

Addressing Falls in Your Clinical Practice

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Patient Case

86 yo F, assisted living resident

- Parkinson's disease x7 years, mild dementia, osteoporosis, hypertension, osteoarthritis
- Three falls past 6 months, all when not using walker
- Enjoys puzzles but does no exercise for strength and balance
- Sinemet, Fosamax, Lisinopril, Calcium, Vicodin PRN pain



Patient Case (cont'd)

- Visual acuity 20/70 L, 20/30 R
- BP standing: 143/66; feels dizzy sitting and standing, worse standing
- Unable to arise from chair without using her arms
- Unable to maintain balance in narrow base of support (feet touching together)
- Gait very slow, shuffling, but steady with front-wheeled walker



Presentation Overview

- Burden and impact of falls
- Causes of falls and fall injuries
- Falls screening and fall risk assessment
- Evidence-based management of fall risk

What do we mean by a fall?

*Coming to rest unintentionally on the ground or lower level **

- *Not due to an acute overwhelming event (seizure, stroke) or external event (push, shove)*

* Kellogg International Work group. *Dan Med Bull* 1987;34:1-24.

Burden and Impact of Falls

- 1 in 3 people 65+ fall every year¹
- Leading cause of fatal and nonfatal injuries²
- 10% result in serious injury³
- 2013: 2.5 million older people treated in EDs²
- Direct medical costs: >\$30 billion annually⁴
- Only 1 in 4 who fall discuss with doctor⁴

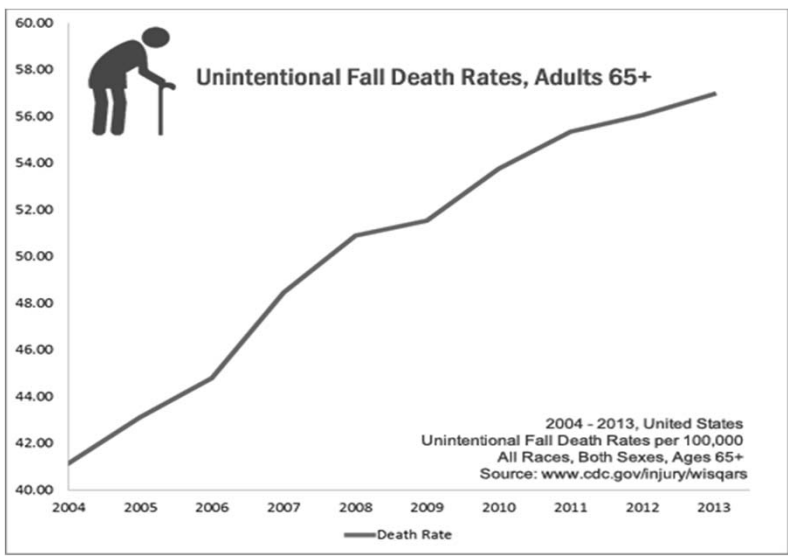
¹ Tromp et al. *J Clin Epi* 2001.

² CDC *WISQARS*.

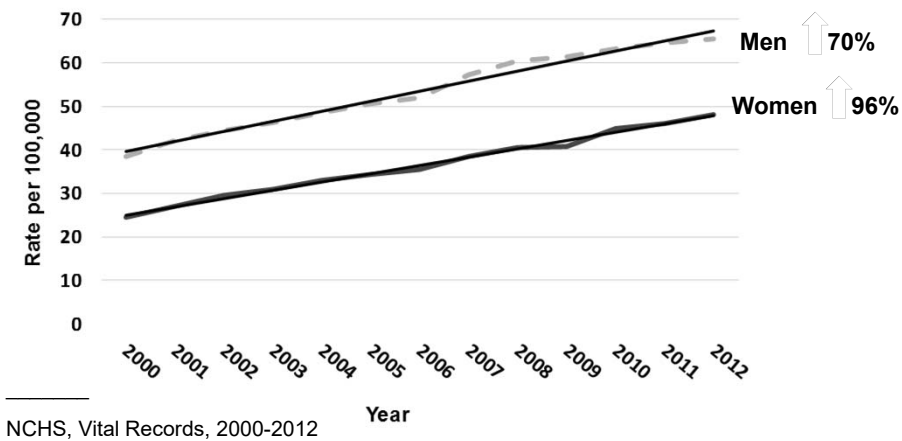
³ Tinetti et al. *J Am Geriatr Soc* 1995.

⁴ Stevens. *Inj Prev* 2006.

