

FALL INJURY CHARACTERISTICS AMONG HIP FRACTURE CASES LIVING IN THE COMMUNITY: IMPLICATIONS FOR COMMUNITY-BASED FALLS PREVENTIVE PROGRAMS

RAY MARKS

Department of Health and Behavior Studies, Columbia University, Teachers College, New York, NY

Supported in part by a SOPHE/CDC Fellowship in Unintentional Injury Prevention

Correspondence to: Dr. Ray Marks, Health and Behavior Studies, Teachers College, Columbia University, Box 114, 525W 120th St, New York, NY 10027.

Tel: 1-212-678-3445. Fax: 1-212-678-8259. e-mail: rm226@columbia.edu

Abstract -Objective: To elucidate if falls are commonly associated with hip fractures among community-dwelling adults and to detail the most common modes of fall injuries associated with hip fractures.

Method: A retrospective analysis of 990 hip fracture case records reported verbally by patients undergoing hip surgery at one of three community-based urban hospitals over an 8-year period was conducted to establish the proportion of cases who reported falling prior to fracturing their hips; how frequently those reporting falls fell in the home or out of doors in traffic areas; and the primary injury modes in and outside the home.

Results: Seven cases reported no falls history, and three could not recall any event prior to their hip fracture. For the remaining 90% of cases, which included adults ages 23-95, overall rates of falling in the home were 60.7%; however, when disaggregated for those younger than 60 years of age, falls that occurred out of doors were more common. Regardless of age, a multiplicity of both indoor and outdoor falls-related situations were reported.

Conclusion: The majority of hip fractures that occur in the community are associated with a simple fall, and are hence probably preventable. While falling in the home and fracturing a hip is more common than falling and fracturing a hip out of doors, this trend is reversed for people younger than 60 years of age. Many different modes of falling appear to be associated with hip fracture in both venues, regardless of age.

Key words: Community, Falls, Hip Fracture, Injury, Prevention.

As our aging populations increase in size, it is important to note that among those older than 65 years of age, falls are a leading cause of death, reduced mobility, independence [1-3], a greater risk of death [4] and subsequent falls [5]. In addition, falls cause considerable economic costs as well as physical and social costs [6,7] and related complications of falls in the older person, which include, injuries such as bone fractures, fear of falling, dependence and functional deterioration, premature death, increase these costs substantially [8-10].

Knowing the risk factors for falls, as well as fall injuries is therefore of vital importance for countering these burgeoning human, economic and social costs. Fortunately, research has shown that 60% of falls occur in the home environment [11], and that fewer than 10% result from overwhelming intrinsic causes such as a loss of consciousness [12], thus opening the door to potential intervention strategies against falls and their consequences. Indeed, cumulative evidence indicates that among the elderly, factors deemed most likely to contribute to falls are: dementia, visual impairments, alcohol misuse, neurological and musculoskeletal disabilities, psychoactive

medications, physical inactivity, physical frailty and difficulties in gait and balance, many of which are preventable or accessible to intervention [13-15,16]. Along with these predisposing factors, situational risk factors for falling including: environmental home hazards, slippery surfaces, uneven floors, poor lighting, loose rugs, unstable furniture, obstacles and objects on floors can be modified or eliminated [12]. Behavioral risk factors for falls in the home where Tideiksaar [17] states more than half affect people age 65 and older occur including climbing on chairs to reach high shelves, hurrying, running especially while carrying bulky or heavy objects or running in areas of poor lighting can likewise be countered [18].

However, extrinsic causes of falls such as being hit by a car, along with environmental risks outside of the home cannot be ignored in any discussion of interventions to prevent falls and their consequences. Furthermore, a systematic review of programs designed to reduce the incidence of falls in community dwelling, institutionalized, or hospitalized elderly people shows that falls and their consequences continue to be a persistent public health problem.

In addition, while fall injuries are a significant cause of morbidity, particularly among frail people older than 65 years of age, risk factors for falling that result in hip fractures among free-living community dwelling adults may differ from those for falls in general [42]. Moreover, although continued efforts towards improving prevention strategies against falls that could lead to hip fractures are strongly indicated, few studies have systematically examined the features of falls incurred by independent community-dwelling adults with a hip fracture, one of the most devastating outcomes of a fall [19].

