Falls Prevention in Older Adults

Edgar Ramos Vieira, PT, MSc, PhD
Associate Professor, Department of Physical Therapy, Florida International University
EVieira@fiu.edu

Disclosure

I am a member of the clinical advisory board of Alivi Therapy Network.

My presentation will not include discussion of off-label or unapproved usage.

Learning Objectives

Upon completion of my lecture, participant should be better able to:
a. Identify and assess risk factors for falls in older adults, and
b. Select evidence-based intervention to reduce the risk of falls in older adults.
Falls in Older Adults

- 30 to 40% of the community-dwelling older adults fall at least once/year.
- Falls are the number one cause of injury, injury-related disability and deaths among older adults (29,668 deaths, 61.6/100,000, in the US in 2016)
- Injuries occur in 40-60% of the falls; ~25% of all falls result in emergency department or primary care physician visits.
- The rate of fall-related deaths among older adults increased 31% from 2007 to 2016.

(Faus and Morris, 2001; Sterling, O’Connor, and Brandon, 2001; Tiedt and Spaisley, 1985; Burns and Kakara, 2018)

In the US, an older adult goes to an ER due to a fall every 11 seconds (3 million visits/year), and

- An older adult dies from a fall-related injury every 19 minutes.
- In Florida, falls are responsible for ~30,000 hospitalizations/year.
- Falls are related with 40% of nursing home admission.

Can result from impairments in gait, balance, and lower limb strength.

Falls trigger a cycle of fear of falls, reduced physical activity, deconditioning, functional decline, social isolation, reduced quality of life, depression, and increased risk of subsequent falls.
Common activities related to falls:
- Getting up/standing
- Bending down
- Turning
- Walking while turning the head
- Overcoming obstacles
- Walking and talking
- Climbing stairs


Vieira et al., 2016
Gait vs. Falls

Safe & efficient gait:
optimum functioning and coordination of the neurological, musculoskeletal, cardiorespiratory, and cognitive systems.

Low risk of falls/ability to recover from fall-prone situations

Need to understand: Normal and altered gait patterns

Gait

- Indicator of functional status and independence
- Biomarker of frailty

Gait speed

<table>
<thead>
<tr>
<th>Reference</th>
<th>Gait speed over 6 m using unimanual means (m/s)</th>
<th>Gait speed over 13 m (m/s)</th>
<th>Gait speed over 13 m (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–11 years</td>
<td>1.11 (0.23)</td>
<td>1.26 (0.34)</td>
<td>1.24 (0.32)</td>
</tr>
<tr>
<td>12–15 years</td>
<td>1.00 (0.22)</td>
<td>1.20 (0.23)</td>
<td>1.44 (0.26)</td>
</tr>
<tr>
<td>16–19 years</td>
<td>0.90 (0.25)</td>
<td>0.95 (0.21)</td>
<td>1.33 (0.22)</td>
</tr>
<tr>
<td>20–21 years</td>
<td>0.86 (0.20)</td>
<td>0.89 (0.21)</td>
<td>1.15 (0.24)</td>
</tr>
</tbody>
</table>

Note: Not measured in these studies.
Gait speed

Clinical meaningful change in gait speed = 0.05 m/s
Substantial change in gait speed = 0.10 m/s

According to Guccione et al. (2012), for normal walking, we need:

- A hip ROM from approximately 20° of extension to 20° of flexion,
- A knee range from straight (0°) to 60° flexion, and
- An ankle range from 25° of plantarflexion to 7° dorsiflexion.

If these joint ranges are not available, the gait pattern would show considerable deviation from the norm.
Gait with and without assistive devices

Canes = most common assistive device used (70%) by community dwelling older adults, followed by walkers (30%).

Using assistive devices may reduce falls, but
> energy consumption (fatigue) and
< speed.

Stigma = resistance

Mcbeath et al., 1974

Gait

Time & Distance Parameters / Temporal Spatial Characteristics

- Stance time
- Swing time
- Stride time/cycle duration (1s)
- Step time (asymmetry)
- Single support time
- Double support time
- Cadence (110-115/min)
- Velocity/Speed

- Stride length
- Step length
- Step width (width of the walking base ~3.5 in)
- Degree of toe out

Whittle (2014)

Gait

Typical older adult gait changes
< floor clearance (< strength & ROM);
> base of support (< balance);
< speed (< steps);
> gait variability;
> stance and double-support time;
> co-contraction (fear of falls…> energy expenditure)

Postural control is achieved by continually positioning the body's center of gravity (COG) over the base of support (BOS) during static and dynamic situations. (Hammil and Knutzen, 2006)

Balance

Vestibular System

Visual System

Somatosensory System

Balance Assessment – Tinetti, Berg, 4 stage balance test or NeuroCom Operating Manual
Balance Assessment
Computerized posturography