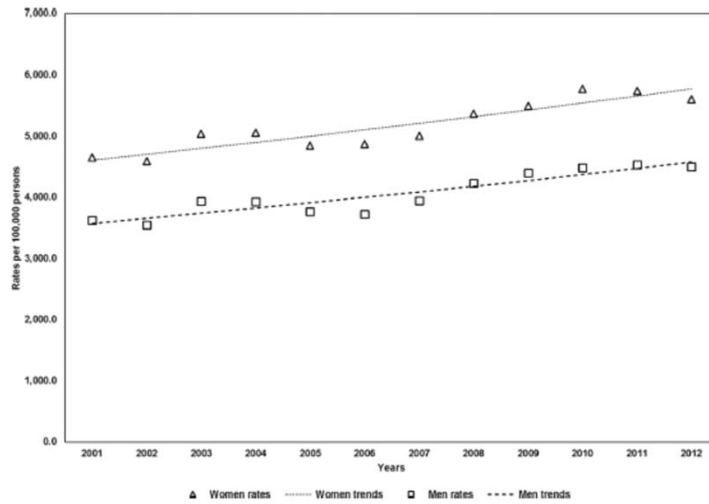
Trends in Fall Death Rates



Age-Adjusted Fall Death Rates, by Sex, for Persons Aged 65+ (2000-2012)

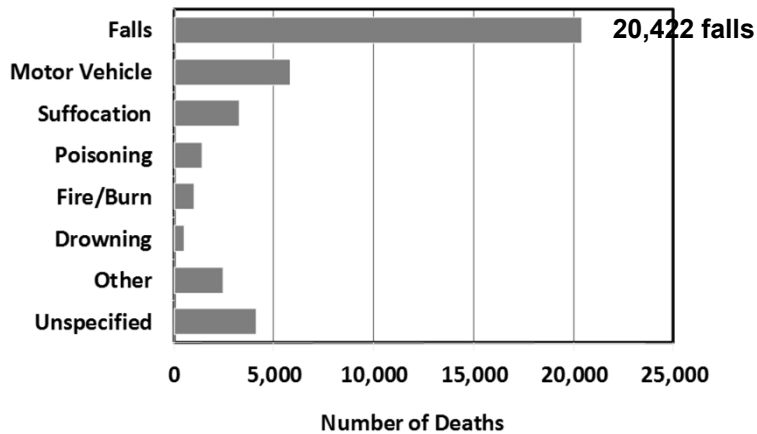


Age-Adjusted Fall Injury Rates for Adults 65+ Treated in EDs (2001-2012)



Leading Causes of Death from Injuries Among Persons 65+

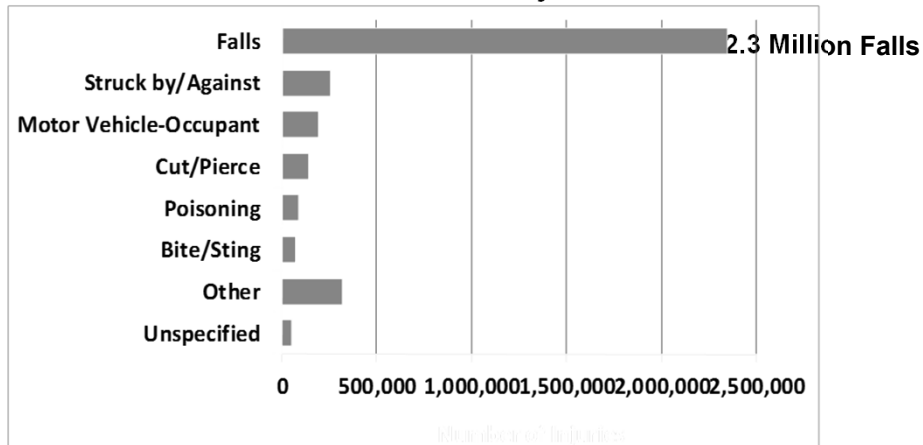
Total = 39,111 deaths



NCHS, Vital Records, 2009

Leading Causes of Nonfatal Injuries Among Persons 65+

Total = 3.7 million injuries



NEISS-AIP, 2010

What do all these statistics translate to for an individual?

- Every 22 minutes, an older adult *dies* from a fall injury
- Every 13 seconds, an older adult is treated in an *emergency department* for a fall
- Every day, 66 older adults *die* from a fall



Falls Threaten Well-Being, Independence, and Quality of Life

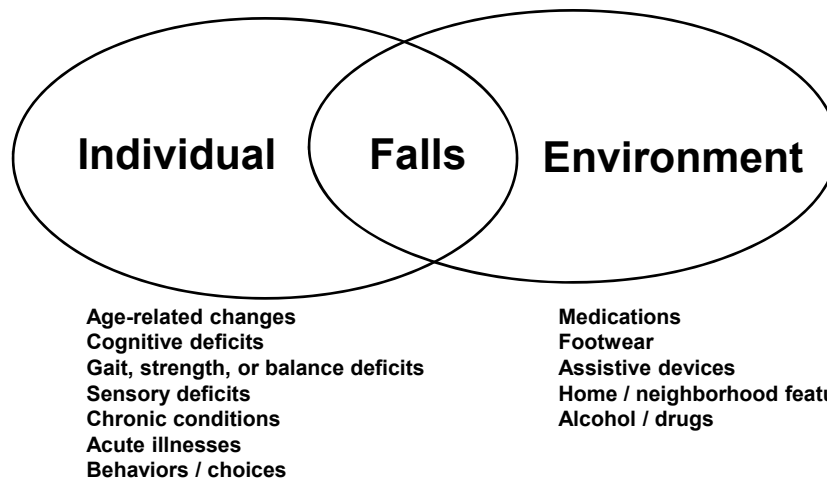
- Fear / loss of confidence
- Activity restriction
- Functional decline
- New or increased dependency
- Diminished quality of life
- Nursing home placement
 - 1 fall increases risk x3
 - 1 injurious fall increases risk x10



