

Assessing falls in older adults

A comprehensive fall evaluation to reduce fall risk in older adults

Joseph O. Nnodim, MD, PhD • Neil B. Alexander, MD

Falls account for significant morbidity and mortality in the older adult population. A comprehensive fall evaluation (CFE) is proposed, particularly for use in recurrent fallers, those who seek medical attention for a fall, and those with a gait and/or balance disorder. The CFE focuses on key factors in the medical and fall history, review of systems, and physical examination. Interventions utilize a multifactorial model, although balance exercise may be the most critical component. While some components may be marginally successful when presented individually as an intervention (such as correction of vision impairment or environmental hazard reduction), when presented together, fall risk can be significantly reduced.

Nnodim JO, Alexander NB. Assessing falls in older adults: A comprehensive fall evaluation to reduce fall risk in older adults. *Geriatrics* 2005 60(10):24-28.

Key words: falls • exercise • fall prevention

Falls are events in which an individual inadvertently comes to rest on a lower-than-usual level in the absence of an overwhelming force, syncope, or stroke. Falls cause substantial morbidity and mortality in older adults, including 5.3% of all older-adult hospitalizations in the United States.¹ Falls and fall-related injury may not be completely preventable, but with a directed evaluation and intervention, the risk of falls and injury can be reduced.

This paper will discuss a directed evaluation that can be used with recurrent fallers (such as two or more falls within 12 months), those who seek medical attention for a fall, and those with a gait and/or balance disorder.

Clinical evaluation

Based on a recent consensus conference guideline, older adults should be asked about falls at least once a year.² Recurrent fallers (such as two or more

falls within 12 months), those who present for medical attention because of a fall, and those who demonstrate a gait and/or balance disorder should undergo a comprehensive fall evaluation (CFE).

The goal of CFE is to identify fall risk factors based on a review of key factors in the medical and fall history, review of systems, physical examination, and other screening (table). The circumstances of a fall help identify common fall risk situations. Premonitory signs (eg, chest pain) are important, although actual loss of consciousness prior to the fall leads to a more traditional syncope, rather than falls, work-up. Acute illness accounts for approximately 10% of falls in older adults, and syncope for an even lower percentage, and the fall assessment and intervention differs from the more common, subacute or chronic fall causation and intervention model.

Intrinsic risk factors from the medical and surgical history are important, such as Parkinson's disease or a previous hip fracture repair. A thorough review of the patient's medications for fall-causing potential, with a particular focus on psychotropic medications, is critical.

Evaluation of daily activities and habits is highly relevant: both functional (ADL) dependency and excess alcohol use (>2 drinks/day) increase fall risk. Assessment of the home environment for physical hazards may require a home visit. Questions about dizziness, paresthesia, focal weakness,

Dr. Nnodim is fellow, division of geriatric medicine, department of internal medicine and institute of gerontology, University of Michigan, and special fellow, program in advanced geriatrics, Veterans Affairs Ann Arbor Health Care System Geriatric Research Education and Clinical Center, Ann Arbor, Michigan.

Dr. Alexander is professor, division of geriatric medicine, department of internal medicine, and research professor, institute of gerontology, University of Michigan; and associate director for research and research scientist, Veterans Affairs Ann Arbor Health Care System Geriatric Research Education and Clinical Center, Ann Arbor, Michigan.

Disclosure: The authors report no conflicts of interest related to the subject under discussion.

and memory problems help determine the extent of vestibular, cognitive, or other neurologic disease. Leg pain, manifested by arthralgia or myalgia, may destabilize gait and increase the likelihood of falls. Urinary urgency, causing a need to rush to the bathroom, may increase fall risk as well.

