CME CREDIT ***EDUCATIONAL OBJECTIVE:*** Readers will assess their elderly patients' risk of falling and intervene appropriately

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# Stand by me! Reducing the risk of injurious falls in older adults

## ABSTRACT

About one-third of community-dwelling adults age 65 and older fall each year, and some suffer fractures, traumatic brain injury, and even death. Therefore, it is important to identify older adults at risk and recommend helpful interventions.

## KEY POINTS

Practitioners can reduce fall-related injury by screening older adults yearly with questions about problems with balance and gait, performing a focused history and examination when necessary, and implementing evidence-based interventions.

Cognitive impairment itself is an independent predictor of falls because it can reduce processing speed and impair executive function.

An exercise program with resistance, balance, and gait training is usually prescribed to patients at high risk, along with a home assessment and withdrawal or minimization of psychoactive and antipsychotic medications.

Combined calcium and vitamin D supplements should be given to most older adults in long-term care facilities to reduce fracture rates.

There are no specific evidence-based recommendations for fall prevention in community-living older adults with cognitive impairment or dementia.

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Falls and fall-related injuries are common in older adults Every year, 30% of those who are 65 and older fall,[1] and the consequences are potentially serious. Falls are the primary cause of hip fracture, which requires an extensive period of rehabilitation. However, rehabilitation does not always restore the older adult to his or her preinjury functional state. In fact, at 6 to 12 months after a hip fracture, 22% to 75% of elderly patients have not recovered their prefracture ambulatory or functional status.[2]

Falls are also the most common cause of traumatic brain injury in older adults,[3] often resulting in long-term cognitive and emotional problems and pain that compromise quality of life. Falls can be fatal and in fact are the leading cause of death from injury in older adults.[4]

Practitioners can reduce fall-related injury[5] and potentially improve quality of life by screening older adults yearly, performing a focused history and examination when necessary, and implementing evidence-based interventions.

## RISK FACTORS

A single identifiable factor may account for only a small portion of the fall risk. Falls in older adults are, in general, multifactorial and can be caused by medical conditions (eg, sarcopenia, particularly of the lower limbs, vision loss, urinary incontinence, neuropathies), cognitive impairment, medications such as psychotropic drugs, and home hazards such as area rugs, extension cords, and dimly lit stairways.

The strongest predictors of falls are a recent fall and the presence of a gait or balance disorder.[6]