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- *Causes of falls and fall injuries*
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Falls result from an interaction between factors in the individual (intrinsic) and factors in the environment (extrinsic)



Age-Related Changes in Gait, Strength, and Balance

- **Gait**: Decreased step height; altered gait pattern (wide- or narrow-based, shortened stride, flexed posture)
- **Strength**: Modest decline from peak in 20s until 5th decade, then rapid decline thereafter
- **Balance**: Diminished proprioception, slowed righting reflexes, increased postural sway

Age-Related Changes in Vision

- **Pupil: decreased diameter; decreased response to light variations**
 - Clinical effects: harder to see in dim light; longer to adapt to changes in illumination
- **Lens: thickening, yellowing and loss of elasticity**
 - Clinical effects: harder to see contrast and sharpness of objects and colors

Chronic Conditions

- Diseases of the eye
- Cardiovascular (carotid sinus hypersensitivity, vasovagal syndrome, bradyarrhythmias)
- Musculoskeletal (arthritis, foot deformities, persistent pain)
- Neurologic (dementia, Parkinson's, peripheral neuropathy, stroke)
- Urologic (incontinence, nocturia)
- Insomnia / sleep deprivation

Medications

- **Number of medications (≥ 4)**
- **Recent dose changes**
- **Certain medication classes**



Tinetti et al. *N Eng J Med* 2003;348:42.

Table 2 Medications that increase the risk of falls	
Medication Class	Odds Ratio (95% CI)
Psychoactive Medications	
Antidepressants	1.68 (1.47–1.91)
Antipsychotics	1.59 (1.37–1.83)
Sedative hypnotics	1.47 (1.35–1.62)
Benzodiazepines	1.57 (1.43–1.72)
Other Medications	
Antihypertensives	1.24 (1.01–1.50)
Nonsteroidal antiinflammatory drugs	1.21 (1.01–1.44)
Diuretics	1.07 (1.01–1.14)

Abbreviation: CI, confidence interval.

Data from Woolcott JC, Richardson KJ, Wiens MO, et al. Meta-analysis of the impact of 9 medication classes on falls in elderly persons. *Arch Intern Med* 2009;169:1957.

Phelan et al. *Med Clin N Am* 2015;99:281.

Risk of Injury Associated with Opioid Use in Older Adults

David Buckeridge, MD, PhD,^{*†} Allen Huang, MD, CM,[†] James Hanley, PhD,^{*†} Arnel Kelome, PhD,[‡] Kristen Reidel, BSc,^{*} Aman Verma, MSc,^{*} Nancy Winslade, PharmD, MSc,[†] and Robyn Tamblyn, PhD^{*†}

Opioids	HR (95% CI)	P
Low-potency opioids*	1.36 (1.33–1.39)	<.001
Codeine combinations	2.27 (2.21–2.34)	<.001
Codeine	1.10 (1.03–1.17)	<.001
Oxycodone	1.19 (1.09–1.30)	<.001
Intermediate-potency opioids	1.05 (1.02–1.07)	<.001
High-potency opioids	1.06 (0.77–1.46)	.73

Adjusted for concurrent use of CNS-active medications and person-level risk factors (age, gender, cognitive impairment, prior injury, gait, strength and balance problems).

Buckeridge et al. *J Am Geriatr Soc* 2010;58:1664.

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	HR (95% CI)	P
Anxiolytics, sedatives, and hypnotics		
Long-acting benzodiazepines	1.15 (1.03–1.27)	.01
Intermediate-acting benzodiazepines	1.07 (1.03–1.11)	<.001
Other anxiolytics and hypnotics	1.12 (0.92–1.36)	.27
Antidepressants		
Selective serotonin reuptake inhibitors and selective serotonin norepinephrine reuptake inhibitors	1.28 (1.24–1.33)	<.001
Tricyclics	1.12 (0.97–1.30)	.12
Other antidepressants	1.03 (0.91–1.16)	.66
Other sedating drugs		
Muscles relaxants	1.13 (0.98–1.31)	.10
Anticonvulsants	1.31 (1.19–1.44)	<.001
Antipsychotics	1.24 (1.17–1.32)	<.001
Antihistamines	1.13 (1.01–1.26)	.04

Buckeridge et al. *J Am Geriatr Soc* 2010;58:1664.

Orthostatic Hypotension

- Reduction in systolic BP of at least 20 mm Hg within 3 *minutes* of standing
- Affects 30% of community dwelling elders
- Symptoms: Dizzy, lightheaded, blurred vision, weakness, headache, fatigue, falls, syncope
- Causes
 - Neurogenic (Parkinson's disease, diabetic neuropathy)
 - Non-neurogenic (aortic stenosis, volume depletion, vasodilation)

Footwear

- Independent risk factors for falling
 - Going barefoot or in socks indoors
 - Shoes with inadequate fixation (ie, no laces, straps, or buckles)
 - Higher heels
 - Reduced sole contact area

Koepsell et al. *J Am Geriatr Soc* 2004;52:1495.