Physical examination

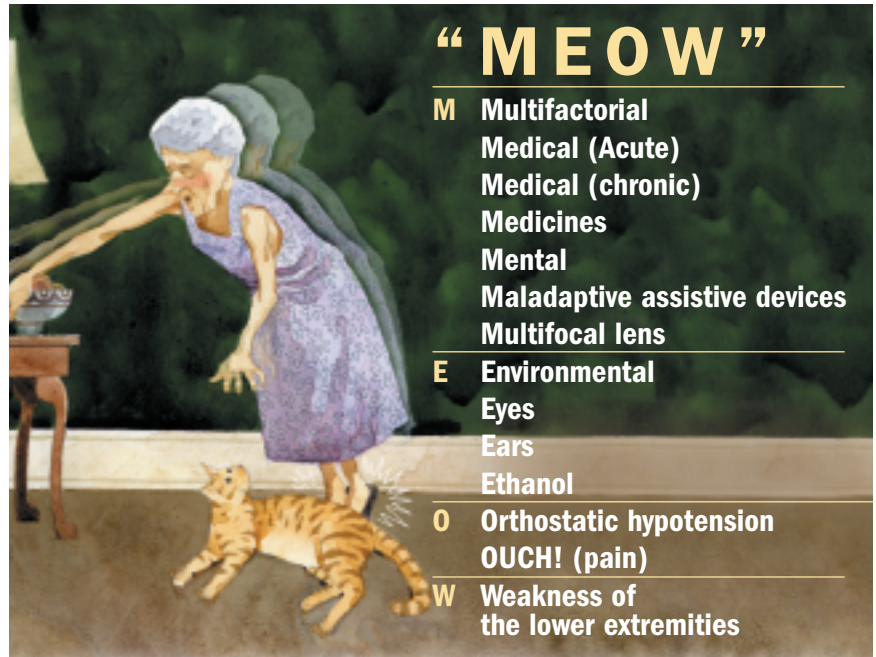
The physical examination begins with a general assessment of fluid and nutritional status. Blood pressure and pulse are measured with the patient supine, then immediately after standing and after at least two minutes of standing to check for orthostatic hypotension. Positional dizziness should also prompt administration of the Dix-Hallpike maneuver.

The precordium and neck are auscultated for rhythm, murmurs, and bruits. Carotid sinus massage, to identify a highly select group of those with carotid sinus hypersensitivity who might benefit from a pacemaker, should be performed only under EKG monitoring with IV access.

Examination of the lower extremities includes an inspection of leg joints and the feet for deformities and limitations in range of motion. Footwear should be checked for appropriateness; the sole wear pattern may provide insight into abnormal weight distribution while walking.

Neurologic examination should be thorough, including assessments of cerebellar coordination, muscle tone and power, deep tendon reflexes, and peripheral sensory perception.

Of the measures of gait and balance disorder, gait speed and, in particular, the Timed Up and Go (TUG: rise from a chair, walk 10 feet, turn, and return to the chair) are thought to be particularly strong predictors of clinical outcomes (TUG over 14 seconds suggests an increased risk of falls).³ In a standard gait evaluation, gait initiation, base width, stride length, speed, floor clearance, trajectory, truncal posture, arm swing, and quality of turn are observed. The use of an assistive device



GERIATRICS Medical Editor Fredrick T. Sherman, MD, MSc, has developed the “MEOW” mnemonic to give the primary care practitioner a logical approach for evaluation of elderly patients who have fallen. See page 5.

Illustration for Geriatrics by Jeff Suntala

is monitored for appropriateness, fit, and efficacy. While classical gait patterns (such as festination in Parkinson’s disease) may be encountered, an abnormally appearing gait in an older adult usually has a multifactorial eti-

Footwear should be checked; sole wear pattern may provide insight into abnormal weight distribution while walking

ology, requiring exploration of the factors already reviewed elsewhere.⁴

Assessment of bipedal (feet together) stance with eyes open and then with eyes closed, establishes whether the patient has low-level stance ability and functional proprioception and vestibular function. High-level testing includes

tandem and unipedal (eyes open) stance (at least 10 seconds) and tandem walk (10 steps); patients who can perform these tests generally do not have a significant balance or gait disorder.

