target directly in front of you at eye level.

Stand tall with shoulders and hips level, and chin parallel to floor. Make sure the belly button is between the heel of the front foot and toes of the rear foot during the split stance.
Fine Tuning the Senses # 35

Semi-Tandem & Tandem Stance

with Ball Toss

Functional Benefits:

Activity performed on firm surface/floor.
• Improves stability when in visually distracting or darkened environments.

Activity performed standing on foam pad.
• Improves stability when standing on soft or uneven surfaces in visually distracting or darkened environments.

Instructions for Activity:

• Reference Balance Basics #19 for instructions regarding foot positions.

• Students individually toss ball up-and-down with right foot forward.

• Students toss ball from hand-to-hand with left foot forward.

Safety Guidelines:

• Position students near chair or wall for added safety.

• Each of the above may not be suitable for all participants. Review standing balance test to determine starting level for each student.

Recommended Room Set-up:

• 6B

Equipment:

• Balls

• Airex® foam pads

• Non-slip material to prevent foam slipping on floor

Reinforcing Verbal Cues:

• Stand tall with shoulders level, and chin parallel to floor.

• Be sure to move belly button forward until it is:
  ✓ between (semi-tandem) or
  ✓ above (tandem) the heel of the front foot and the toes of the rear foot.

• Don’t forget to breathe.
Line Passing

Functional Benefits:
- Improves ability to reach for objects at various heights and directions.

Instructions for Activity:
Position group into lines of 4-6, all facing the same direction. Arrange each line from shortest to tallest. First person in the line has the ball.

- Stand with feet hip-width apart.
- With both hands, pass the ball to the person behind you.
- The last person then passes the ball forward.
- Passes can be any of the following:
  - Side to side, waist level, high, low or alternating. (Pass the ball on the opposite side from which you receive the ball.)
  - Over the head.
  - Between the legs

Once introduced, this activity can be performed on foam pads to increase the challenge (for appropriate individuals).

Safety Guidelines:
- Position participants close enough to each other in the line so that passing can be performed safely.
- Some individuals may need to modify the passing method due to limited shoulder mobility, neck or back problems.
- Review standing balance test to determine which students should stand on foam surface.

Recommended Room Set-up:
- 3

Equipment:
- Non-weighted and weighted balls
- Airex® foam pads and non-slip material

Reinforcing Verbal Cues:
- Stand with feet apart.
- Remember to use two hands.
- When passing the ball to the side, shift your weight onto the leg opposite the side to which you are passing the ball.
- When passing the ball over the head, shift your belly button forward.
- When passing the ball between the legs, bend the knees and keep head level to maintain balance.
Fine Tuning the Senses # 37

Walking with Altered Vision

Functional Benefits:

- Improves stability when moving in visually distracting, dark or dimly lit environments.

Instructions for Activity:

Divide the class into two groups positioned at opposite ends of the room (refer to Room Set-Up #8). Students engage in the following activities as they cross the room.

1. Tossing Ball – Each student tosses a ball from hand-to-hand, or two students toss ball to each other while walking.
2. Reading – Students read aloud
3. Wearing Sunglasses or Walking with Eyes Closed

Safety Guidelines:

- Instruct students to walk at a comfortable pace.
- Advise participants to stop if a dropped ball rolls into their path.
- Adopt a close “spotting” position behind certain students, if needed, during the eyes closed activities.
- Reduce the number of students in each line if more supervision is needed.

Recommended Room Set-up:

- 8 or 14

Equipment:

- Playground balls
- Sunglasses
- Large print reading material (jokes, poems, etc.)

Reinforcing Verbal Cues:

- Maintain “tall” posture as you walk.
- When reading, keep chin level.
- When walking with eyes closed:
  - Feel the floor with each step as you walk
  - Feel the heel contacting the floor first, and then the toes.
**Copy Cat**

*Functional Benefits:*

• Improves cognitive & memory skills.

• Improves ability to respond quickly to changes in the environment.

*Instructions for Activity:*

Divide the class into pairs (matching ability level). Partners face each other with one partner as the leader. Provide a written selection of suggested exercises from which each pair leader can choose. (Activities are listed on the following page, exercise #40-A.)

• Begin an activity that your partner will then follow along with you, as if looking in the mirror.

• Take turns with your partner as the leader of a new activity.

*Safety Guidelines:*

• Remind participants that safety always comes first.

*Recommended Room Set-up:*

• 16

*Equipment:*

• None

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**Functional Frolics # 40**

*Reinforcing Verbal Cues:*

• Remember that safety always comes first.

• Perform only activities from the list provided by your instructor.

• Let your partner know if you feel the activity is too difficult or challenging.
Waiters’ Relay

*Functional Benefits:*

- Improves posture and stability when carrying objects while walking.

*Instructions for Activity:*

*Divide class into teams of 4-5, half of each team on opposite sides of the room. Give a tray with items on it to the first person from each team.*

- Carry the tray across the room as quickly (and safely) as you can without “spilling” the contents.
- You can carry the tray with one hand along side your head, or in front of you with both hands.
- Give the tray to the next person on your team when you reach the other side.

*Safety Guidelines:*

- Remind participants that safety always comes first. (Maintain a safe pace when crossing the room.)
- Emphasize completion of task, not speed.

*Recommended Room Set-up:*

- 8 or 14

*Equipment:*

- Light tray or dish (substitute clip board, binder, or other flat surface)
- Plastic cups (with or without marbles inside)

*Reinforcing Verbal Cues:*

- Maintain good posture with shoulders level, and chin parallel to floor.
- Look straight ahead at your destination.
- Be aware of the other waiters’ whereabouts in your area.
Moving Line Pass

**Functional Benefits:**

- Improves stability when reaching for moving objects, i.e., luggage from the airport carousel.

**Instructions for Activity:**

Students form two lines, one behind the other, and walk around the outside perimeter of the room. Provide a selection of suggested gait patterns that the leader of the line can select.

- Continue to move the line forward with the gait pattern of your choice, and pass the ball to the person behind you (or next to you if moving in pairs).
- The last person to receive the ball moves to the head of the line, selects a new gait pattern, and begins the ball pass again.

**Safety Guidelines:**

- Remind participants that safety always comes first.
- Maintain a safe pace while walking in the line.
- Have participants walk close enough to each other so that they can safely pass the ball.

**Recommended Room Set-up:**

- 8 or 18

**Equipment:**

- Non-weighted ball (4” - 6” in diameter)

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**Reinforcing Verbal Cues:**

- Safety comes first.
- Maintain proper posture while walking.
Best Practice Recommendations

✓ Moderate-to-high challenge
✓ Must be of a sufficient dose
✓ Ongoing exercise is necessary
✓ Target delivery strategy to risk level

✓ Standing with Minimal Support
✓ Equally effective in group or 1:1 settings
✓ Include walking program but not at expense of balance training
✓ Include a strength training component
✓ Exercise alone may not be sufficient

Sherrington et al. (2008, 2011)