Tencer et al. *J Am Geriatr Soc* 2004;52:1840.

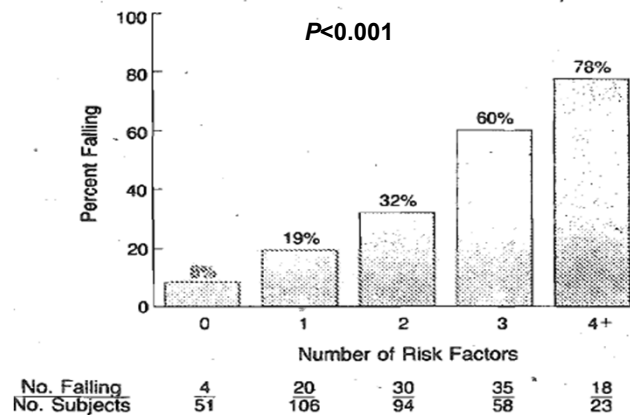
Foot Problems

- Independent risk factors for falling
 - Foot pain
 - Reduced range of motion
 - Toe weakness
 - Toe deformity

Menz et al. J Gerontol 2006;61:866.

Mickle et al. Clin Biomech 2009;24:787.

Risk of Falling Increases with Number of Risk Factors

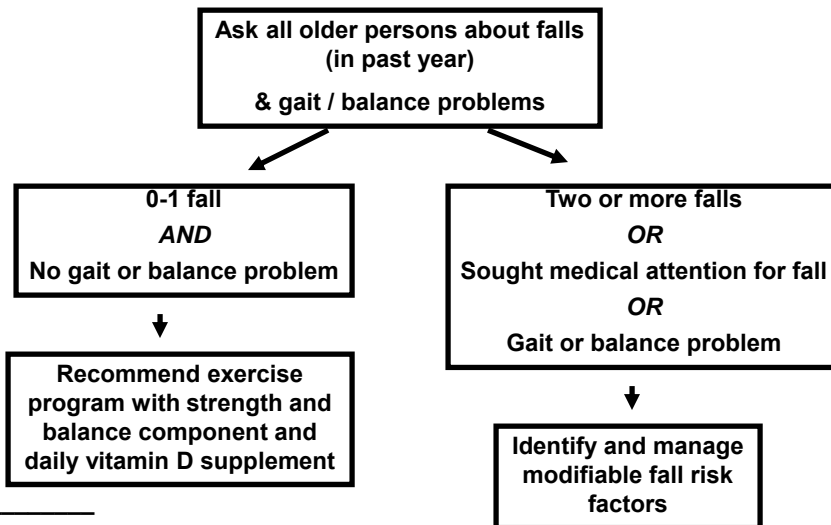


Tinetti et al. *NEJM* 1988;319:1701.

Presentation Overview

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- *Falls screening and fall risk assessment*
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Fall Prevention: Clinical Care Algorithm



AGS/BGS. *J Am Geriatr Soc* 2011;59:148.
Moyer et al. *Ann Intern Med* 2012;157:197.

Routine Screening Questions

- **Have you fallen in the past year?**
- **Do you feel unsteady when standing or walking?**
- **Do you worry about falling?**



“Are You Asking Your Older Patients the Right Questions?”

<http://www.medscape.com/viewarticle/841020> (video)

Fall History

- Fall circumstances
 - Symptoms (prodromal – e.g., dizziness)
 - Prior falls
 - Location
 - Activity
 - Timing
- Able to get up from a fall?
 - Only ½ of those who fall can get up without help

Fall-Focused Physical Examination

- **Orthostatic blood pressure**
- **Distance visual acuity**
- **Cardiac exam (rate, rhythm, murmurs)**
- **Gait, strength, and balance assessment**
- **Musculoskeletal exam (back, lower extremities, feet)**
- **Neurologic exam**
(cognitive screen, sensation, proprioception; muscle bulk, tone, reflexes, range of motion, observe for tremor)

Signs of Gait, Strength, Balance Deficits

- **Slow pace**
- **Short strides, shuffling feet**
- **Drops (“plops”) into a chair**
- **Rocks to get out of a chair or uses arms to get up**
- **Trips, staggers, or loses balance when walking or turning**
- **Using walls and/or furniture to steady self**
- **Requires multiple attempts or human help to change position**
- **Loses balance reaching to pick up an object or open a door or drawer**

Patient Case: Initial Assessment Summary

- Modifiable fall risk factors:
 - Poor vision
 - Postural dizziness
 - Gait, strength and balance problems



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- *Evidence-based management of fall risk*

Managing Fall Risk: What are the Goals?

