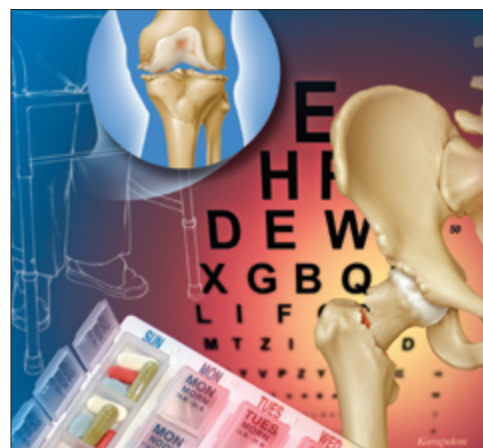


# Prevention of Falls in Older Patients

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Falls are one of the most common geriatric syndromes threatening the independence of older persons. Between 30 and 40 percent of community-dwelling adults older than 65 years fall each year, and the rates are higher for nursing home residents. Falls are associated with increased morbidity, mortality, and nursing home placement. Most falls have multiple causes. Risk factors for falls include muscle weakness, a history of falls, use of four or more prescription medications, use of an assistive device, arthritis, depression, age older than 80 years, and impairments in gait, balance, cognition, vision, and activities of daily living. Physicians caring for older patients should ask about any falls that have occurred in the past year. Assessment should include evaluating the circumstances of the fall and a complete history and physical examination, looking for potential risk factors. The most effective fall prevention strategies are multifactorial interventions targeting identified risk factors, exercises for muscle strengthening combined with balance training, and withdrawal of psychotropic medication. Home hazard assessment and modification by a health professional also is helpful. (*Am Fam Physician* 2005;72:81-8,93-4. Copyright© 2005 American Academy of Family Physicians.)



► **Patient Information:** A handout on preventing falls in older patients, written by the author of this article, is provided on page 93.

Falls are among the most serious health concerns facing older patients. From 30 to 40 percent of community-dwelling adults older than 65 years fall each year.<sup>1,2</sup> Rates are higher in nursing home residents and hospitalized patients. The incidence of falls rises steadily from middle age and peaks in persons older than 80 years.<sup>3</sup> Between 20 and 30 percent of older adults who fall suffer serious injuries such as hip fractures and head trauma.<sup>4</sup> Recovery from falls often is complicated by poor quality of life caused by restricted mobility, functional decline, and increased risk for nursing home placement.<sup>3-5</sup> Self-imposed functional limitations due to the fear of falling can cause post-fall anxiety syndrome. This can lead to depression, feelings of helplessness, and social isolation.

## Causes and Risk Factors

Most falls result from a complex interplay of predisposing and precipitating factors in a person's environment. One half to two thirds of falls occur in or around the patient's home.<sup>2,4,6</sup>

## CAUSES

Environmental hazards are the leading cause of falls, accounting for about 25 to 45 percent in most studies.<sup>3</sup> Gait disturbance and muscle weakness also are common causes. Dizziness, vertigo, drop attacks, postural hypotension, visual impairment, and syncope also are known to cause falls (*Table 1*).<sup>3</sup>

## RISK FACTORS

Lower extremity muscle weakness is a significant risk factor for falls, increasing the odds of falling fourfold.<sup>3</sup> A history of fall and gait or balance deficits increases the risk threefold.<sup>3</sup> Other high-risk situations that can cause or contribute to falls are use of an assistive device, visual deficit, arthritis, impaired activities of daily living, depression, cognitive impairment, and age older than 80 years.<sup>7</sup>

Use of four or more medications has been strongly associated with an increased risk of falls.<sup>8</sup> In particular, use of psychotropic medications, cardiac drugs including class 1A antiarrhythmic agents, digoxin, diuretics, and anticonvulsants have been implicated in increasing the risk of falls.<sup>8,9</sup>