Screening for cognition (Mini-Mental State Examination), depression (Geriatric Depression Scale) and vision (visual acuity and, if possible, contrast sensitivity using, for example, a 10% contrast letter chart and the Pelli-Robson chart respectively) are advocated.

Laboratory testing is ordinarily not a key component of fall risk assessment. However, some findings (eg, mucosal pallor, low back pain with radiculopathy) may require either blood work or imaging for fuller characterization. Assessment batteries of varying degrees of technical complexity have been developed, with defined cut-points for patient stratification for fall risk. Some of these instruments are listed in Rubinstein et al.⁵

Intervention

The goal of intervention is to eliminate or minimize remediable risk factors. The Panel on Falls Prevention² has en-

Table Components of comprehensive fall evaluation

History

Circumstances of fall
Medical and surgical history
Medications
Social History

Review of systems

Neurologic
(including ophthalmologic, otologic)
Cardiovascular
Musculoskeletal
Genitourinary

Physical examination
Vital signs
Head and neck
Cardiovascular
Extremities
Neurologic (including gait, balance)

Screening tests

Mini Mental State Examination
Geriatric Depression Scale
Visual acuity
Laboratory and radiological testing

Source: Developed for Geriatrics by JO Nnodim, MD, PhD, and NB Alexander, MD.

dorsed a multifactorial intervention model. In the community setting, the following are recommended:

- exercise (such as balance training)
- correct use of assistive devices
- medications review
- environmental hazard elimination
- treatment of postural hypotension and cardiovascular disorders, if present.

In long-term care facilities, the critical component is staff and resident education. Other specific recommendations are:

- gait training
- correct use of assistive devices
- medications review.

Studies of interventions in the acute care setting have methodological problems and may not conclusively demon-

In older adults at high risk for falls, exercise should be customized, of long duration, and include balance routines

strate fall reduction.⁶ Nevertheless, risk factors consistently observed in the inpatient setting, namely a history of previous falls, gait instability, agitated confusion, urinary incontinence/frequency, and medications, such as sedatives/hypnotics, suggest that a multifactorial approach might be useful in this setting. Such an approach resulted in a 21% relative risk reduction in acute wards.⁷ In the subacute setting, while one recent study found no significant benefit of a multifactorial program,⁸ another study of similar design reported a 30% reduction in falls.⁹

Specific interventions

Exercise: Exercise may be the most crucial component of successful community-based multifactorial programs, and an effective single intervention according to a recent meta-analysis.¹⁰ In older adults at high risk for falls, exercise likely needs to be individualized, of long duration (at least 10 weeks), and include balance routines.² The optimal type, duration, and intensity remain to be determined. Recent studies suggest group exercise may also be effective, although fall reduction outcomes for an initially promising program, Tai Chi, were more modest in follow-up with a more physically impaired cohort.¹¹ In a physical therapy-rehabilitation model, patients with specific disease-related impairments who are at high risk for falls, such as patients with vestibular impairment, may reduce their fall risk as indicated by im-

provement in intermediate fall risk measures.¹²

Medications: Careful review of the patient's medications (including over-the-counter agents) is essential.² Medications should be limited to those absolutely essential, given that the risk of falls increases with multiple medications. Whenever possible, non-pharmacologic modalities should be tried first (eg, sleep hygiene and evaluation for sleep-disordered breathing for insomnia).

If medications are deemed necessary, fall-inducing potential should be considered as well as dose adjustments. Both short-acting and long-acting benzodiazepines increase fall risk. While tricyclic antidepressants have been traditionally implicated in falls, falls have also been associated with selective serotonin-reuptake inhibitors, particularly at high doses.

Medications, especially psychotropics, should be initiated at a low dose and then slowly titrated upward. Complete removal of psychotropics can reduce fall risk by as much as 66% but many patients will eventually be placed back on a psychotropic medication.¹³

Drug interactions and acute conditions, such as sepsis, may increase fall risk by altering drug pharmacokinetics.