- Reduce chances of falling: address modifiable fall risk factors
- Reduce risk of injury from falls
- Maintain highest possible level of mobility
- Ensure ongoing follow-up

Identify and Manage Modifiable Fall Risk Factors

- **Medications**
- **Postural hypotension / postural dizziness**
- **Gait, strength, and balance deficits**
- **Home/environment**
- **Feet and footwear**
- **Vision**

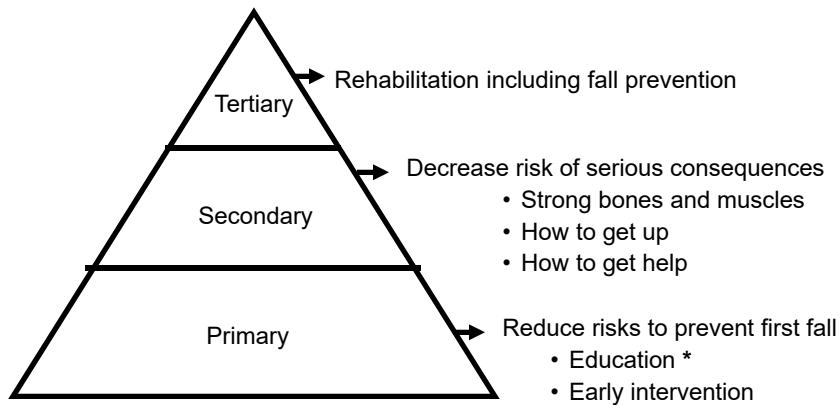
Multifactorial Fall Risk Assessment

- Individually tailored, one-on-one clinical evaluation of *modifiable fall risk factors*, with treatments prescribed to address identified risk factors
 - Gait and balance abnormalities
 - Lower extremity weakness
 - Postural hypotension or dizziness
 - Medications
 - Vision
 - Home environment
 - Feet and footwear
- Targets persons at *high risk* of falling

Multifactorial Fall Risk Assessment

- Pooled analysis of RCTs: **24% reduction in fall rates (RaR=0.76, 95% CI, 0.67-0.86)**
Robertson et al. *JAMA* 2013;309:1406.
- Quasi-experimental study: **9% reduction in serious fall-related injuries (adj RaR=0.91, CI, 0.88-0.94)**
Tinetti et al. *New Engl J Med* 2008;359:252.
- Other benefits from trials
 - Improved physical functioning
 - Enhanced falls self-efficacy
 - Reduction in fear of falling
 - Improved health-related quality of life
 - Cost-effective

Levels of Prevention



* Education necessary but not sufficient to reduce fall rate

Match Extent of Intervention to Severity of Fall Risk

- **Low Risk**
 - Fall prevention education
 - Vitamin D supplementation
 - Strength and balance exercise
- **Moderate Risk**
 - Fall prevention education
 - Medication modifications + vitamin D
 - Strength and balance exercise
- **High Risk: multifactorial**
 - Fall prevention education
 - Medication modifications + Vitamin D
 - Strength and balance exercise
 - Manage hypotension
 - Address foot problems
 - Optimize vision
 - Optimize home safety



Review and Reduce Medications

- **Evidence supports withdrawal of psychotropic medications (RaR 0.34, 0.16-0.73)**
AGS/BGS. *J Am Geriatr Soc* 2011;59:148.
Robertson et al. *JAMA* 2013;309:1406.
- **No evidence to suggest serious harms**
Moyer et al. *Ann Intern Med* 2012;157:197.
- **What if a medication is indicated?**
 - **Attempt to reduce dose to lowest effective**
 - **Assess other fall risk factors and intervene to reduce risk of falling**

Supplement Vitamin D

- **Supplementation reduces fall risk among assisted living residents even in those not D deficient** Flicker et al. *J Am Geriatr Soc* 2005;53:1881.
- **Direct effects on muscle strength (binds to receptors in muscle tissue)**
 - **<20 ng/ml - increased postural sway**
 - **<12 ng/ml - decreased muscle strength**
 - **<10 ng/mL - increased fall risk**

Vitamin D Supplementation

- **US Preventive Services Task Force “Primary care-relevant interventions to prevent falling in older adults: a systematic evidence review”** Moyer et al. *Ann Intern Med* 2012;157:197.
 - 9 RCTs of vitamin D supplementation in persons aged 65+
 - All but 2 trials used cholecalciferol
 - Median daily dose was 800 IU
 - Vitamin D reduced risk of falling 17% (RR=0.83, 95% CI, 0.77 to 0.89)

American Geriatrics Society Consensus Statement on Vitamin D for Prevention of Falls

- Recommend 1,000 IU vitamin D/day and calcium for adults aged 65+
- Strategies to optimize vitamin D status
 - Recommend average daily vitamin D intake from all sources of 4,000 IU
 - Individualize supplementation adjusting for sun exposure, skin pigmentation, and obesity
 - Monitoring 25 (OH) D levels is unnecessary except in certain circumstances (e.g., obesity, malabsorption syndromes, P450 inducer meds)
 - Do not give vitamin D with vitamin D binders (fiber, cholestyramine) AGS Workgroup. *JAGS* 2014;62:147.