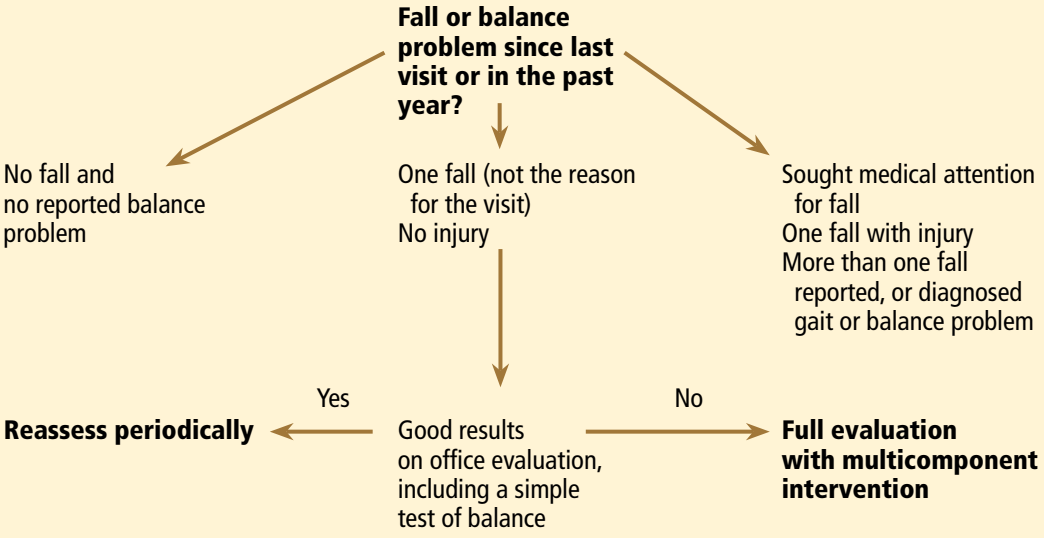


**FIGURE 1.** An approach to the screening and assessment of fall risk

## SCREENING TESTS

**The strongest predictors of falls are a recent fall and the presence of a gait or balance disorder**

Joint guidelines from the American Geriatrics Society and British Geriatrics Society,[7] published in 2011, recommend that practitioners screen older adults yearly for fall risk by asking two questions: "Have you fallen in the past year?" and "Are you having difficulty with gait or balance?" A negative response to both questions suggests a low risk of falling in the near future. Patients with two or more falls, a balance or gait problem (subjective or objective), or history of a fall requiring medical attention should undergo a focused history and physical examination plus a multifactorial risk assessment.

A report of one fall without injury should prompt a simple office-based test of balance. Examples of tests include the Get Up and Go, the Timed Up and Go, and the One-Legged Stance (the Unipedal Stance).

In the Get Up and Go test, patients sit comfortably in a chair with a straight back. They rise from the chair, stand still, walk a short distance (about 3 meters), turn around, walk back to the chair, and sit down.[8] The clinician notes any deviation from a confident, smooth performance.

In the Timed Up and Go test, the clinician records the time it takes for the patient to rise from a hardback chair, walk 10 feet (3 meters), turn, return to the chair, and sit down.[9] Most older adults complete this test in less than 10 seconds. Taking longer than 14 seconds is associated with a high risk of falls.[10]

For the One-Legged Stance test, the clinician asks the patient to stand on one leg. A patient without significant balance issues is able to stand for at least 5 seconds.[11]

**FIGURE 1** summarizes the approach for a community-dwelling patient who presents to the outpatient setting. A complete multifactorial risk assessment may require a dedicated appointment or referral to a specialist such as a geriatrician, physiatrist, or neurologist.

## WHAT INFORMATION DOES A FOCUSED HISTORY INCLUDE?

The fall-focused history includes:

**A detailed description** of the circumstances of the fall or falls, symptoms (such as dizziness), and injuries or other consequences of the fall.[7]

**A medication review.** **TABLE 1** includes commonly prescribed drug classes associated with increased fall risk.[12] Be especially vigilant for eyedrops used to treat glaucoma (some can potentiate bradycardia) and for psychotropic drugs.

Drug regimens with a high psychotropic burden can be identified with the Drug Burden Index[13] or the Anticholinergic Risk Scale,[14] but these scales are cumbersome and are usually used only as part of a research study. The updated Beers criteria[15] and use of a structured medication review such as the START and STOPP algorithms[16] can help prune unnecessary, inappropriate, and high-risk medications such as:

- Selective serotonin reuptake inhibitors in the absence of current major depression. These drugs increase the risk of falls and decrease bone density.[17]
- Proton pump inhibitors in the absence of a true indication for this drug class to treat reflux. Drugs in this class reduce bone density and increase the risk of hip fracture after 1 year of continuous use[18]
- Cholinesterase inhibitors in the absence of demonstrated benefit to dementia symptoms for the particular patient. Drugs in this class are associated with falls, hip fracture, bradycardia, and possible need for pacemaker placement.[19]

**Review of activities of daily living** (ADLs). A functional assessment of the patient's ability to complete ADLs helps identify targets for therapy. Assess whether the patient is afraid of falling and, if so, what impact this fear has on ADLs. This can help determine whether the fear protects the patient from performing risky tasks, or harms the patient by contributing to deconditioning.

**Medical conditions.** Consider chronic conditions that can impair mobility and increase fall risk. These include urinary incontinence, cognitive impairment (eg, dementia), neuropathy, degenerative neurologic conditions such as Parkinson disease, and degenerative arthritis. Osteoporosis increases the risk of fracture in a fall. Vitamin D deficiency increases both fall and fracture risk.[20]

**TABLE 1**

**Drug classes associated with falls**

| Drug | Odds ratio |
|---|---|
| Any psychotropic | 1.73 |
| Any antidepressant | 1.66 |
| Type 1a antiarrhythmics | 1.59 |
| Sedative-hypnotics | 1.54 |
| Tricyclic antidepressants | 1.51 |
| Neuroleptics | 1.50 |
| Benzodiazepines | 1.48 |
| Digoxin | 1.22 |
| Nitrates | 1.13 |
| Antihypertensives [a] | NS |

[a] Calcium channel blockers, diuretics, loop diuretics, angiotensin-converting enzyme inhibitors, beta-blockers.

