

The Effects of Aging on Balance



Objectives

- Understand the 4 physiological systems of balance and how they change with age.
- Gain an understanding of the comprehensive assessment required in treating patients with balance dysfunction.

How BIG is the problem?

Among people 65 years of age and older,
falls are:

- The leading cause of injury deaths
- The most common cause of hospital admissions for trauma.

(CDC 2006)

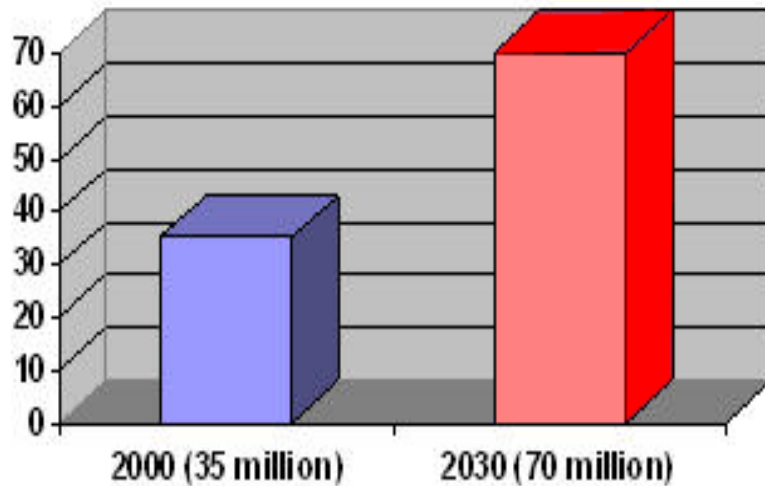
How BIG is the problem? Falls

- **More than 1/3** of adults over 65 fall each year in the United States
(Hornbrook et al. 1994; Hausdorff et al. 2001)
- In 2004, **14,900** people 65 and older died from injuries related to falls.

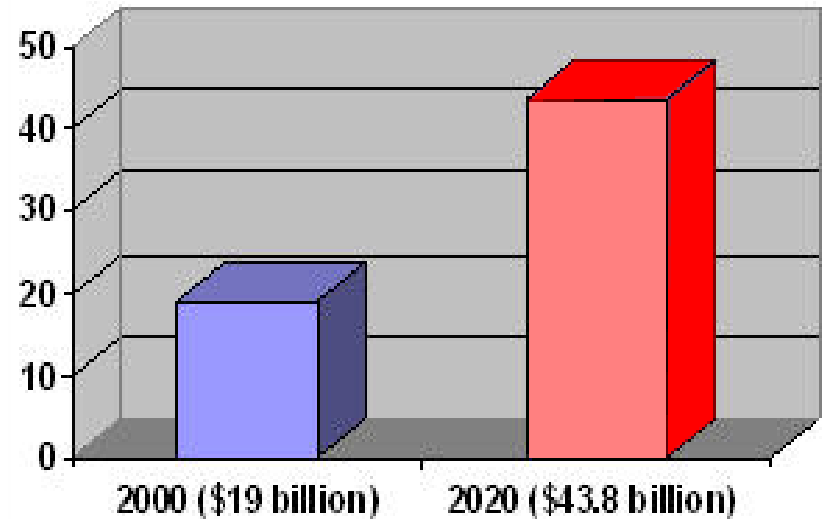
How BIG is the problem?

Healthcare Costs

U.S. Population Age 65 and Older



Annual Cost of Falls in Older Adults



(CDC statistic)