Encourage Strength and Balance Exercise

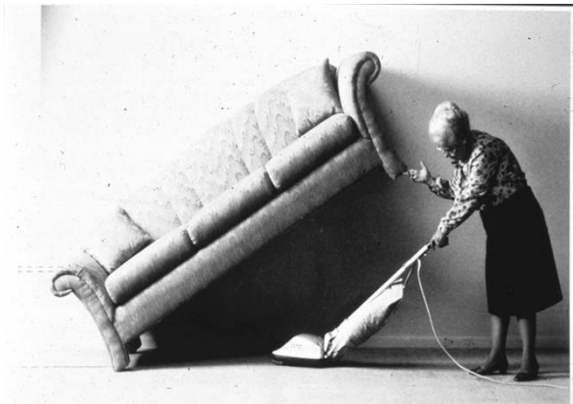
- Exercise that involves progressive balance and strength training reduces risk of falling ($NNT=16$) (RR 0.87, 95% CI, 0.81-0.94)
Moyer et al. Ann Intern Med 2012;157:197.
- Fall-prevention exercise programs reduce fall-related injuries, including most severe injuries
 - Any injurious falls: RR 0.63 (0.51-0.77)
 - Falls resulting in medical care: RR 0.70 (0.54-0.92)
 - Serious injurious falls: 0.57 (0.36-0.90)
 - Fall-related fractures: RR 0.39 (0.22-0.66)

El-Khoury et al. BMJ 2013;347:f6234.

Walking is not enough!

Easy Steps
Walking Trial:

No difference
in fall rates,
proportions
of fallers, or
recurrent
fallers



Voukelatos et al. Age Ageing 2015;0:1.

Keys to Fall-Prevention Exercise

- Improving balance is essential to preventing falls
- Exercises must be done in standing
- Balance must be safely challenged in a progressive manner (decreased support, increased maneuvering)
- Challenge level must be at least moderate
- Must practice exercises 2-3 times per week
- Benefits won't be apparent for several months (dose = 50 hours)
- Practice must be long-term for sustained effect

Sherrington et al. *J Am Geriatr Soc* 2008;56:2234.

Balance Challenge

- **Moderate challenge:** At least *two* of three modes of balance exercise are included
 - Movement around center of mass
 - Narrow base of support
 - Minimal upper extremity assist
- **High challenge:** includes all *three*

Schubert. *J Geriatr Phys Ther* 2011;34:100.

Evidence-Based Options for Fall-Prevention Exercise

- **Community classes**
 - **Tai Chi**
- **Home-based**
 - **Otago, LiFE**
- **Physical therapy referral**



Community-Based Group Exercise Programs

- Tai Chi
 - Tai Ji Quan: Moving for Better Balance®
 - Simplified Tai Chi
 - Central Sydney Tai Chi
- Falls Management Exercise (FaME) Program
- Veterans Affairs Group Exercise Program
- Australian Group Exercise Program
- Erlangen Fitness Program
- Stay Safe, Stay Active
- Adapted Physical Activity Program
- Music-Based Multitask Exercise Program
- Multi-target Stepping Program
- Senior Fitness and Prevention (SEFIP)

Stevens. *CDC Compendium*, 3rd edition, 2015.

Tai Ji Quan: Moving for Better Balance®

- Eight forms derived from Yang style Tai Chi
- Extensively studied
- Reduces falls, fall-related injuries, and fear of falling
- Effective in patients with Parkinson's disease
- Mini-therapeutic movements for individualized, rehab therapist-delivered training and home practice



Li et al. *J Gerontol* 2005;60A:187.

Li et al. *New Eng J Med* 2012;366:511.

Home-Based Exercise

- Otago Exercise Program
 - Individually tailored strength and balance exercises of increasing difficulty, combined with a walking program
 - Extensively tested
 - CDC funding dissemination in USA
- LiFE Program
 - Strength and balance exercises incorporated into daily routine
 - DVD of program being developed

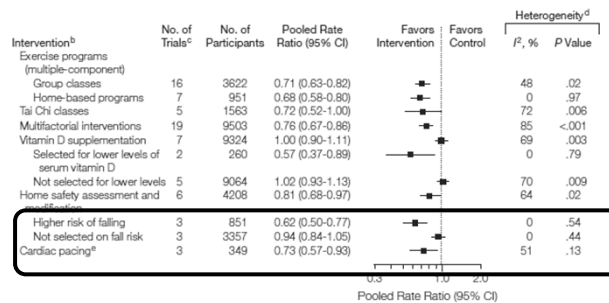
www.med.unc.edu/aging/cgec/exercise-program

Clemson et al. *BMJ* 2012;345:e4547.

Address Home/Environmental Safety

Figure. Rate Ratios (All Falls) for Selected Fall-Prevention Interventions vs Control in Community-Dwelling Older People^a

Home safety modifications reduce falls in at-risk older adults



^aBased on data from Gillespie LD, Robertson MC, Gillespie WJ, et al. Interventions for preventing falls in older people living in the community. *Cochrane Database Sys Rev.* 2012;(9):CD007146. doi:10.1002

Robertson et al. *JAMA* 2013;309:1406.
Gillespie LD et al. *Cochrane Rev* 2012.

Home/Environment/Behavior

- Identify and prioritize hazards collaboratively; enlist family support
- Encourage protective adaptations and avoidance of risky behaviors
- Incorporate exercises that help maintain functional mobility into daily routine

Peterson et al. *OT Practice* 2008;13:CE1.

Home Safety Intervention is Effective for People with Low Vision

- **VIP trial**
 - **Community-dwelling adults aged 75+ with severe visual impairment**
 - **Design: home safety by OT, exercise (Otago)+vitamin D, both interventions, social visit control group**
 - **Home safety but NOT exercise programme reduced falls (IRR=0.59, 95% CI 0.42-0.83) and was cost-effective; neither reduced fall-related injuries**

Campbell et al. *BMJ* 2005;331:817.