DATA FROM LEIPZIG RM, CUMMING RG, TINETTI ME. DRUGS AND FALLS IN OLDER PEOPLE: A SYSTEMATIC REVIEW AND META-ANALYSIS: I. PSYCHOTROPIC DRUGS. J AM GERIATR SOC 1999; 47:30–39.

## PHYSICAL EXAMINATION FINDINGS

Assess the patient's vision, proprioception, reflexes, and cortical, extrapyramidal, and cerebellar function.[7]

Perform a detailed assessment of the patient's gait, balance, and mobility. Assess the lower extremities for joint and nerve function, muscle strength, and range of motion.[7] The use of brain imaging, if appropriate, is guided by gait abnormalities. Unexpected findings such as neuropathy may require referrals for further evaluation.

**Exercise recommendations should be customized to the patient**

Examine the patient's feet and footwear for signs of poor fit and for styles that may be inappropriate for someone at risk of falling, such as high heels.

Conduct a cardiovascular examination. In addition to assessing heart rate and rhythm and checking for heart murmurs, evaluate the patient for postural changes in heart rate and blood pressure. Wait at least 2 minutes before asking the patient to change position from supine to seated and from seated to standing. A longer interval (3 to 5 minutes) can be used depending on the patient's history. For example, an older adult reporting a syncopal episode standing by the kitchen sink may need a longer standing interval prior to blood pressure measurement than an older adult who falls right after standing up from a chair.

If there is a strong suspicion that an orthostatic condition contributed to a fall but it is

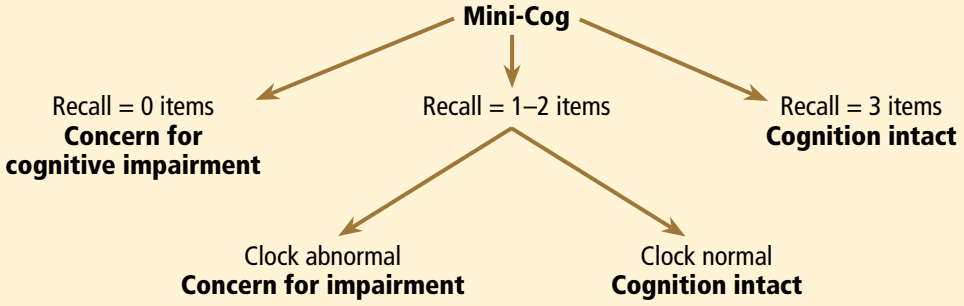


**FIGURE 2.** Interpretation of the Mini-Cog test, which requires the patient to recall three words and draw an analog clock

not possible to elicit orthostasis in the office, it may be necessary to refer the patient for tilt-table testing. If the circumstances suggest that pressure along the neck, or turning the neck, contributed to a fall, referral for carotid sinus stimulation may be appropriate. If there is a concern that a brady- or tachyarrhythmia contributed to the fall, a referral for 24- or 48-hour Holter monitoring or a 30-day loop monitor may be indicated.

**Advise patients to wear shoes when they are at home**

Assess the patient's mental status. Cognitive impairment itself is an independent predictor of falls[7] because it can reduce processing speed and impair executive function.[21] Executive dysfunction may contribute to falls by causing problems with multitasking, drug compliance, and judgment. The presence and severity of cognitive impairment may affect recommendation options (see below), so the assessment should include a screening test. Consider using the Mini-Cog, which requires the patient to recall three words and draw an analog clock (FIGURE 2).[22]

Some cognitive screening tests validated for use in the general older population include the General Practitioner Assessment of Cognition and the Memory Impairment Screen.[23] More involved cognitive testing such as the Folstein Mini-Mental State Examination, Montreal Cognitive Assessment, and the Saint Louis University Mental Status Examination are routinely performed in a geriatric or neurologic setting. The Folstein is a proprietary test; the other two are not.

