

Exercise Interventions to Reduce Falls in Older Adults



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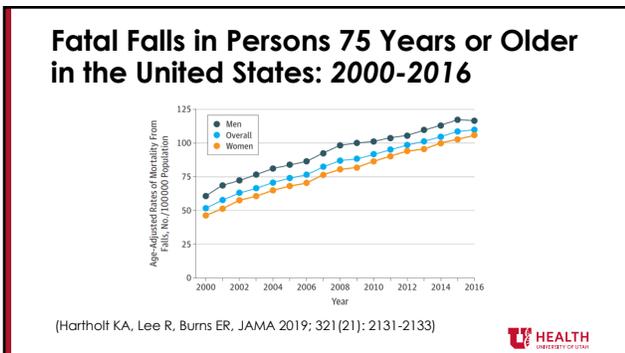
Objectives

By the end of this presentation, you will be able to demonstrate an understanding of:

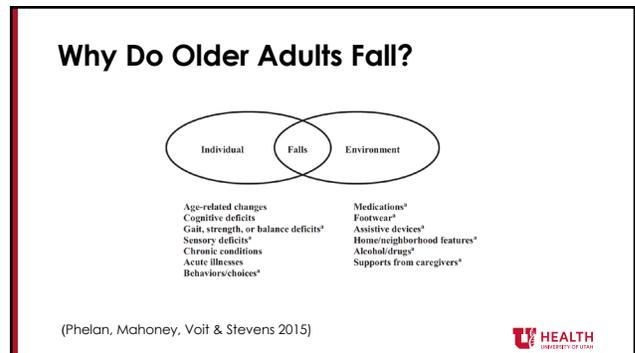
- Exercise interventions related to improving balance and decreasing fall risk in older adults



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Exercise for preventing falls in older people living in the community (Review)

Sherrington C, Fairhall NJ, Wallbank GK, Tiedemann A, Michaleff ZA, Howard K, Clemson L, Hopewell S, Lamb SE

- Exercise programmes reduce the rate of falls and the number of people experiencing falls in older people living in the community
 - High-certainty evidence
- Exercise programmes that reduce falls primarily involve balance and functional exercises

(Cochrane Database of Systematic Reviews 2019, Issue 1.)



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Exercise for preventing falls in older people living in the community (Review)

Sherrington C, Fairhall NJ, Wallbank GK, Tiedemann A, Michaleff ZA, Howard K, Clemson L, Hopewell S, Lamb SE

- Programmes that probably reduce falls include multiple exercise categories (typically balance and functional exercises plus resistance exercises)
- Uncertain of the effect of resistance exercise (without balance and functional exercises), dance, or walking on the rate of falls

(Cochrane Database of Systematic Reviews 2019, Issue 1.)



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Balance Training: Dose-Response Relationship

Effects of Balance Training on Balance Performance in Healthy Older Adults: A Systematic Review and Meta-analysis

Melanie Lesinski¹ · Tiber Hortobágyi² · Thomas Muehlbauer¹ · Albert Gollhofer¹ · Urs Granacher¹



Effective Balance Training Characteristics:

- Training duration 11–12 weeks
- Frequency of three sessions per week
- Total number of 36–40 training sessions
- Duration of 31–45 min of a single training session
- Total duration of 91–120 min of training per week

(Sports Med (2015) 45:1721–1738)



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ACSM: Older Adults and Neuromotor (Balance) Exercise

Frequency: 2-3 days/wk

Type:

- Progressively difficult postures that reduce the base of support
 - Two-legged, semi-tandem, tandem, one-legged stance
- Dynamic movements that perturb center of gravity
 - Tandem gait, circle turns
- Stressing postural muscle groups
 - Heel, toe stands
- Reducing sensory input
 - Standing with eyes closed
- Tai chi

(ACSM Guidelines, Tenth Edition)



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Stepping Training

- Both reactive and volitional stepping interventions reduce falls among older adults by approximately 50%
- Reduction may be due to improvements in reaction time, gait, balance and balance recovery
 - But not in strength

(Okubo Y, et al. Br J Sports Med 2017;51:586–593)



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Perturbation Balance Training

- Therapist exposes patient to unexpected balance perturbation – in a safe, controlled environment
- Treadmill accelerations, pushes or pulls in multiple directions
- Appears to be a feasible approach to reducing falls among older adults in clinical settings

(Gerards M, McCrum C, Mansfield A, Meijer K 2018)



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Balance Training: Tai Chi – Systematic Review, Meta-analysis

- 18 trials with 3824 participants were included
- Tai Chi significantly reduced the number of fallers (by 20%) and the rate of falls (by 31%)
 - Compared to control groups
- Yang style Tai Chi versus control was likely to be larger than the effect of Sun style Tai Chi



(Huang, Feng, Li, and Lv, 2017)



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What About Resistance Training and Falls?