Force Plates

Lin et al., 2008

Balance Assessment
Computerized posturography

Bolbecker et al., 2012

Biomechanical vs. clinical measures
Reliability & Sensitivity

Bolbecker et al., 2012

Prevention of falls in older people living in the community

Edgar J. Shea,1 Richard C. Plotnik,1 Paul M. Chaves2

ABSTRACT

The number of people living into older age (65 years) is rising rapidly. Older people are more likely to fall and this has serious consequences for their quality of life and that of their families. Falls also pose a substantial financial burden on healthcare systems. Inadequate research on systematic reviews and meta-analyses has established effective approaches for reducing falls among older people, although uncertainties and inconsistencies remain. The evidence suggests that exercise-based and tailored interventions may be more effective than a single fall and associated healthcare costs among older people in the community. This review emphasizes current knowledge on assessment and management strategies to prevent falls in older people living in the community. It summarizes known risk factors for falls in this population and presents assessment strategies that can be used to assess the risk of falls. It discusses the management of risks and interventions to reduce falls among older people in the community, as well as future directions and promising approaches.
Interventions to Reduce Falls
- Exercise programs
  - Tai Chi: Moving for Better Balance reduced falls by 55% (Ory et al., 2015)
  - Stepping On reduced falls by 30% (Clemson & Swann, 2019)
  - Otago Exercise Program reduced falls by 35% (Colligan, Tomoyasu, & Howell, 2015)

Interventions to support mobility and reduce falls
- Equipment
- Environment
- Education
- Exercise

4Es

Take Home Message/Next Steps
- Falls are the #1 cause of injury and related deaths among older adults;
- Falls can be reduced by identifying and minimizing the modifiable risk factors such as gait, balance and strength impairments, polypharmacy, and clutter;
- Evidence-based interventions to reduce the risk of falls in older adults include physical therapy and/or exercise, medication reviews, and environmental modifications.
References

  blog/it%E2%80%99s-older-americans-month-are-our-seniors-safe
• Centers for Medicare & Medicaid Services (2013). Evaluation of Community-Based Wellness and Prevention Programs.
• GAITRite Operating Manual (2007). Havertown. PA: MAP/CIR INC.
• Tinetti ME, Speechley M. Prevention of falls among the elderly. N Engl J Med 1989 Apr 20;320(16):1055-
  1060.
  10.3390/geriatrics3030042.

Falls Prevention in Older Adults

Edgar Ramos Vieira, PT, MSc, PhD
Associate Professor,
Department of Physical Therapy,
Florida International University
EVieira@fiu.edu
Studies involving Gait and Balance Assessments, and Exercises to Reduce Falls in Older Adults

- Street crossing by Younger and Older Adults (Vieira et al., 2015)
- Baptist H – Falls prevention after discharge (Vieira et al., 2016)
- Effects of exercise in Older Caribbean Americans (Vieira et al., 2017)
- Health of Hispanics in Senior Centers (Vieira et al., 2018)
- Diet and/or exercise in older Hispanics with diabetes (ongoing)

Street crossing by Younger and Older Adults

To develop a method and compare temporospatial gait parameters of younger and older adults during simulated street crossing situations. (Vieira et al., 2015)

Walking and Street Crossing

Changes on Walking During Street Crossing Situations and on Dorsiflexion Strength of Older Caribbean Americans After an Exercise Program: A Pilot Study
Edgar R. Vieira, Ruth Tapper, Sarena S. Gooper, Maria T. Sereni, Gabriella Engelhorn, Marco R. de Oliveira, Alexandre C. Barbosa, and Robena A. da Silva

The objective of this pilot study was to evaluate a 12-week exercise program completed by 30 older Caribbean Americans. Assessment was done at baseline and 12 weeks, and included video monitoring of gait parameters and during the exercise program. The exercise program consisted of 12 weeks of 3 times per week, incorporating strength training exercises and aerobic exercise. Results showed significant improvements in gait parameters and strength.

Keywords: Older adults, Caribbean, exercise, intervention, gait strength
Health of Hispanics in Senior Centers
To understand how frailty affects balance and gait of older Hispanics (n=63)

<table>
<thead>
<tr>
<th>Status</th>
<th>Preferred Speed</th>
<th>Regular Speed</th>
<th>Reduced Speed</th>
<th>ANOVA F Values</th>
<th>Post-hoc Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Frail</td>
<td>124±17</td>
<td>127±14</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Pre-Frail</td>
<td>134±16</td>
<td>133±14</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 Robust</td>
<td>147±18</td>
<td>141±15</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Velocity (cm/s)
- F = 6.3, F = 3.6, F = 1.9, P = 0.003*, P = 0.035*, P = 0.165
- Post-hoc: 3>1 and 2 NA

Step Length (cm)
- F = 7.4, F = 4.0, F = 3.6, P = 0.001*, P = 0.024*, P = 0.032*
- Post-hoc: 3>1 and 2 3>1 and 2 3>1

Base of Support (cm)
- F = 2.5, F = 3.3, F = 2.3, P = 0.091, P = 0.042*, P = 0.165
- Post-hoc: NA 3<1 NA

97% had frailty and pre-frailty status; these statuses were associated with balance and gait impairments.

(Vieira et al., 2017)