## STRENGTH OF RECOMMENDATIONS

Key clinical recommendation	Label	References	Comments
Home hazard assessment and modification is recommended for patients with a history of falls.	A	13	RRR 0.66 (95 percent CI, 0.54 to 0.81), NNT = 5 for prevention of falls
Exercise and physical therapy are recommended to prevent falls and injury from falls.	A	13, 14	RRR 0.86 (95 percent CI, 0.75 to 0.99), NNT = 16 for prevention of falls; RRR 0.67 (95 percent CI, 0.51 to 0.89), NNT = 9 for reduction in number of falls resulting in injury
Patients should receive a multifactorial risk assessment and intervention because it is the most consistently effective strategy to prevent falls.	A	13, 14	RRR 0.82 (95 percent CI, 0.72 to 0.94), NNT = 11 for prevention of falls
Evaluation of medications and withdrawal of medications that increase the risk of falling is recommended.	B	13, 17	RRR 0.61 (95 percent CI, 0.32 to 1.15), NNT = 7 for prevention of falls; risk reduction not statistically significant
Dual-chamber pacemaker placement is recommended for selected patients with carotid sinus syndrome and syncope.	B	13, 18	RRR 0.48 (95 percent CI, 0.32 to 0.73), NNT = 4 for prevention of syncope
Hip protectors are recommended for patients at high risk of falling in an institutional setting.	B	19	
Patients with a history of falls or with risk factors for falling should undergo a formal evaluation.	C	7	

RRR = relative risk reduction; CI = confidence interval; NNT = number needed to treat.

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, opinion, or case series. For information about the SORT evidence rating system, see page 15 or <http://www.aafp.org/afpsort.xml>.

TABLE 1  
Causes of Falls in Older Persons

Cause	Mean (%)*	Range†
Accident and environment-related causes	31	1 to 53
Gait and balance disorders or weakness	17	4 to 39
Dizziness and vertigo	13	0 to 30
Drop attack	9	0 to 52
Confusion	5	0 to 14
Postural hypotension	3	0 to 24
Visual disorder	2	0 to 5
Syncope	0.3	0 to 3
Other specified causes‡	15	2 to 39
Unknown	5	0 to 21

\*—Mean calculated from the 3,628 reported falls.

†—Range of percentages reported in the 12 studies.

‡—This category includes: arthritis, acute illness, drugs, alcohol, pain, epilepsy, and falling from bed.

Adapted with permission from Rubenstein LZ, Josephson KR. The epidemiology of falls and syncope. *Clin Geriatr Med* 2002;18:146.

In a recent study<sup>10</sup> of nursing home residents followed for one year, starting a new benzodiazepine or antipsychotic medication was associated with a very high risk (odds ratio = 11) for falls. Careful selection in prescribing, continual review, and withdrawal of unnecessary medications may reduce the risk of falls.

There is a positive correlation between increased risk of falling and the number of risk factors. Among a cohort of community-dwelling older adults, during one year of follow-up, the risk of falling increased from 8 percent for persons with no risk factor to 78 percent for persons with four or more risk factors.<sup>2</sup>

### Assessment of Falls

Family physicians caring for older patients should integrate fall assessment into the annual history and physical examination. Many falls may never come to the physician's attention because the patient may

not volunteer the information. A guideline on fall prevention published by the American Geriatric Society, the British Geriatric Society, and the American Academy of Orthopaedic Surgeons<sup>7</sup> recommends that physicians caring for older patients should ask whether any falls have occurred in the past year. The panel also recommends that an evaluation be performed on patients who present with a fall, report recurrent falls, or have gait and balance abnormalities. *Figure 1*<sup>5,7</sup> summarizes an approach to the assessment and management of falls in older persons.

#### MEDICAL HISTORY

When evaluating a fall, physicians should obtain a description of the circumstances surrounding the fall and any associated symp-

toms. Additionally, the evaluation should include a thorough review of medications, assessment for acute and chronic medical problems, mobility level, and functional and cognitive status.