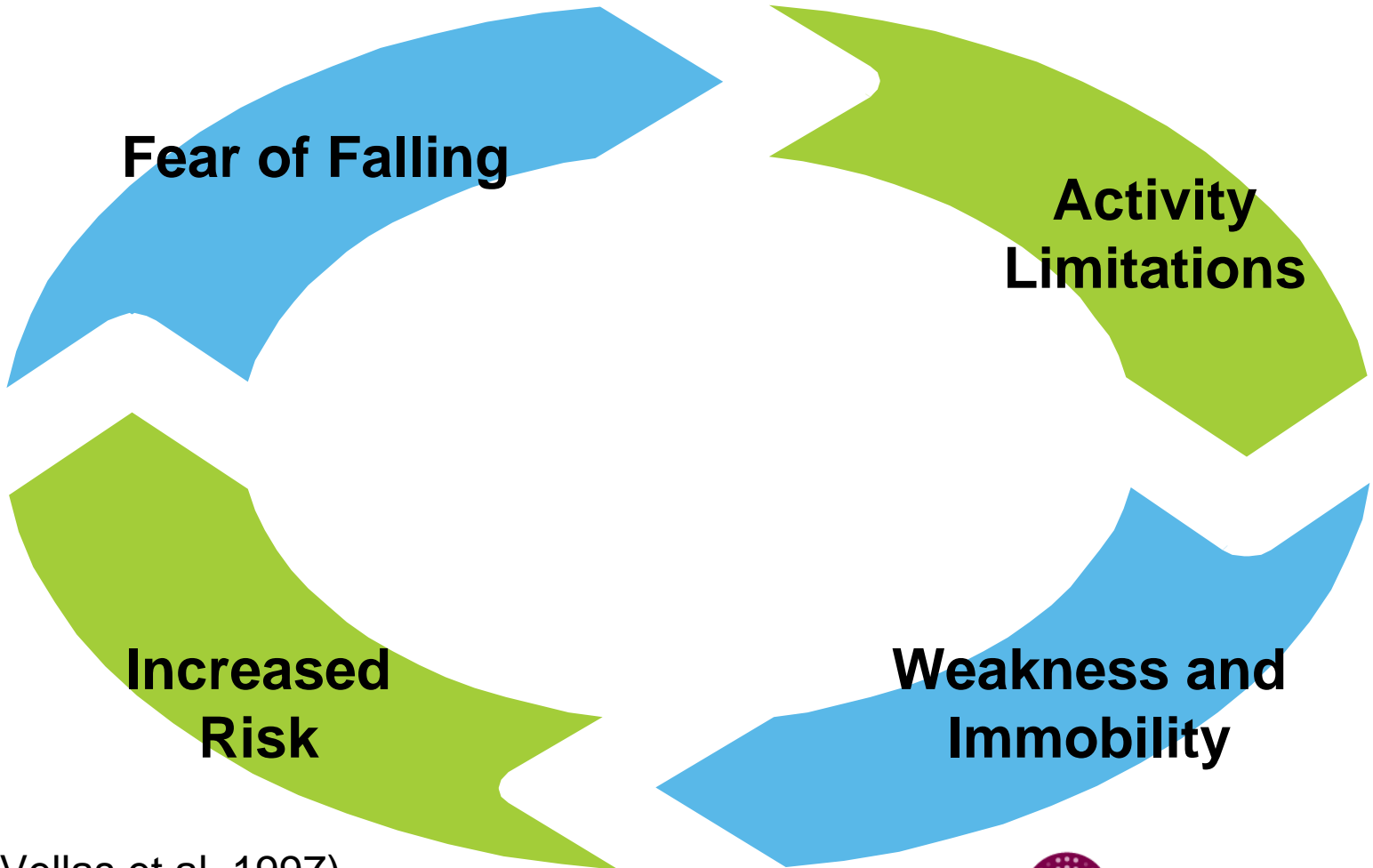
Fall-Related Injuries

- **Hips fractures** are the most common type of non-fatal injuries caused by falls.
(Stevens et al. 2006)
- More than **95%** of hip fractures among adults ages 65 and older are results of **falls** (Grisso et al. 1991).

Hip Fractures - Institutionalization

- Up to 25% of adults who lived independently before their hip fracture have to stay in a nursing home for at least one year after their injury (Magaziner et al. 2000).

The Silent Cycle of Fear



(Vellas et al. 1997).

How can you help?

- By having a basic understanding of the systems of balance, and how they change with age, you can help your patients **BEFORE** they become one of these statistics.

What Systems Control Balance?