To improve our knowledge base about the role of falls as a risk factor for hip fracture among community-dwelling adults, the present study surveyed:

1. The extent to which previously independent community dwelling adults hospitalized with a hip fracture reported falling as a key circumstance leading to their hospitalization.
2. The location of the fall events as described by hospitalized adults who had fallen and sustained a hip fracture.
3. The details of the fall event, where documented.

Because hip fractures pose such a serious threat to the well-being of the individual, and it is unclear whether 95% of hip fractures deemed to be caused by falls refer to falls that occur in nursing homes and institutions, rather than in the community [20] it was felt this additional knowledge might help to promote an improved understanding of additional measures that could be put in place to prevent falls that lead to hip fractures among community dwelling adults. This is important because even though medical management approaches including the use of antiresorptive agents such as the bisphosphonates, which strengthen bone may be helpful and nonmedical management including hip protectors and falls prevention programs focusing on weight-bearing and resistance exercises and home safety are indicated [39,41], programs among community-dwelling adults to prevent hip fractures per se, are scarce [21]. Furthermore, those that are in place to prevent falls in the community, usually take place in the context of the home, rather than out of doors, and usually address only the older adult, rather than adults, in general.

The specific study objectives were:

1. To examine how frequently hip fracture injuries sustained by community-dwelling adults are preceded by a simple fall.
2. To characterize the most common modes and circumstances associated with fall injuries sustained by previously independent community-dwelling adults with hip fractures, and to document the demographic makeup of the cases.

It was hypothesized that falls would prove to be a very common antecedent of hip fractures sustained by previously independent community dwelling adults, and that the mechanisms of falling would be diverse and affect younger as well as older adults.

Methods:

To achieve the study objectives, we analyzed the self-reported or proxy-reported descriptions of 990 individuals who had verbally described their proximate physical situation just prior to sustaining a hip fracture injury, retrospectively. All 990 individuals had previously been independent community-dwelling adults who required surgery to repair a hip fracture. They were housed in one of three community-based general hospitals

over an eight year period (1993-2000). This resulted in approximately all cases admitted to these hospitals with a diagnosis of hip fracture being included in the data base. All were deemed eligible to participate in an exercise trial supported by the hospital ethics committee, and thus had to have adequate cognitive and physical capacity. The required data had been recorded consecutively by independent research assistants in a personal interview with the patient or a care giver or relative within three days of their fracture. The survey was then attached to the patient's medical record and indicated whether or not a fall had preceded the fracture, and if so what the nature of the fall circumstance was. These data were then extracted systematically from the records and transcribed by a single recorder onto an excel spreadsheet along with data reporting the patient's age and gender. The primary modes and locations of the falling incidents were coded and the details of the injuries occurring in the home and outside the home that were documented were categorized into themes by the same reviewer. The review process excluded persons falling in nursing homes, and those who had fallen, but had not sustained a hip fracture. Descriptive statistics were generated to provide a summary of the salient data trends.

We defined fall in this study as any event that could result in an impact between the person and the ground that occurred either due to an environmental hazard, a slip or a trip resulting in a fall to the ground, a fall resulting from an encounter with a motor vehicle or a fall as a result of being pushed by another person.

Results

The previously independent males and females whose records were presently studied had a mean age of 78.9 yr, age range 23-95, and 90% had fallen prior to sustaining their hip fracture. A majority (77%) were females, with a hip fracture and falls history, and slightly more than half of the cases had sustained a left-sided hip fracture (55.2%). Sixty six cases were under the age of 60 years, and of these 49% were females.

For the sample as a whole, 20% of falls were classified as unknown in terms of location. Among the remaining 80% of cases, almost two thirds of falls had occurred in the home (60.7%) and out of doors in traffic areas falls occurred about one third of the time (30.1%). However, those under the age of 60 years had higher rates of falling outdoors than indoors. Females younger than 60 years fell out of doors 71% of the time, and males fell out of doors 81% of the time. When considering the group in its entirety, however, males and females were observed to have fallen indoors and outdoors at comparable rates of 66% and 33% respectively.

Fall rates indoors were highest for falling in bathrooms (5%), bedrooms (2.2%), kitchens (1.3%), on stairs (2.2), slipping or tripping, and falling off, or in relation to chairs (3.5%).

Out of doors, slipping and tripping and being hit by a car prior to falling, or problematic stair or curb descent most commonly led to falling and hip fracture.