Medication use to treat disease symptoms may increase fall risk. Narcotics are associated with injurious falls and should be prescribed judiciously. For chronic pain, scheduled dosing is more effective than use "as needed." Advanced osteoarthritis, with rest pain and functional compromise, may merit surgical evaluation.

While recurrent falls occur in those with extrapyramidal syndromes, such as Parkinson's, as well as in patients with cognitive impairment, administration of appropriate medications (eg, dopaminomimetic and cholinesterase inhibitor medications, respectively) has not been proven to reduce falls. Whether medication treatment may somehow facilitate participation in other interventions, such as exercise, in these two cohorts is also not clear.

Environmental modification: As a single intervention in controlled trials, environmental modification to increase safety does not reduce fall risk. However, as a component of multifactorial programs, environmental safety measures are thought to contribute only modestly to risk reduction. Use of an occupational therapist, presumably to provide home hazard assessment and safety instruction, however, results in significant fall risk reductions post-discharge from the hospital, with a 31% fall reduction in a group receiving two home safety visits.¹⁴ A facilitated home environmental assessment is thus recommended for at-risk older patients upon discharge from the hospital.²

Behavior modification: Behavioral strategies, as a single intervention to reduce falls, are generally unsuccessful. However, as part of a multifactorial fall risk intervention, patients should be provided with their individual risk factors and counseled regarding coping with fall risk. Patients with vision loss or those with vestibular or proprioceptive loss, who are particularly dependent on vision, must maximize lighting in the home and develop safe navigation strategies and paths. Patients with cognitive loss may need supervision and maintenance of a distraction- and clutter-free environment.

Assistive/protective devices: Assistive devices (eg, cane or walker) increase stability by augmenting the base of support, providing proprioceptive input, and redistributing weight off an impaired (painful or weak) limb. Trained help is essential in choosing and fitting all assistive devices because the wrong equipment or incorrect fitting will exacerbate the fall risk. No fall reduction benefits are seen with the use of physical restraints. Instead, restraints increase the fall risk when applied to confused persons and have been associated with serious injuries, even deaths.¹⁵

Hip pads (foam with a hard shell) deflect the force of impact during a hip landing to the soft tissues around the joint. Their use has been shown to result in a three-fold reduction in hip

fracture risk but also high non-compliance and drop-out rates.¹⁶ The Amsterdam Hip Protector Study,¹⁷ in which data analysis was by intention-to-treat, failed to show a hip fracture preventive benefit with use of the device. In other studies, fall risk was not reduced but falls self-efficacy appeared to be enhanced.¹⁸ The optimal clinical use of hip pads to reduce hip fractures is still not clear.

Footwear: Walking in stocking feet is discouraged. Shoes should be well-fitting, sturdy, and well-contoured, with a non-skid sole and low broad heel. Footwear with laces or Velcro fasteners are favored over slip-ons. Athletic and canvas shoes are the footwear styles least associated with falls in community-dwelling elders.

Athletic and canvas shoes are the footwear styles least associated with falls in community-dwelling elders

Cardiac and circulatory interventions: In successful programs, the measures targeted at orthostatic hypotension include elimination or adjustment of any suspect medications (especially diuretics and antihypertensives), oral rehydration, judicious salt loading, pre-standing ankle pumping, hand clenching, and waiting at the edge of a bed or upon immediate stance prior to walking. Compression stockings are used to counteract venous pooling and fludrocortisone or midodrine are also sometimes considered.

In patients with carotid sinus hypersensitivity, bradyarrhythmic episodes can precipitate falls. Many such falls may well be syncopal, with the patients amnesic of their loss of consciousness.

However, without a history of syncope, an evaluation for possible cardioinhibitory carotid sinus syndrome is usually not undertaken. Cardiac pacing of recurrent fallers with cardioinhibitory carotid sinus syndrome reduced events by two-thirds in the SAFE PACE study in a highly select sample.¹⁹

Vision: Prescription lenses correct acuity errors. Single-lens glasses are preferred to multifocal glasses since the latter lead to impaired edge contrast and depth perception and increased fall risk.