- I. Somatosensory
- II. Vision
- III. Musculoskeletal
- IV. Vestibular

Somatosensory System

- Proprioception senses information about joint position. These sensory messages are gathered, sent to, and processed by the CNS resulting in continuous postural modifications.

Age related changes

- 20% of older Americans experience peripheral neuropathy (1/2 related to DM)
(Richardson, JK 1996)
- Peripheral neuropathy results in numbness and pain, most notably in the feet.
- Reflexes are diminished
- Muscles of the feet and lower legs can atrophy



Peripheral Neuropathy

- People with peripheral neuropathy are 20 times more likely to fall than those without (Richardson, JK 1996).
- Decreased ability to single leg stand which effects:
 - Stair climbing
 - Dressing
 - Gait speed
 - Getting into and out of the bathtub

Treatment Strategies for PN

- Modalities to increase circulation (IFR)
- Recommendations for proper footwear including orthotics
- Exercises that improve strength and mobility in ankles.
- Maximizing vision strategies to substitute for lost sensation
- Recommendations for use of a cane or walker.

Vision

- Provides input to the central nervous system with respect to the position of the body within its surrounding environment
- Not absolutely necessary for balance as evidenced by the ability to maintain balance in the dark or with our eyes closed; but will always be used.

Age related changes

- 80% of people over 65 need glasses to be independent in their daily activities
- Macular degeneration, glaucoma, diabetic retinopathy...
- Visual changes can happen so slowly that the person may not even be aware they are unable to accurately “see” their surroundings.

Visual Preference

- People tend to rely on vision for balance, which can put them at a higher risk for falls
- Statistically, the highest incidence of falls happens when going to the bathroom at night



Treatment Strategies

Areas we can affect:

- Visual Preference
 - The focus of our intervention is to facilitate the integration of all the systems of balance by challenging the ability to use vision for postural correction. Safe Strides strives to decrease visual preference.
- Gaze Stabilization
 - Through therapeutic interventions we can improve the ability to stabilize the eyes while the head and body are in motion.

Musculoskeletal System

- This system includes the bones, muscles, tendons, ligaments and joints.

Age related changes

- Stiffness occurs more quickly and easily due to cross linking of collagen
- This natural degeneration causes osteoporotic postural changes, decreased joint motion and muscle weakness.

Treatment Strategies

- There are increasing numbers of studies enumerating the benefits of “keeping fit” as a line of defense against balance problems related to changes in the musculoskeletal system.
- Strengthening and flexibility exercises are essential in slowing the effects of aging on the musculoskeletal system.

“Stand Up and Be Strong” - APTA

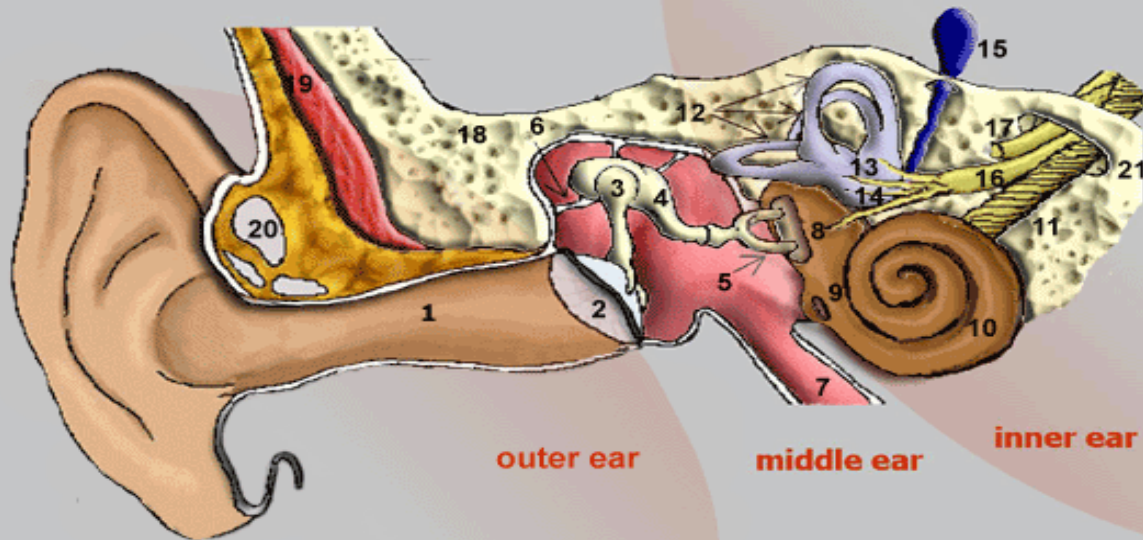
- Assessment to determine risk of falling
 - Based upon leg strength
 - Repetitive sit-to-stand
- Exercises for you and your patients
 - Repetitive sit-to-stand
 - Side Hip Raise