#### PHYSICAL EXAMINATION

On physical examination, it is important to look for postural changes in vital signs, presence of arrhythmias, carotid bruits, visual problems, gait and balance abnormalities, lower extremity strength, and joint function. A neurologic evaluation looking for focal deficits, assessment of lower extremity peripheral nerves, proprioception, vibration sense, and tests for cortical, cerebellar, and extrapyramidal functions is important.

**Syncope evaluation should be considered in older persons who have unexplained falls.**

### Assessment and Management of Falls

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Figure 1.

Patients who report a fall should be screened with the "Get Up and Go" test. This test involves observing for unsteadiness as the patient gets up from a chair without using the arms, walks 10 feet, turns around, walks back, and resumes a seated position. Timing the process, which should take less than 16 seconds, enhances the sensitivity of this test. Patient difficulties performing this test indicate an increased risk for falling and the need for further comprehensive evaluation.

#### LABORATORY AND DIAGNOSTIC TESTS

The role of laboratory testing and diagnostic evaluation for fall prevention has not been well studied. It is reasonable to perform tests to determine complete blood count, and thyroid function, electrolytes, blood urea nitrogen, creatinine, glucose, and vitamin B<sub>12</sub> levels. The results can help rule out potentially treatable causes for falls such as anemia, dehydration, hypoglycemia, or hyperglycemia.

There is an association between falls and syncope, and older persons who fall may not be aware of episodes of loss of consciousness.<sup>7,11</sup> Syncope evaluation should be considered in older persons who have unexplained falls, possibly in consultation with their cardiologist.<sup>7</sup> This could include ambulatory electrocardiography (Holter monitor) and an echocardiogram. Brain imaging and other relevant studies may be considered based on abnormalities suggested by the history and physical examination. *Table 2* lists selected important clues obtained by history and physical examination matched with the suggested diagnosis.

#### Interventions

The U.S. Preventive Services Task Force (USPSTF)<sup>12</sup> recommends counseling older patients on measures to reduce the risk of falling. These measures include exercise (particularly training to improve balance), safety-related skills and behaviors, environmental hazard reduction, and monitoring and adjusting medications. This recommendation is based on fair evidence that these measures reduce the likelihood of falling. The USPSTF also recommends an intensive individualized home-based multifactorial intervention for high-risk older patients in settings where adequate resources are available to deliver such services.

Several studies have examined single risk-factor modification and multifactorial interventions, and have found that both can prevent falls in older patients.<sup>13,14</sup> The results are summarized in the Strength of Recommendations table.

#### SINGLE INTERVENTIONS

*Exercise and Physical Therapy.* The Cochrane Collaboration conducted a systematic review<sup>13</sup> of fall prevention studies incorporating exercise programs such as progressive muscle strengthening, balance training, and a walking plan, individually tailored for each participant by a trained health professional. Pooled data<sup>13</sup> from these studies indicate that such programs significantly decreased the number of individuals experiencing a fall over one year when compared with a control group that received no intervention. The number of patients injured during a fall also was significantly reduced. The evidence was strongest for balance retraining, supporting inclusion of these exercises as a component of fall prevention programs. In community-dwelling older adults, a 15-week tai chi group exercise intervention also has been shown to reduce the risk of falls.<sup>15</sup>

*Home Safety Assessment and Modification.* In a study of older patients discharged from an acute care hospital, home assessment and modification by an occupational therapist reduced the risk of falls by 20 percent compared with a group who did not receive the intervention.<sup>16</sup> The intervention was par-

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ticularly effective in those with a history of falling. A recent systematic review also found that in patients with a history of falling, home hazard modification by a trained health professional reduced falls.<sup>13</sup>

**Medication Withdrawal.** In one study, withdrawal of psychotropic medications such as benzodiazepines, other sedatives or hypnotics, neuroleptic agents, or antidepressants

over 14 weeks resulted in a 66 percent reduction in risk of falling.<sup>17</sup> However, one month after completion of the study, 47 percent of the patients in the intervention group had restarted their psychotropic medication. Further studies are needed to find effective ways to support patients tapering off these medications.