Address Sensory Deficits

- **Single lens distance glasses in wearers of multifocal lenses who regularly walk outdoors**

Haran MJ et al. *BMJ* 2010;340:c2265.

- **Cataract surgery**
 - **Expedited first cataract surgery reduced fall rates by 34% (RaR 0.66, 0.45-0.96) and fractures**

Harwood et al. *Brit J Ophth* 2005;89:53.

- **Hearing aids improve postural stability in adults aged 65+ with hearing loss**

Rumalla et al. *Laryngoscope* 2015;125:720.

Address Feet and Footwear

- **Multifaceted podiatric intervention trial**
 - **Community-dwelling adults aged 65+ with foot pain ≥ 1 day in past month with pain-related disability and increased fall risk**
 - **Intervention: multifaceted podiatric intervention vs. routine podiatry care alone x12 months**
 - **Custom orthotics, footwear review and advice, foot and ankle exercises, fall prevention education, 12 months routine podiatry care**
 - **Reduced falls 31% (IRR=0.64, 95% CI 0.45-0.91)**

Spink et al. *BMJ* 2011;342:d3411.

Falls from the Elder's Perspective

- **Prevalent beliefs**
 - Falls are inevitable as people get old
 - Falls happen by accident, and accidents can't be prevented
 - Falling will happen to someone else but not me
 - Walking for exercise is sufficient
- **Behaviors**
 - Few engage in proven behaviors to reduce fall risk after a fall (most report "being more careful")
 - Care-seeking to reduce chances of falling is driven by perceived need

Calhoun et al. *J Aging Res* 2011; Epub 2011 May 12.

Behavior Change

“Have you ever thought you might be at risk for falling?”

- **Precontemplation: “No”**
- **Contemplation: “...hope that doesn’t happen to me”**
- **Action: “Yes, I am worried, what can I do?”**

Prochaska J. *Changing for Good*.

What facilitates engagement in fall prevention behaviors?

- Recommendation of healthcare provider
- Range of options and involvement in decision-making
- Emphasis on life-enhancing effects
- Social component (enjoyable/fun)

Bunn et al. *Ageing Soc* 2008;28:449.

Resources for Clinicians

Source	Item	Location
CDC	Compendium of Effective Fall Prevention Programs	www.cdc.gov/homeandcommunitybased/recreational-safety/falls/compendium.html
CDC	STEADI tool kit	www.cdc.gov/steady/index.html
National Institute on Aging	Go4Life DVD and booklet	http://go4life.nia.nih.gov/
YMCA	Y-Tai Chi	www.ymca.net
Local community / senior centers	Exercise classes	—

STEADI Toolkit

www.cdc.gov/steady/index.html

Supporting
Clinical
Screening, Risk
Assessment,
Treatment, &
Follow-up



Centers for Disease
Control and Prevention
National Center for Injury
Prevention and Control

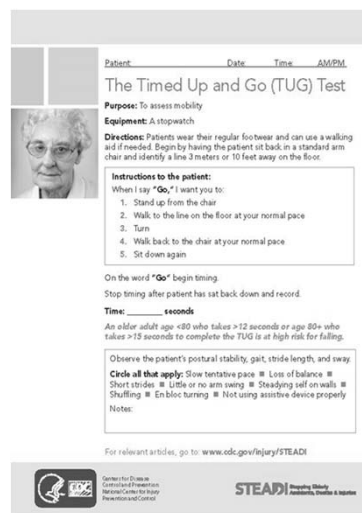
STEADI Staying Steady
Avoiding Falls & Injuries

STEAD Stopping Elderly
Accidents, Deaths & Injuries

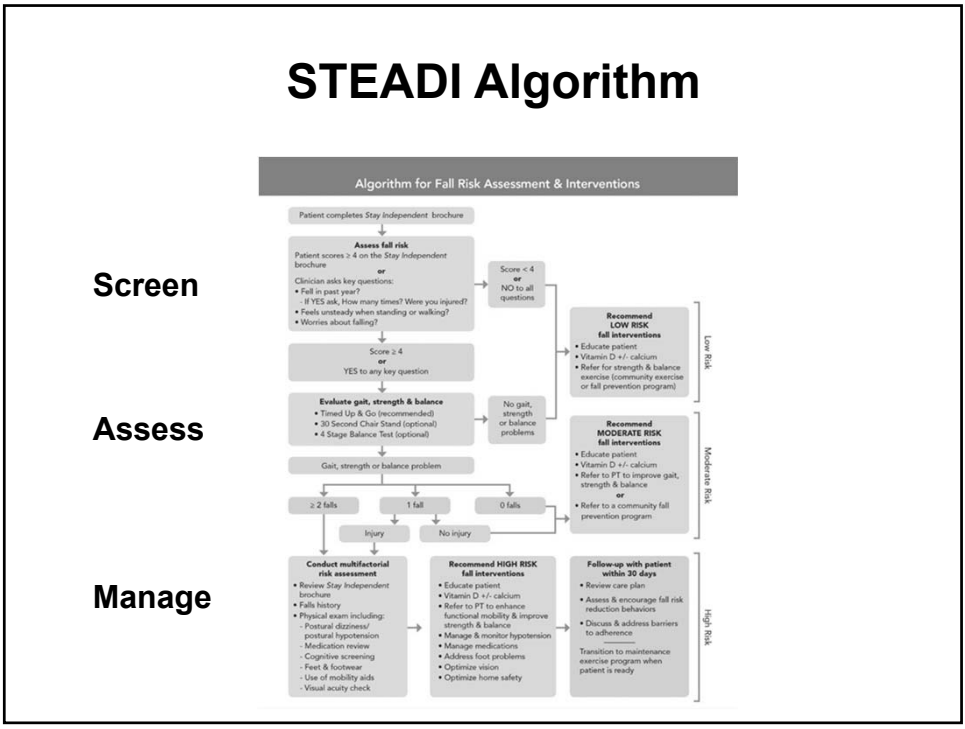
- **Materials to assist health care providers provide fall risk assessment and management**
- **Developed with input from clinicians**
- **Available in hard copy and for download from the CDC website**