Cataract extraction, even in unilateral disease, reduces fall risk. Whereas vision modification is generally not effective as a single intervention, vision may contribute to fall risk reduction as part of a multifactorial risk reduction program.

Vitamin D: In a recent meta-analysis, treatment with vitamin D resulted in 20% fall risk reduction, independent of calcium supplementation.²⁰ The proposed physiologic basis of this benefit is increased muscle strength but the extent of musculoskeletal improvement associated with this reduction in fall risk is modest. There are no current recommendations for supplementation, although targeting women and using doses of 800 IU may be beneficial.

Conclusion

A comprehensive fall evaluation (CFE) is proposed, particularly for use in recurrent fallers, those who seek medical attention for a fall, and those with a gait and/or balance disorder. The CFE focuses on key factors in the medical and fall history, review of systems and physical examination. Interventions utilize a multifactorial model, although balance exercise may be the most critical component. While some components may be marginally successful when presented individually as an intervention (such as vision impairment or environmental hazard reduction), when presented together, fall risk can be significantly reduced.

Assessing falls

Acknowledgments: The authors wish to acknowledge the support of National Institute on Aging (NIA) Claude Pepper Older Adults Independence Center grant AG08808, and the Department of Veterans Affairs Research and Development and the VA Ann Arbor Health Care System GRECC. Dr. Nnodim is the recipient of the VA Special Fellowship in Advanced Geriatrics. Dr. Alexander is also a recipient of a K24 Mid-Career Investigator Award in Patient-Oriented Research AG109675 from NIA. We also gratefully acknowledge the contributions of Debbie Strasburg and Diane Scarpace. 

References

1. Alexander BH, Rivara FP, Wolf ME. The cost and frequency of hospitalization for fall-related injuries in older adults. *Am J Public Health* 1992; 82(7):1020–3.
2. Guideline for the prevention of falls in older persons. American Geriatrics Society, British Geriatrics Society, American Academy of Orthopedic Surgeons Panel on Falls Prevention. *J Am Geriatr Soc* 2001; 49(5):664–72.
3. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. *Phys Ther* 2000; 80(9):896–903.
4. Alexander NB, Goldberg A. Common gait disorders: A clinical overview. In: Evaluation and management of gait disorders, Hausdorff J, Alexander NB, eds. Taylor and Francis, Boca Raton, 2005.
5. Rubinstein TC, Alexander NB, Hausdorff JM. Evaluating fall risk in older adults: steps and missteps. *Clinical Geriatrics* 2003; 11(1):52–60.
6. Oliver D, Hopper A, Seed P. Do hospital fall prevention programs work? A systematic review. *J Am Geriatr Soc* 2000; 48(12):1679–89.
7. Healey F, Monro A, Cockram A, Adams V, Heseltine D. Using targeted risk factor reduction to prevent falls in older inpatients: A randomized controlled trial. *Age Ageing* 2004; 33(4):390–5.
8. Vassallo M, Vignaraja R, Sharma JC, et al. The effect of changing practice on fall prevention in a rehabilitative hospital: The Hospital Injury Prevention Study. *J Am Geriatr Soc* 2004; 52(3):335–9.
9. Haines TP, Bennell KL, Osborne RH, Hill KD. Effectiveness of targeted falls prevention program in subacute hospital setting: Randomized controlled trial. *BMJ* 2004; 328(7441):676–81.
10. Chang JT, Morton SC, Rubenstein LZ, et al. Interventions for the prevention of falls in older adults: Systematic review and meta-analysis of randomised clinical trials. *BMJ* 2004; 328(7441):680–7.
11. Wolf SL, Sattin RW, Kutner M, O'Grady M, Greenspan AI, Gregor RJ. Intense Tai Chi exercise training and fall occurrences in older, transitionally frail adults: A randomized, controlled trial. *J Am Geriatr Soc* 2003; 51(12):1693–701.
12. Herdman SJ, Schubert MC, Tusa RJ. Strategies for balance rehabilitation. Fall risk and treatment. *Ann N Y Acad Sci* 2001; 942 (Oct):394–412.
13. Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Psychotropic medication withdrawal and a home-based exercise program to prevent falls: A randomized trial. *J Am Geriatr Soc* 1999; 47(7):850–3.
14. Nikolaus T, Bach M. Preventing falls in community-dwelling frail older people using a home intervention team (HIT): Results from the randomized falls-HIT trial. *J Am Geriatr Soc* 2003; 51(3):300–5.
15. Parker K, Miles SH. Deaths caused by bedrails. *J Am Geriatr Soc* 1997; 45(7):797–802.
16. Parker MJ, Gillespie LD, Gillespie WJ. Hip protectors for preventing hip fractures in the elderly. *Cochrane Database Systematic Review* 2001(2):CD001255.
17. van Schoor NM, Smit JH, Twisk JWR, Bouter LM, Lips P. Prevention of hip fractures by external hip protectors. A randomized controlled trial. *JAMA* 2003; 289(15):1957–62.
18. Cameron ID, Stafford B, Cumming RG, et al. Hip protectors improve falls self-efficacy. *Age Ageing* 2000;29(1):57–62.
19. Kenny RA, Richardson DA, Steen N, Bexton RS, Shaw FE, Bond J. Carotid sinus syndrome: a modifiable risk factor for non-accidental falls in older adults (SAFE PACE). *J Am Coll Cardiol* 2001; 38(5):1491–6.
20. Bischoff-Ferrari HA, Dawson-Hughes B, Willett WC, Staehelin HB, Bazemore MG, Zee RY, Wong JB. Effect of vitamin D on falls: a meta-analysis. *JAMA* 2004; 291(16):1999–2006.