Conditions such as circulatory disease, chronic obstructive pulmonary disease, depression, and arthritis are associated with a higher risk of falling, even with adjustment for drug use and other potential confounding factors.[24]

A brief mood assessment is part of the multifactorial assessment because mood disorders in older adults can lead to deconditioning, drug noncompliance, and other conditions that lead to falls and fall-related injuries. Options for screening include the Geriatric Depression Scale (15 or 30 questions) and the Patient Health Questionnaire (the PHQ-2 or the PHQ-9).[7]

## WHAT ARE THE EVIDENCE-BASED INTERVENTIONS?

In general, interventions are chosen according to the risks identified by the assessment; multiple interventions are usually necessary. It is ineffective to identify risk factors without providing intervention.[25]

Specific interventions with recommendation levels A and B are listed in TABLE 2.[7] Level A interventions are specifically supported by strong evidence and should be recommended. Of note, although vitamin $D_3$ may not be bioequivalent to vitamin $D_2$, studies in older adults have not consistently found a clinically different outcome, and either may be supplemented in the community-dwelling elderly. Except for vitamin D, these interventions target community-dwelling older adults who are cognitively intact.

**Home assessments** are effective in high-risk patients, such as those with poor vision and those who were recently hospitalized. The

goal is to improve safety, particularly during patient transfers, with education and training provided by an occupational or physical therapist or other geriatric specialist. The benefit of home assessment and environmental modification is greater when combined with other strategies and in general should not be implemented alone.

**Exercise** is an important intervention. The number needed to treat (NNT) to prevent one fall in older people over the course of at least 12 weeks is 16.[26] This compares favorably with interventions that are commonly used in the general population, such as aspirin therapy as secondary prevention for cardiovascular disease (NNT for 1 year = 50)[27] and statin therapy to prevent one death from a cardiovascular event over 5 years in people with known heart disease (NNT = 83).[28]

Exercise recommendations should be customized to the patient. The amount and type of exercise depends on the patient's baseline physical activity, medication use including antiplatelet and anticoagulant therapy, home environment, cardiac and pulmonary reserve, vision and hearing deficits, and comorbidities including neuropathy and arthritis.

The well-known risks associated with exercise include myocardial infarction and cardiac arrest, as well as falls and fractures. However, the benefits extend beyond fall risk and include improvements in physical function, glycemic control, cardiopulmonary reserve, bone density, arthritic pain, mood, and cognition. Exercise can also help manage weight, reduce sarcopenia, and increase opportunities for socialization. In most positive trials, the exercise interventions lasted longer than 12 weeks, had variable intensity, and occurred 1 to 3 times per week.

The American College of Sports Medicine recommends that older adults perform aerobic exercise 3 to 5 times per week, 20 to 60 minutes per session (the lower ranges are for frail elderly patients).[29] It also recommends resistance training 2 to 4 days per week, 20 to 45 minutes per session, depending on the patient's level of frailty and conditioning.[30] Most older adults do not exercise enough.

Interventions listed at the bottom of **TABLE 2** do not, in general, have enough evidence to support or discourage their use; these are level C recommendations. However, these interventions may be considered for certain individuals. For example, older adults with diabetic neuropathy are often unaware of their foot position when they walk. Additionally, those with diabetic neuropathy may have slower generation of ankle and knee strength compared with age-matched controls. These patients may benefit from targeted physical therapy to strengthen ankle and knee exten-

**TABLE 2**

## Interventions to prevent falls in older community-dwelling adults

**Rating level A (strongly recommended)**

Exercise for balance, gait, and strength; includes tai chi; customized to the patient

Interventions targeted to all fall risk factors

Vitamin D ≥ 800 units/day for proven vitamin D deficiency

Home environment assessment by healthcare professional with modification as needed

**Rating level B (recommended)**

Stopping or minimizing psychoactive and antipsychotic medications

Review of medications and reduction of the total number

Exercise, with group or at home

Expedited surgery for older women with cataracts

Assessment and treatment of postural hypotension

Dual-chamber cardiac pacing for cardioinhibitory carotid sinus hypersensitivity

Vitamin D 800 U/day for suspected vitamin D deficiency or high risk of falls

**Rating level C (no recommendation for or against)**

Management of footwear and foot problems

Noncataract vision interventions

Change of eyewear from multifocal to single corrective lens

Wearing shoes with low heels and a wide base

BASED ON INFORMATION IN: PANEL ON PREVENTION OF FALLS IN OLDER PERSONS, AMERICAN GERIATRICS SOCIETY AND BRITISH GERIATRICS SOCIETY. SUMMARY OF THE UPDATED AMERICAN GERIATRICS SOCIETY/BRITISH GERIATRICS SOCIETY CLINICAL PRACTICE GUIDELINE FOR PREVENTION OF FALLS IN OLDER PERSONS. J AM GERIATR SOC 2011; 59:148–157.

sors and to retrain stride and speed to improve both gait and safety awareness.