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

| Risk factor | Significant/total ^a | Mean RR-OR ^b | Range |
|--------------------------|--------------------------------|-------------------------|----------|
| Lower extremity weakness | 10/11 | 4.4 | 1.5-10.3 |
| History of falls | 12/13 | 3.0 | 1.7-7.0 |
| Gait deficit | 10/12 | 2.9 | 1.3-5.6 |
| Balance deficit | 8/11 | 2.9 | 1.6-5.4 |
| Use assistive device | 8/8 | 2.6 | 1.2-4.6 |
| Visual deficit | 6/12 | 2.5 | 1.6-3.5 |
| Arthritis | 3/7 | 2.4 | 1.9-2.9 |
| Impaired ADL | 8/9 | 2.3 | 1.5-3.4 |
| Depression | 3/6 | 2.2 | 1.7-2.5 |
| Cognitive impairment | 4/11 | 1.8 | 1.0-2.3 |
| Age ≥ 80 y | 5/8 | 1.7 | 1.1-2.5 |

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

(Rubenstein & Josephson 2006)



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Resistance Training and Balance

- Presence of moderate or high-intensity strength training was not found to be associated with a greater effect of exercise on falls
- Impaired balance is likely a stronger risk factor for falls than poor muscle strength
- Strength training increases strength, but effects on balance are less clear

(Sherrington C, Whitney JC, Lord SR, et al. 2008)



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Resistance Training and Balance

- Relationship between strength and falls appears to be nonlinear
- Once a person has sufficient strength to avoid falling, further strength training may not be of additional benefit
- However, strength training provides other health benefits

(Sherrington C, Whitney JC, Lord SR, et al. 2008)



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Resistance Training and Balance

“The results of this review suggest that progressive resistance training as an isolated intervention has not to date been consistently shown to improve balance performance in older adults.”

Orr R, Raymond J, & Fiatarone Singh M. Efficacy of Progressive Resistance Training on Balance Performance in Older Adults: A Systematic Review of Randomized Controlled Trials. *Sports Med.* 2008; 38 (4): 317-143.



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Assistive Devices and Fall Prevention: What is the evidence?



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Guideline for the Prevention of Falls in Older Persons

Assistive Devices:

“There is no direct evidence that the use of assistive devices alone will prevent falls.”

“Therefore, while assistive devices may be effective elements of a multifactorial intervention, their isolated use without attention to other risk factors cannot be recommended.”

(J American Geriatrics Society, 49:664-672, 2001)



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Assistive Devices and Fall Prevention: What is the evidence?

- 30 to 50% of people abandon assistive devices shortly after receiving them
- Several studies have found that using a mobility aid is a prospective predictor of increased fall risk or is associated with falls and related injuries

(Bateni and Maki 2005)



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Understanding the Relationship Between Walking Aids and Falls in Older Adults: A Prospective Cohort Study

- Walking aids are risk factor for future falls
 - Due to possible altered spatiotemporal gait pattern, increased age, and psychotropic drug intake
- Extensive training periods and appropriate instructions on the proper use of walking aids are necessary

(de Mettelinge R, Cambier D. J of Geriatric PT; 2015 38(3): 127-132)



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Falling for Dogs

- An estimated average of 86,629 fall injuries associated with cats and dogs in the US from 2001-2006
 - 88% of injuries involved dogs



(CDC: Morbidity and Mortality Weekly Report 2009)



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Footwear and Falls

- Recommendations for Older Adults:
 - Wear shoes both inside and outside the house
 - Walking barefoot or in socks indoors are the footwear conditions associated with the greatest risk of falling

(Hatton AL, Rome K 2019; Menant et al. 2008; Mentz, Morris, Lord 2006)



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Footwear and Falls

- Recommendations for Older Adults:
 - Wear low heel shoes
 - The detrimental effects of high-heel shoes on posture, balance, and gait are numerous and this type of footwear is also associated with an increased risk of falls

(Hatton AL, Rome K 2019; Menant et al. 2008; Mentz, Morris, Lord 2006)



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Footwear and Falls

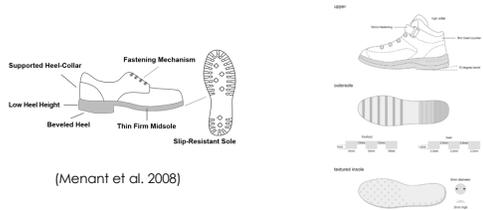
- Recommendations for Older Adults:
 - Wear thin, hard-soled shoes
 - Shoes with a softer sole (sole hardness less than shore A-33) can alter balance control during challenging gait tasks
 - A tread sole and a treaded beveled heel may further prevent slips on wet and slippery surfaces

(Menant et al. 2008)



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Footwear and Falls: Recommended shoe features for older adults



(Menant et al. 2008)

(Menz HB, Auhl M, Munteanu SE, 2017)



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Systematic Review: Shoe Characteristics and Balance

- Thin, hard-soled shoes with high collars reduce the risk of falling
- Some foot orthoses improve postural stability
 - Via a somatosensory or biomechanical effect
- The concept of what constitutes an ideal design for stable footwear to prevent falls is still somewhat obscured

(Aboutorabi et al. 2016)



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Environmental Assessment

- Fall-Related Injuries
 - 55% occur inside the home
 - 23% occur outside, but near the home
 - 22% occur in the community
- Prevalence of environmental hazards in the home is high
 - 80% of homes contain at least 1 hazard

(Pynoos J, Steinman BA, Nguyen A 2010)



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Environmental Assessment: Extrinsic Factors

- Slippery surfaces
- Inadequate lighting
- Loose or worn carpeting
- Staircases without railings
- Badly arranged or unsupportive furniture
- Clutter
- Poorly designed tubs, toilets, fixtures

(Pynoos J, Steinman BA, Nguyen A 2010)



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Conclusions

- Approximately 30% of older adults fall each year
- Fall-related injuries can result in disability, nursing home admission or death and are expensive
- Most falls result from a complex interplay between intrinsic predisposing factors and environmental hazards
- Multifactorial exercise programs can reduce fall rates in older adults



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