Resources file

1. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988; 319(26):1701-7.
2. Mukamal KJ, Mittleman MA, Longstreth WT Jr, Newman AB, Fried LP, Siscovick DS. Self-reported alcohol consumption and falls in older adults: Cross-sectional and longitudinal analyses of the cardiovascular health study. *J Am Geriatr Soc* 2004; 52(7):1174-9.
3. Brown JS, Vittinghoff E, Wyman JF, et al. Urinary incontinence: Does it increase risk for falls and fracture? Study of Osteoporotic Fractures Research Group. *J Am Geriatr Soc* 2000; 48(7):721-5.
4. Lord SR, Dayhew J. Visual risk factors for falls in older people. *J Am Geriatr Soc* 2001; 49(5):508-15.
5. Pelli DG, Robson JG, Wilkins AJ. The design of a new letter chart for measuring contrast sensitivity. *Clin Vis Sci* 1988; 2(3):187-99.
6. Lord SR, Menz HB, Tiedemann A. A physiological profile approach to falls risk assessment and prevention. *Phys Ther* 2003; 83(3):237-52.
7. Tinetti ME, Baker DI, McAvay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N Engl J Med* 1994; 331(13):821-7.
8. Jensen J, Lundin-Olsson L, Nyberg L, Gustafson Y. Fall and injury prevention in older people living in residential care facilities. A cluster randomized trial. *Ann Intern Med* 2002; 136(10):733-41.
9. Oliver D, Daly F, Martin FC, McMurdo ME. Risk factors and risk assessment tools for falls in hospital in-patients: A systematic review. *Age Ageing*. 2004; 33(2):122-30.
10. Herdman SJ, Blatt PJ, Schubert MC, Tusa RJ. Falls in patients with vestibular deficits. *Am J Otol* 2000; 21(6):84-51.
11. Leipzig RM, Cumming RG, Tinetti ME. Drugs and falls in older people: A systematic review and meta-analysis: II. Cardiac and analgesic drugs. *J Am Geriatr Soc* 1999; 47(1):40-50.
12. 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(1):30-9.
13. Ensrud KE, Blackwell TL, Mangione CM, et al. Central nervous system-active medications and risk for falls in older women. *J Am Geriatr Soc* 2002; 50(10):1629-37.
14. Thapa PB, Gideon P, Cost TW, Milam AB, Ray WA. Antidepressants and the risk of falls among nursing home residents. *N Engl J Med* 1998; 339(13):875-82.
15. Kelly KD, Pickett W, Yiannakoulis N, et al. Medication use and falls in community-dwelling older persons. *Age Ageing* 2003; 32(5):503-9.
16. Bloem BR, Hausdorff JM; Visser JE, Giladi N. Falls and freezing of gait in Parkinson's disease: A review of two interconnected, episodic phenomena. *Mov Disord* 2004; 19(8):871-84.