Falling in bathroom settings in homes and out of the home occurred in a variety of ways, as indicated below:

- Slipping or tripping or falling on the bathroom floor-54.6%
- Falling going to the bathroom-28.6%
- Falling off the toilet-6.8%
- Falling leaving the bathroom.-5%
- Falling getting up from the toilet-2.3%
- Falling when stepping out of tub-2.3%
- Falling in the bathtub-2.3%.

Most commonly, patients recalled either slipping or tripping on the bathroom floor, which could reflect intrinsic as well as extrinsic factors, or both.

Fall mechanisms in bedroom settings included tripping over bedspreads, falling out of bed (most common mode), falling while making bed, falling getting into bed, and falling putting away clothes.

Of the 17 falls reported to occur in the kitchen, fall mechanisms involved tripping or slipping on kitchen carpet (8 cases), slipping on a wet floor (1 case), falling with a walker (1 case), losing balance while at the sink (1 case), falling when putting away groceries (1 case), falling out of kitchen chair (1 case), falling going to the kitchen (1 case), falling while in kitchen (2 cases), falling when walking to the fridge (1 case).

Falls in relation to chairs, appeared to occur due to intrinsic factors, chair instability, or during chair transfer, or where the chair posed an unpredictable obstacle. As indicated below, most chair-related falls that resulted in a hip fracture took place while seated.

- Falling from a chair-60.5%
- Falling over a chair-11.6%
- Falling while sitting down on a chair-9.3%
- Falling getting up from a chair-6.9%
- Falling while standing on a chair or stool-6.9%.
- Falling while moving a chair-2.3%.
- Falling while transferring to chair-2.3%

In descending order of frequency of occurrence, fall mechanisms on stairs in and outdoors were variable and included:

- Falling downstairs-55%
- Falling or tripping on stairs-20%
- Missing the last 2 stairs-8.3%
- Missing one step-4.1%
- Falling on loose stairs-4.1%
- Falling while going upstairs-4.1%
- Falling from bottom step of bus-4.1%

Thus falling downstairs, which may be due to both intrinsic factors as well as extrinsic factors was the most common mode whereby a fall associated with stairs led to a hip fracture injury in this cohort.

Of the 92 'slips' and 165 reported 'trips' these occurred in relation to: rugs, stairs, television wires, irregular street surfaces, boxes, walls, telephone cords, heating pad wires, ice, chairs, canes, tables, a cat, wet floors, a wet street, clothes, straps of a bag. Approximately, 3% were associated with assistive devices including canes (.8%) and walkers (1.8%), and .4% had fallen while pushing a wheelchair.

Discussion

This observational study sought to examine the extent to which falls are associated with hip fractures, plus the circumstances surrounding such falls as described by a cohort of persons with hip fractures. It specifically sought a better understanding of what should be included in falls prevention programs designed to reduce hip fracture disability and who should be targeted. Although there are obvious limitations in reporting on survey responses to a limited set of questions about the individual's recollection of any fall event prior to hip fracture, and missing data may have revealed alternate trends, the present findings were consistent with the literature in that the percentage of those who fell prior to fracturing their hip was 90% and that more women than men appear to sustain hip fractures associated with a fall [20]. Moreover, the finding that more hip fractures associated with falls took place indoors than out of doors was consistent with the observations of Aharonoff et al. [22]. However, when disaggregated by age, as observed by Bergland, Jarnlo and Laake [23], falls recorded by people living in the community can take place to a greater extent in the outdoor rather than the indoor environment [24].

Although we did not examine the impact of health status on the presently reported fall events, evidence suggests that adults who fall indoors and fracture a hip may be less healthy than those who fall outdoors [22], [25]. Moreover, individuals confined to the home may be excessively weak, with poor balance control, low bone density [40] and a reduced walking speed which are independent risk factors for indoor falls [23], regardless of age. In addition, it is possible that living with more home hazards may impact those adults living in the community who are healthy and vigorous more often the more frail home bound individual, regardless of age. In

contrast, older active persons, as well as the younger person may fall during outdoor activities due to a variety of causes.

Yet, targets for community-based fall-injury prevention programs are often less likely to be the younger adult or the vigorous older person, and are often highly focused on identifying and reducing potential home environmental hazards, even though not all home based falls may be associated with an environmental hazard. They may hence be quite restricted in nature and may explain why current fall-prevention strategies of finding and changing all environmental home hazards in all community-dwelling adult's homes may not reduce the risk of fall injury events to the extent previously believed [38]. Indeed, similar to our observations, a study of community-based seniors by Craven and Bruno [27] found the most common activities associated with falls were walking (42%), performing household chores (12%), using the stairs (10%), using transportation (10%) or transferring from one activity to another (10%), but some of these factors are often not included in community-based falls prevention intervention programs. These investigators also noted that slightly more falls occurred outside and most occurred between 8.00am and 8.00pm. Peak hours for falling outdoors were noon to 8.00pm. and inside were 8.00am. to 4.00pm. and 8.00 pm. to midnight. Some of these data may explain our present findings of a variety of falls related to walking activities indoors and out of doors and to stairs and performing household chores or activities, and may help to pinpoint when adults should be especially cautious and where.