Patients who wear shoes that fit poorly, have high heels, or are not laced or buckled have a higher risk of falls.[31] Consider recommending footwear that has a firm, low, rubber heel and a sole with a large surface contact area, which may help reduce the risk of falling.[32] Advise patients to wear shoes when they are at home and to avoid using slippers and going barefoot.[33]

Cataract surgery, another level C intervention, is associated with fewer fall-related injuries, particularly hip fracture.[34] Noncataract vision interventions (such as exchanging progressive or bifocal lenses for single-lens glasses) may be effective in select patients if distorted vision in the lower fields of view increases the risk of falling, particularly outdoors.[35]

## INTERVENTIONS FOR SPECIAL POPULATIONS

Falls occur more frequently in mobile residents of long-term care facilities than in community-dwelling adults.[7] Institutional residents are older and more frail, have more cognitive impairment, and are prescribed more medications. Half of long-term care residents fall at least once a year.[7]

**Up to 7% of patients fall in the first week after a stroke**

The data support giving combined calcium and vitamin D supplementation to older adults in long-term care facilities to reduce fracture rates.[36] The NNT to prevent one hip fracture is about 111.[37] Hip protectors in this setting may reduce the risk of a hip fracture but also may increase the risk of a pelvic fracture. They do not alter the risk of falling.[38]

Collaborative interventions can help reduce the fall risk in older adults in the nursing home.[39] Input from medical, psychosocial, nursing, podiatric, dietary, and therapy services can be solicited and incorporated into an individualized fall prevention program. The program can also include modifications in the environment to improve safety and reduce fall risk.

The benefits of exercise in reducing injurious falls in long-term care is less clear than in the community, likely because of the heterogeneity of both the long-term care population and the studied interventions. Exercise has other benefits, however. It maintains a person's ability to complete ADLs, improves mood, reduces hyperglycemia, and improves quality of life. Some studies have found a greater risk of falling with exercise therapy as independence increased.[40] However, a meta-analysis in 2013 found that exercise interventions, ranging from 3 to 24 months and consisting mainly of balance and resistance training, reduced the risk of falls by 23%.[41] Mixing several types of exercises was helpful. Studies of a longer duration with exercise sessions at least 2 to 3 times per week demonstrated the most benefit.[41] There was no statistically significant reduction in fracture risk in this meta-analysis,[41] although, possibly, more participants would have been needed for a longer period to demonstrate a benefit. Additionally, no study combined osteoporosis treatment with exercise interventions.

## WHAT EVIDENCE EXISTS FOR PATIENTS WITH COGNITIVE IMPAIRMENT?

Currently, there are no specific evidence-based recommendations for fall prevention in community-dwelling older adults with cognitive impairment and dementia.[7] Cognitively impaired adults are typically excluded from community studies of fall prevention. The one study that specifically investigated community-dwelling adults with cognitive impairment was not able to demonstrate a fall reduction with multifactorial intervention.[42]

## PREVENTING FALLS IN ELDERLY PATIENTS WHO RECENTLY HAD A STROKE

Falls are common in patients who have had a cerebrovascular event. Up to 7% of patients fall in the first week after a stroke. In the year after a stroke, 55% to 75% of patients experience a fall.[43] Falls account for the most common medical complication after a stroke.[44]

Several small studies found that vitamin D supplementation after a stroke reduced both the rate of falls and the number of people who fall.[45] Additional interventions such as exercise, medication, and visual aids have been studied, but there is little evidence to support their use. Mobile patients who have lower-extremity hemiparesis after a stroke may develop osteoporosis in the affected limb, so evaluation and appropriate pharmacologic therapy may be considered.

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