

Using Assessment Results to Create Falls Prevention Exercise Programs



ACSM HFS 2013

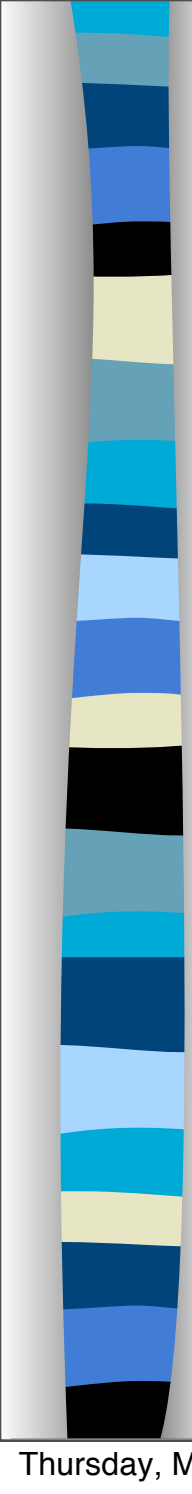
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Objectives

- n Describe the prevalence of falls and falls-related injuries and the costs associated with them
- n Identify intrinsic and extrinsic risk factors for falls
- n Explain the balance control mechanisms in the body and how they work together to reduce falls risk
- n Review 3 simple, validated assessment protocols to identify falls risk and functional capabilities in older clients
- n Identify movement dysfunctions through observation of assessment performance
- n Develop an individualized falls prevention program using objective & subjective data from assessment performance

Sad Statistics!

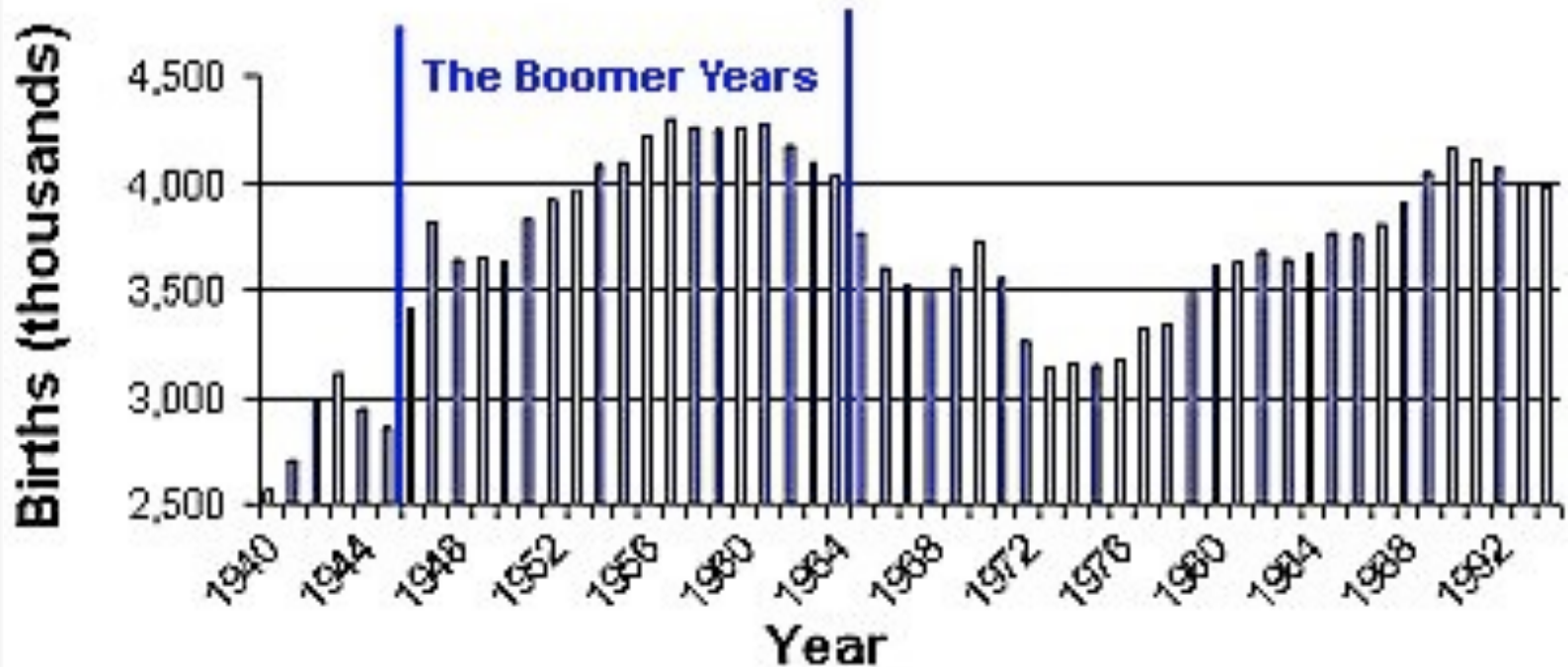
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- n Over 1/3 of people aged of 65+ fall each year
 - n In 2007, over 1.8 million seniors were treated for fall-related injuries at emergency rooms
 - n Approx. 400,000 fractures per year due to falls
 - n Over 20% of hip fractures result in death in 1 yr
 - n Problem will only continue to increase with the “Graying of America” and its changing demographics