Vestibular System

- Made up of structures in the inner ear and the brain, that help a person perceive and respond to movement .
- Impairment can cause symptoms of nausea and vertigo, disequilibrium and blurred vision.

Ear diagram

©Vestibular Disorders Association



- | | | |
|-----------------------------------|-------------------------|---|
| 1. external auditory canal | 8. oval window | 15. endolymphatic sac |
| 2. tympanic membrane
(eardrum) | 9. round window | 16. vestibular nerve |
| 3. malleus | 10. cochlea | 17. facial nerve |
| 4. incus | 11. cochlear nerve | 18. temporal bone |
| 5. stapes | 12. semicircular canals | 19. muscle |
| 6. ligament | 13. utricle | 20. cartilage |
| 7. Eustachian tube | 14. saccule | 21. internal auditory
canal to brain |



Age related changes

Central

MS, CVA, anxiety...

VS.

Peripheral

Vestibular hypofunction, BPPV, neuritis,
labyrinthitis...

Treatment Strategies

- Assessment of vestibular system to determine the cause of symptoms
- Positional treatments, if indicated.
- Symptom-inducing exercises to habituate the vestibular system
- Limiting the availability of other systems to intervene, thus challenging the vestibular system to interpret equilibrium

What can you do?

Understand how external factors affect the systems of balance

Prevention of Falls-Medications

- Encourage your patients to have their list of medications reviewed on a regular basis.
 - Some medicines, or combinations of medicines can cause drowsiness, dizziness weakness, hypotension, dehydration and confusion.
 - Don't forget about the over-the-counter medicines! (CDC)
 - Understand the depressive effects on the CNS of vestibular suppressants.

Prevention of Falls-Vision

- Annual visual exams
- Avoid glare when moving from a dark area into a brighter one.
- Consider lighting options to improve safety
- Use contrasting colors to help distinguish changing surfaces, step edges, and similarly colored furnishings.

Prevention of Falls-Environmental

- Have the conversation:
 - About ½ of all falls happen at home. To make your patient's home safer:
 - Remove clutter from stairs and places where you walk
 - Remove small throw rugs or use double-sided tape to keep the rugs from slipping
 - Keep items you use often in cabinets you can reach easily without using a step stool

(CDC)

Prevention of Falls-Environmental

- HOME SAFER (cont'd)
 - Have grab bars put in next to your toilet and in the tub or shower
 - Use non-slip mats in the bathtub and shower floors
 - Maintain adaptive equipment and wheelchairs
 - Improve the lighting in your home
 - Wear shoes both inside and outside the house, and make sure they are properly fitting.

Proper Footwear



Prevention of Falls-Activity

- **EXERCISE REGULARLY**
 - Exercise is one of the most important ways to lower your chances of falling.
 - Exercise programs like Tai Chi increase strength and balance, and group exercise fosters socialization.
 - Everyone should be doing some sort of stretching, strengthening and cardiovascular exercise every day.

Know your Resources

The Continuum of Care

- Hospitalization
- TCU
- Medicare A Homecare: PT, OT, ST
- Medicare B: In the home/outpatient
- Private Pay
- Home Exercise Program-independent or caregiver- assisted

Thanks for having us!

Questions?

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