Tool Kit Contents

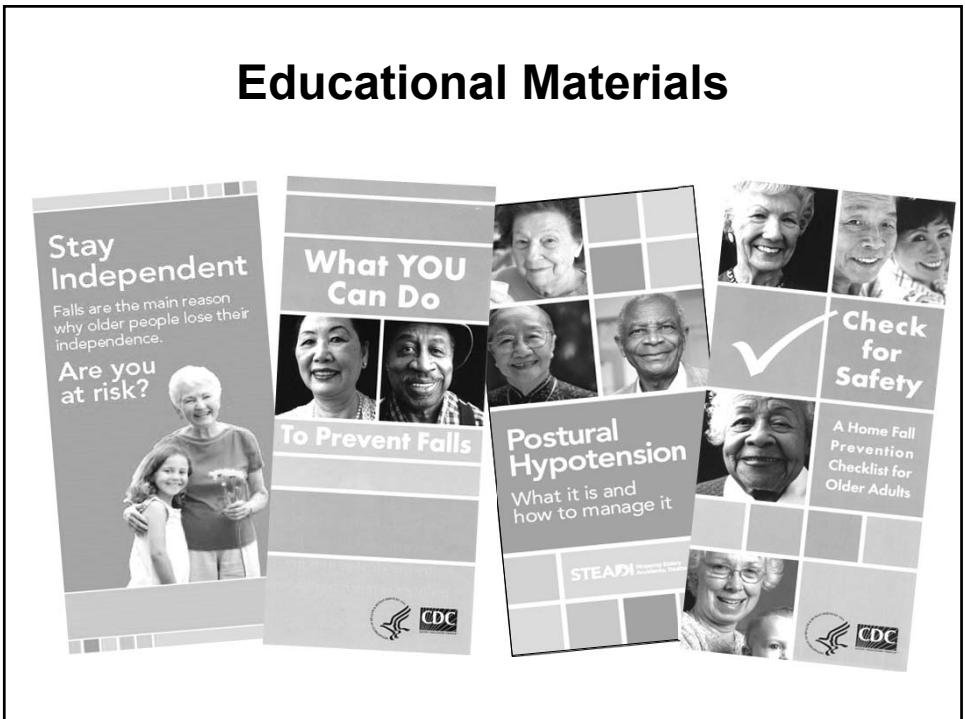
- **Algorithm to guide assessment and interventions**
- **Videos and written descriptions of gait and balance tests**
- **Talking about fall prevention based on stage of readiness to make behavior change**
- **Educational brochures**



STEADI Algorithm



Educational Materials



Fall Prevention Using STEADI – How-To

- **Online, self-paced, free, interactive, continuing education course**
- **Clinical decision support tools for electronic health records (Epic, GE Centricity)**
 - **Falls screening, risk assessment, and management**
 - **Medication review and reduction**

Our Case Patient: Will She Benefit from Preventive Interventions?

YES! She can be expected to benefit substantially from interventions to reduce fall risk, fall frequency, and injurious falls

- **She is among the oldest-old (aged 85+)**
- **She has fallen before**
- **Her dementia is mild**

Robertson et al. *J Am Geriatr Soc* 2002;50:905.

Patient Case: Initial Management

- **Strengths:** engages, asks questions, motivated/ready to make changes
- **Initial recommendations:**
 - Update eye exam
 - Change positions slowly, stand for a few moments before walking, do fist clenches and ankle pumps 10x prior to standing
 - Add daily vitamin D (1,000 IU)
 - Learn exercises for strength and balance for home practice
 - Use walker at all times



Summary and Conclusions

- Falls...
 - Common and usually multifactorial
 - Associated with adverse consequences
 - Often preventable
- Screen at least annually to identify those who need further assessment and management of modifiable fall risk factors
- Recommend regular exercise that includes strength and balance along with vitamin D supplementation for everyone else

***“Falls are a public
health problem that
is largely
Preventable”***

***Judy Stevens, PhD
National Center for Injury Prevention
and Control
CDC***