**Cardiac Pacemaker.** In one study,<sup>18</sup> patients

TABLE 2

**Selected Clinical Clues and Common Diagnoses for Fall Assessment**

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**Hip protectors are plastic shields or foam pads fitted in pockets within specially designed underwear that reduce the impact of a fall.**

with unexplained or recurrent falls who had cardioinhibitory carotid sinus hypersensitivity wererandomized to dual-chamber pacemaker implantation or the standard treatment. The total number of falls at one year was reduced by two thirds in the pacemaker group compared with the control group.

*Hip Protectors.* Hip protectors are plastic shields or foam pads fitted in pockets within specially designed underwear. They do not reduce the risk of falling, but aim to reduce the impact of a fall. The pads are recommended for prevention of hip fractures for persons at high risk of falls or those living in an institution.<sup>19</sup> The reported adverse effects include skin irritation, abrasion, and local discomfort. Compliance with wearing hip protectors is low because many older patients find them uncomfortable.

#### **MULTIFACTORIAL INTERVENTIONS**

A multifactorial evaluation followed by targeted intervention for identified risk factors is the most effective strategy for fall prevention.<sup>20-22</sup> A systematic review<sup>13</sup> of multidisciplinary, multifactorial health and environmental screening and intervention programs in community-dwelling older adults found a significant reduction in falls when compared with a control group in unselected, community-dwelling older adults and in older patients with a history of falling or with known risk factors.

The components of a successful multifactorial intervention include: exercise programs incorporating gait and balance training; advice on appropriate use of assistive devices by an occupational therapist; review and modification of medications; evaluation and treatment of postural hypotension; removal or modification of environmental hazards; and targeted medical and cardiovascular assessment and treatments.

Falls and resulting injuries are more common among those in residential care facilities. Multifactorial interventions also have been successful in preventing falls in these settings.<sup>13,23,24</sup> Successful multifactorial interventions include: comprehensive individual

assessment with specific safety recommendations targeting environmental and personal safety (e.g., improvement in room lighting, flooring, and footwear); wheelchair use; psychotropic drug use; exercises for strength, balance, transfer, and ambulation; provision and repair of aids; providing hip protectors; facility-wide educational programs; and post-fall problem-solving conferences.

#### **Interventions of Unknown Effectiveness**

The effectiveness of a number of interventions is unknown.<sup>13</sup> Examples include home hazard modification in older persons without history of falling in association with advice on optimizing medication, or in association with education on exercise and reducing falls. Other interventions of unknown effectiveness in preventing falls include group exercise programs, nutritional supplements, vitamin D with or without calcium, cognitive behavior approaches, pharmacologic therapy with raubasine-dihydroergocristine (not currently available in the United States), and hormone therapy.

#### **Approach to the Patient**

*Figure 1*<sup>5,7</sup> and *Table 3*<sup>5</sup> summarize the assessment and management of falls in older persons living in the community, including those who are at risk for falls or who have fallen recently. Appropriate interventions can be initiated based on identified risk factors.

For example, when the assessment indicates gait and balance disturbance, interventions should include management of underlying medical conditions, modification of medication that impairs balance, and referral to a physical therapist for gait and balance exercises and assistive devices. Patients with orthostatic hypotension can be helped with the use of compensatory strategies, such as rising slowly or sitting on the side of the bed for several minutes before standing, review and reduction of medications, adequate hydration, and use of elastic stockings to minimize venous pooling in the legs. Liberal use of salt and pharmacologic therapy with fludrocortisone (Florinef) or midodrine (ProAmatine)