Sources: CDC, 2010; Kannus et al., 2005; Ngyuen et al., 2007

The Baby **BOOM** Phenomenon

- n Baby Boomers: Those who were born in the 20 years following W.W.II (1946-1964): 3.1 million EVERY YEAR!

U.S Births: 1940 - 1994



Factors Affecting Falls



Extrinsic Factors

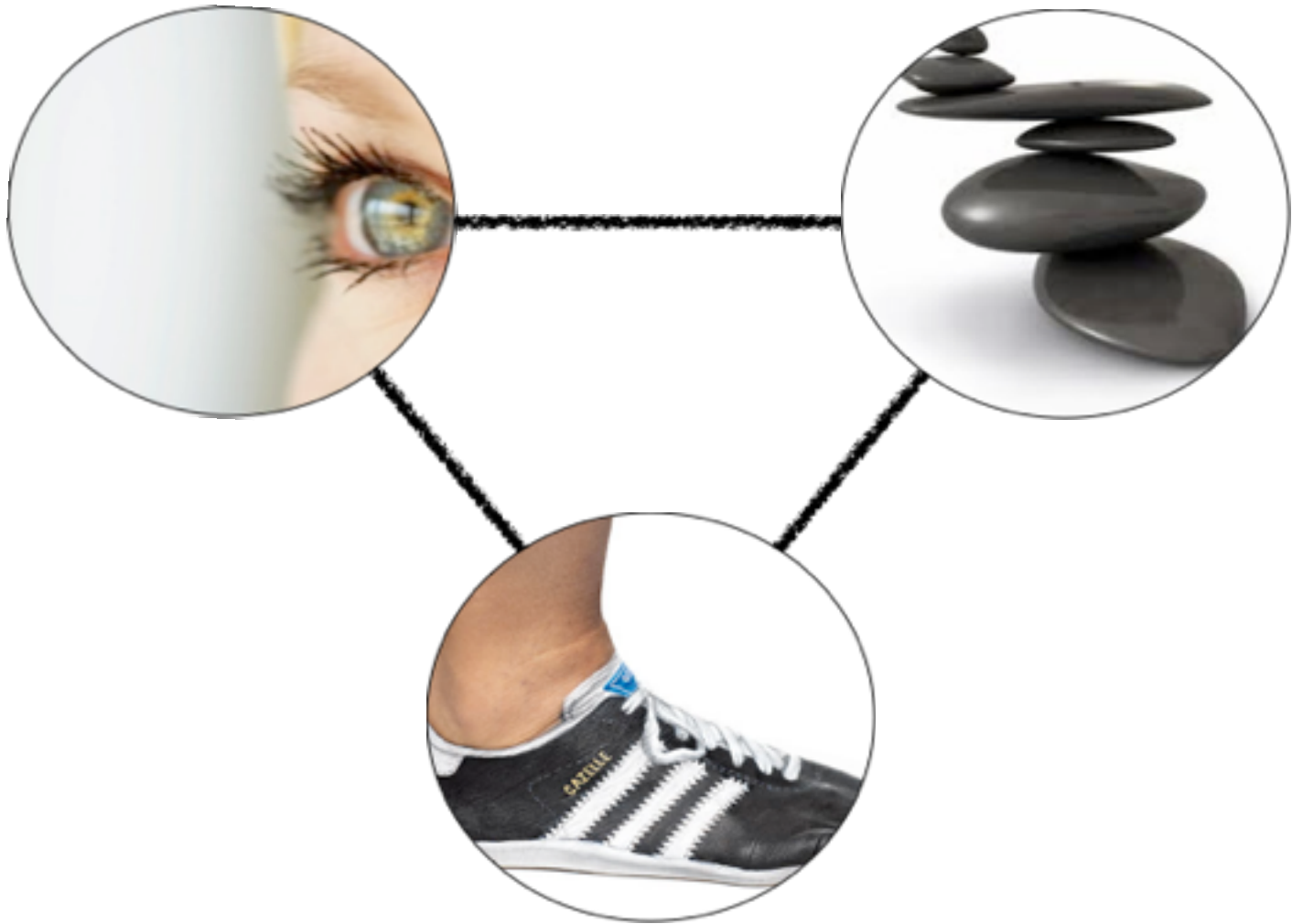




Intrinsic Factors



Falls Defense Mechanisms



Source: Carter, Kannus & Khan, 2001

Vestibular System



Vision



Somatosensory System



Fortunately - Exercise CAN HELP!



Unfortunately - FP Programs Are “One Size Fits All”





What To Do About It??

- IDENTIFY the Balance Control Deficits
- CONSTRUCT Corrective Strategies
- MODIFY Based on Functional Capabilities



IDENTIFY Deficits

Three simple, validated assessments

1. Functional Reach Test
2. Timed Up and Go Test
3. 30 Second Chair Stand Test



Interpreting Assessment Results

- Compare objective outcome measurement to established normative values

Provides baseline/follow-up comparison

Informs and motivates the older adult

- Observe movement quality to determine correct exercise selection

Identifies individual
STRENGTHS & WEAKNESSES

Objective outcome measurements are influenced by compensatory movement strategies



Assessment #1: Functional Reach Test

- FRT developed by Duncan & colleagues (*J. Gerontology*, 1990)
- Measures limits of stability – ability to control sagittal COP movement while limiting frontal/transverse COP movement
- Requires stabilization of lower extremity during active reach with upper extremity
- Outcome measurement is anterior COP displacement (± 0.25 ")

Looking Beyond The Outcomes Measurement

- Break down the assessment into its individual task demands (*Starting Position, Extending Reach, Reach Hold, Return to Starting Position*)
- Observation of MOVEMENT QUALITY may reveal:
 - Poor ankle dorsiflexion, poor hamstring flexibility, impaired lumbar, thoracic & cervical spine mechanics, sensory/vestibular dysfunction, lower body &/or core strength deficits

Functional Reach Test In Action



YouTube Channel: www.youtube.com/ThompsonFitnessSolut

Functional Reach Test

Normative Values

Functional Reach Test	25th % (low)	50th % (median)	75th % (high)	90% percentile (excellent)
65-70 years old	6.7 inches	8.3 inches	9.9 inches	12.1 inches
71-75 years old	6.3 inches	8.1 inches	9.5 inches	11.7 inches
76-80 years old	6.1 inches	7.8 inches	9.4 inches	11.4 inches
81-85 years old	5.5 inches	7.1 inches	8.8 inches	10.6 inches
86-90 years old	4.9 inches	6.4 inches	8.4 inches	10.0 inches
90+ years old	3.8 inches	5.5 inches	6.8 inches	8.9 inches



Assessment #2: Timed Up-and-Go Test

- TUG developed by Podsiadlo & Richardson (*JAGS*, 1991)
- Modify by increasing walking speed to “fast but safe”
- Measures several aspects of function including lower body strength, ambulation, & postural control
- Outcome measure is time ($\pm 0.01s$)

Looking Beyond The Measurement

- Break down the assessment into its individual task demands (*Seated to Standing, Ambulation, Cone Turn, Preparation to Sit, Standing to Seated*)
- Observation of MOVEMENT QUALITY may reveal:
Flexibility restrictions, gait abnormalities, sensory/vestibular impairments, concentric force/eccentric control deficits

Timed Up and Go Test In Action



YouTube Channel: www.youtube.com/ThompsonFitnessSolut

Timed Up And Go Test

Normative Values

Timed Up and Go Test	25th % (low)	50th % (median)	75th % (high)	90% percentile (excellent)
65-70 years old	15.4 secs	8.4 secs	7.1 secs	6.6 secs
71-75 years old	13.9 secs	8.9 secs	7.2 secs	6.8 secs
76-80 years old	15.5 secs	9.0 secs	7.8 secs	7.1 secs
81-85 years old	17.6 secs	12.3 secs	9.2 secs	7.7 secs
86-90 years old	20.2 secs	14.3 secs	10.1 secs	8.8 secs
90+ years old	24.6 secs	15.9 secs	11.5 secs	9.2 secs