17. Jensen J, Nyberg L, Gustafson Y, Lundin-Olsson L. Fall and injury prevention in residential care—effects in residents with higher and lower levels of cognition. *J Am Geriatr Soc* 2003; 51(5):627-35.
18. Gill TM, Williams CS, Tinetti ME. Environmental hazards and the risk of nonsyncopal falls in the homes of community-living older persons. *Med Care* 2000; 38(12):1174-83.
19. Day L, Fildes B, Gordon I, Fitzharris M, Flamer H, Lord S. Randomized factorial trial of falls prevention among older people living in their own homes. *BMJ* 2002; 325(7356):128.
20. Cumming RG, Thomas M, Szonyi G, et al. Home visits by an occupational therapist for assessment and modification of environmental hazards: A randomized trial of falls prevention. *J Am Geriatr Soc* 1999; 47(12):1397-402.
21. Clemson L, Cumming RG, Kendig H, Swann M, Heard R, Taylor K. The effectiveness of a community-based program for reducing the incidence of falls in the elderly: A randomized trial. *J Am Geriatr Soc* 2004; 52(9):1487-94.
22. Dean E, Ross J. Relationships among cane fitting, function, and falls. *Phys Ther* 1993; 73(8):494-504.
23. Hanger HC, Ball MC, Wood LA. An analysis of falls in the hospital: Can we do without bedrails? *J Am Geriatr Soc* 1999; 47(5):529-31.
24. Capezuti E, Evans L, Strumpf N, Maislin G. Physical restraint use and falls in nursing home residents. *J Am Geriatr Soc* 1996; 44(6):627-33.
25. Lauritzen JB, Petersen MM, Lund B. Effect of external hip protectors on hip fractures. *Lancet* 1993; 341(8836):11-3.
26. Kannus P, Parkkari J, Niemi S, et al. Prevention of hip fracture in elderly people with use of a hip protector. *N Engl J Med* 2000; 343(21):1506-13.
27. American Academy of Orthopedic Surgeons. Footwear and Falls. American Academy of Orthopedic Surgeons Online Service Fact Sheet. 2000. http://orthoinfo.aaos.org/fact/thr_repor t.cfm?Thread_ID=83&topcategory=Foot
28. Koepsell TD, Wolf ME, Buchner DM, et al. Footwear style and risk of falls in older adults. *J Am Geriatr Soc* 2004; 52(9):1495-501.
29. McIntosh S, Da Costa D, Kenny RA. Outcome of an integrated approach to the investigation of dizziness, falls, and syncope in elderly patients referred to a 'syncope' clinic. *Age Ageing* 1993; 22(1):53-8.
30. Lord SR, Dayhew J, Howland A. Multifocal glasses impair edge-contrast sensitivity and depth perception and increase the risk of falls in older people. *J Am Geriatr Soc* 2002; 50(11):1760-6.
31. Brannan S, Dewar C, Sen J, Clark D, Marshall T, Murray PI. A prospective study of the rate of falls before and after cataract surgery. *Br J Ophthalmol* 2003; 87(5):560-2.