TABLE 3

**Clinical Assessments and Interventions for Older Persons at Risk for Falls**

<i>Assessment and risk factor</i>	<i>Interventions</i>
Circumstances of previous falls*	Changes in environment and activity to reduce the likelihood of recurrent falls
Medication use	Review and reduction of medications
High-risk medications (e.g., benzodiazepines, other sleeping medications, neuroleptics, antidepressants, anticonvulsants, or class IA antiarrhythmics)*†‡	
Four or more medications‡	
Vision*	Ample lighting without glare; avoidance of multifocal glasses while walking; referral to an ophthalmologist
Acuity < 20/60	
Decreased depth perception	
Decreased contrast sensitivity	
Cataracts	
Postural blood pressure (after five or more minutes in a supine position, immediately after standing, and two minutes after standing‡); $\geq 20$ mm Hg (or $\geq 20$ percent) drop in systolic pressure, with or without symptoms, repeat immediately or after two minutes of standing	Diagnosis and treatment of underlying cause, if possible; review and reduction of medications; modification of salt restriction; adequate hydration; compensatory strategies (e.g., elevation of head of bed, rising slowly, or dorsiflexion exercises); pressure stockings; pharmacologic therapy if the above strategies fail
Balance and gait†‡	Diagnosis and treatment of underlying cause, if possible; reduction of medications that impair balance; environmental interventions; referral to physical therapist for assistive devices and for gait and progressive balance training
Patient's report or observation of unsteadiness	
Impairment on brief assessment (e.g., the "Get Up and Go" test or performance-oriented assessment of mobility)	
Targeted neurologic examination	Diagnosis and treatment of underlying cause, if possible; increase in proprioceptive input (with an assistive device or appropriate footwear that encases the foot and has a low heel and thin sole); reduction of medications that impede cognition; awareness on the part of caregivers of cognitive deficits; reduction of environmental risk factors; referral to physical therapist for gait, balance, and strength training
Impaired proprioception*	
Impaired cognition*	
Decreased muscle strength†‡	
Targeted musculoskeletal examination: examination of legs (joints and range of motion) and feet*	Diagnosis and treatment of underlying cause, if possible; referral to physical therapist for strength, range-of-motion, and gait and balance training and for assistive devices; use of appropriate footwear; referral to podiatrist
Targeted cardiovascular examination†	Referral to cardiologist; carotid-sinus massage (in the case of syncope)
Syncope	
Arrhythmia (if there is known cardiac disease, an abnormal electrocardiogram, and syncope)	
Home hazard evaluation after hospital discharge†‡	Removal of loose rugs and use of night lights, non-slip bath mats, and stair rails; other interventions as necessary

\*—Recommendation of this assessment is based on observational data that the finding is associated with an increased risk of falling.

†—Recommendation of this assessment is based on one or more randomized controlled trials of a single intervention.

‡—Recommendation of this assessment is based on one or more randomized controlled trials of a multifactorial intervention strategy that included this component.

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can help maintain normal blood pressure. Cardiac arrhythmias or syncope clearly associated with a fall should be treated with antiarrhythmics or a pacemaker in consultation with a cardiologist.

Multifactorial interventions that have included behavioral and educational programs have shown benefit and should be

an important component of fall prevention strategies. Older patients and their families should be counseled on removing slipping hazards, such as loose rugs and trailing electrical cords. Specific environmental modification, such as adequate lighting, non-slip bath mats, stair rails, rails next to the toilet and in the shower or tub, and raised toilet

seats should be considered. An occupational therapist or a trained professional can perform these evaluations, and Medicare usually covers these services. Preventing recurrent falls in patients with nonmodifiable risks such as hemiplegia or joint deformities can be more challenging. Careful investigation and rectification of other risk factors such as vision and hearing deficits are important. Wearing hip protectors and using medications for osteoporosis may be necessary to prevent serious injuries such as hip fractures. Although restraints have been used traditionally in nursing homes and hospitals, there is no evidence that this prevents falls.<sup>7</sup>

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