Assessment #3: Chair Stand Test

- CS developed by Rikli & Jones (*JAPA*, 1999)
- Measures lower body muscular strength
- Outcome measure is completed repetitions in 30 seconds

Looking Beyond The Measurement

- Break down the assessment into its individual task demands (*Seated to Standing, Standing, Standing to Seated*)
- Observation of MOVEMENT QUALITY may reveal:
Flexibility restrictions, muscle activation asymmetries,
sensory/vestibular impairments, concentric force production
& eccentric control deficits

Chair Stand Test In Action



YouTube Channel: www.youtube.com/ThompsonFitnessSolut

Chair Stand Test Normative Values

Chair Stand Test	25th % (low)	50th % (median)	75th % (high)	90% percentile (excellent)
65-70 years old	7.4 reps	11.2 reps	13.5 reps	18.8 reps
71-75 years old	6.9 reps	10.1 reps	13.1 reps	16.2 reps
76-80 years old	6.0 reps	8.2 reps	12.3 reps	14.4 reps
81-85 years old	5.1 reps	6.3 reps	8.9 reps	10.1 reps
86-90 years old	3.5 reps	5.2 reps	6.8 reps	7.7 reps
90+ years old	0 reps	3.4 reps	5.4 reps	8.7 reps



CONSTRUCT Corrective Strategies



Interpreting Assessment Results

- Compare objective outcome measurement to established normative values

USE TO DETERMINE STARTING LEVEL OF DIFFICULTY!

Provides baseline/follow-up comparison

Informs and motivates the older adult

- Observe movement quality to determine correct exercise selection

USE TO DETERMINE WHICH EXERCISES TO INCLUDE

Identifies individual STRENGTHS & WEAKNESSES

Falls Prevention Program Template

“The FPP Template”

Assess %tile Result	Mobility Exercises	Strength Exercises	Sensory Exercises	Dynamic Balance/Gait Enhancement Exercises
25th %	Most Regressed	Most Regressed	Most Regressed	Most Regressed
50th %	1st Progression	1st Progression	1st Progression	1st Progression
75th %	2nd Progression	2nd Progression	2nd Progression	2nd Progression
90th %	3rd Progression	3rd Progression	3rd Progression	3rd Progression

Remember This!!!!
All Exercises Exist On A Continuum!!!





BASIC Strategy for Progression & Regression

Lower Body

1. Wide Stance
2. Narrow Stance
3. Stagger Stance
4. Tandem Stance
5. Single Leg Stance

Upper Body

1. Both Hands
2. Alternating Hands
3. Single Hand

Additional Considerations

Stability of Surface, Multijoint Exercises,
Sensory Modifications...etc.

CONSTRUCT

Joint Mobility

- The ANKLE & HIP are KEY!!!
 - Menz (2005) found reduced proprioceptive input from stiff joint structures with aging
 - Subconscious utilization of ankle “strategy” during quiet standing
 - Reactive utilization of hip “strategy” during movement
- Thoracic spine and shoulder also very important
- Selected isolated non-loaded mobilizations
 - Ankle Circles, Hip Steps
- Selected loaded integrated mobilizations (involvement of full kinetic chain)
 - TADAs, Rotating Punches





CONSTRUCT

Muscle Strengthening

- Goal is more than just gaining strength...
 - Enhance neural recruitment & increase lean tissue mass
 - Challenge postural control and improve stabilization capacity
 - Emphasize eccentric control during movement – deceleration of gravitational forces is essential for falls prevention (we are really training for RECOVERABILITY)
- Selected exercises
 - Chair Stands
 - Step/Lunge Patterns
 - Cable Pull
 - Cable Press





CONSTRUCT

Sensory Training

- The sensory systems CAN respond to training
 - Neural plasticity and sensitivity to sensory input is possible
 - Challenge postural control and improve stabilization capacity
 - Emphasize challenging one (or two) of the sensory systems responsible for balance maintenance
- Selected exercises
 - Head Turns (reduces vestibular sensory input)
 - Eye Shifts (reduces visual sensory input)
 - Marching/Stepping (challenges somatosensory system)



CONSTRUCT

Dynamic Balance

- Why not just stand on one foot???
 - Must have functional benefit - people fall during MOTION!
 - Proprioception is a dynamic process and most trainable through movement
- Selected exercises
 - Steps to Balance
 - Circle Cone Pass/Reach





CONSTRUCT

Gait Enhancement

- WHY do older people walk the way they do???
 - Reduced mobility of ankle & hip joint
 - Gravity is winning the battle
 - FEAR!!!! (contracts one's sphere of function)
 - Pathological conditions (but only in a small % of OAs)
- Gait Enhancement
 - STANCE phase (requires stability) & STRIDE phase (requires mobility) & BOTH require sensory function (Vis, Vestib, SS)
- Selected Exercises
 - Side Stepping, Ladder Drills





Case Study #1

76 y.o. female

Objective Assessment Results

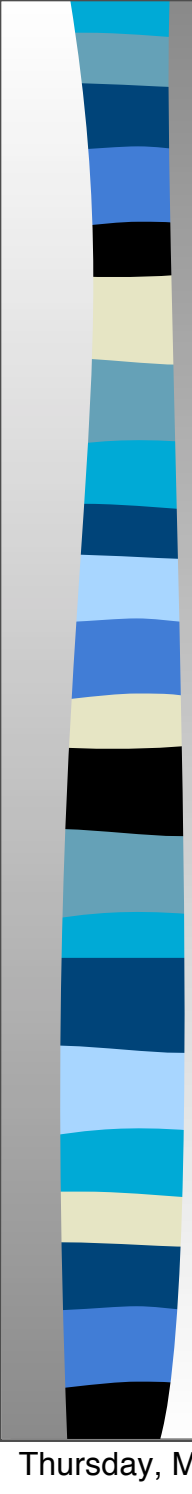
Functional Reach Test:	8.5 inches	50th %
Timed Up and Go Test:	13.8 sec	25th %
30 Second Chair Stand Test:	13 reps	75th %

Case Study #2

78 y.o. male

Objective Assessment Results

Functional Reach Test:	8.4 inches	50th %
Timed Up and Go Test:	14.1 sec	25th %
30 Second Chair Stand Test:	15 reps	75th %



These results suggest that **BOTH**
people should be doing
MOST REGRESSED exercises

But this is only **PART OF THE**
STORY!!!



Case Study #1

76 y.o. female

Subjective Assessment Results (TUG only)

Repeated efforts with Sit/Stand Transitions (poor concentric/eccentric force production), Disorientation during Cone Turn (poor sensorimotor integration)

Case Study #2

78 y.o. male

Subjective Assessment Results (TUG only)

Weaving gait during Straight Line Ambulation (poor gait pattern & possible sensory deficits), Shuffling feet during all ambulation (poor gait pattern & joint mobility deficits)



Case Study #1

76 y.o. female

Program Design (Level 1 Exercises)

Chair Stands, Chest Press, Back Pull, Head Turns, Eye Shifts, Ta-Da's, Side Steps

Case Study #2

78 y.o. male

Program Design (Level 1 Exercises)

Hip Steps, Ankle Circles, Step Return Patterns, Side Steps, Ladder Drills, Eye Shifts, Chair Stands

FPP Template For #1

Assess %tile Result	Mobility Exercises	Strength Exercises	Sensory Exercises	Dynamic Balance/ Gait Enhancement Exercises
25th %	Tada's With Chair Instruct each Component	Chair Stands w/ Hands Seated Chest Press Seated Back Row	Eye Shifts w/ Chair Head Turns w/ Chair	Side Steps 2 steps
50th %	Tada's With Chair	Chair Stands w/ Reach Standing Chest Press Standing Back Pull	Eye Shifts w/o Chair Head Turns w/o Chair	Side Steps 3 steps w/ SS Reach
75th %	Tada's Without Chair	Chair Stands - X Arms Alternate Chest Press Alternate Back Pull	Marching Eye Shifts w/ Chair M Head Turns w/ Chair	Side Steps 4 steps w/ OS Reach
90th %	Variable Speed Tada's	Chair Stands w/o Chair 1 Arm Chest Press 1 Arm Back Pull	Marching Eye Shifts w/o Chair M Head Turns w/o Chair	Side Steps w/ Hip Drop 4 steps

FPP Template For #2

Assess %tile Result	Mobility Exercises	Strength Exercises	Sensory Exercises	Dynamic Balance/ Gait Enhancement Exercises
25th %				
50th %				
75th %				
90th %				



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