While the majority of falls reported in this present study occurred during usual activities, and from the upright position, such as walking on level ground [13], in accord with Tinetti and Speechley [13] we also noted that falls associated with a hip fracture occurred quite commonly in this cohort when the individual was either getting up from a bed or chair or was ascending or descending a stairwell. This was also the observation of Reinsch et al. [28] for repeat fallers. It was not possible from our limited data set to clearly discern whether our sample was constituted by repeat fallers or first time fallers. However, this former possibility cannot be overlooked. In accord with Reinsch et al. it is possible that a number of individual or intrinsic factors contributed uniquely or interactively to the types of fall injuries reported by the present cohort, and that these are substantially more important than either indoor or outdoor environmental factors, especially among the older adult population.

However, as observed by Gallagher [29], a substantive number of the presently surveyed hip fracture group sustained these following a fall that occurred when walking outdoors. This appeared to result because these individuals encountered problems in the walking path, although they may also have had some predisposing intrinsic risk factors as well that contributed to their injury. Thus being ambulatory cannot be deemed to be completely protective against a hip fracture. Indeed, those who were younger than 60 years of age, a group likely to be ambulatory, fell more frequently in the outdoor than the indoor environment. Speechley and Tinetti [12] also found that vigorous elders were more likely to fall when away from home than in the home. According to these researchers they are also likely to fall more often on stairs or around environmental hazards than the frail elderly who are often specifically targeted in preventive efforts. Furthermore, they indicated that since vigorous seniors are more likely to be more seriously injured, than their frail counterparts in falls related circumstances, a concerted effort to target this at risk group is indicated.

Hence, even though younger adults or more vigorous older persons may constitute only a relatively small proportion of those at risk for a fall and hip fracture, because hip fractures are potentially life threatening, it is important to include adults who are healthy and likely to be quite vigorous, as well as those who are older and more frail in future program efforts designed to reduce hip fracture prevalence and premature disability or excessive mobility impairments [30]. Since falls and their many causes do appear to greatly influence the risk of incurring proximal femoral fractures [37,39], strategies to prevent falls in all those at risk in the community setting should be forthcoming.

Steinberg et al. [32] undertook a two year trial to assess the effectiveness of multi-component interventions targeting major risk factors for falls in reducing the incidence of slips, trips and falls among the well, older person in the community. The prevention measures included education and awareness raising of fall risk factors, exercise sessions to improve strength and balance, home safety advice to modify environmental hazards, and medical assessments. After one year, reductions in trips, slips and falls were evident.

However, because people who fall and fracture a hip are not always 'elderly', and falls do not occur solely in the home, an extension of this approach to include younger adults and modifying risk factors in the broader community is indicated. Moreover, given that those who fall and fracture their hip often return to the same environment, a similar broad-based secondary prevention strategy seems warranted. Based on our analysis, attention to chair safety, bathroom safety, stair descent and appropriate ambulatory device usage, plus attention to hazards that exist in the external environment are specifically indicated.

Conclusions

Although our data from this retrospective chart audit are not without limitations, and may have limited generalizability, they clearly show that regardless of age, a high percentage of hip fractures sustained by community dwelling adults are associated with a simple fall. However, in agreement with the observations of Stelmach and Worringham [34] there appears to be no single mode of falling that is universally associated with a hip fracture. Instead, among the present cohort studied in a limited geographic area, who were English speaking, and non-demented, there was evidence of considerable heterogeneity of causation, mirrored in the age range, gender distribution, fall site and type.

Consequently, it seems unlikely that there can be any uniform strategy for preventing falls that result in hip fracture. Hence prevention efforts to reduce injurious falls that lead to hip fracture among community dwelling adults will need to adopt an ecologic approach and incorporate a broad array of strategies into any falls prevention strategy designed to reduce hip fracture prevalence rates among community dwelling adults. Such efforts must take into account not only the nature of home hazards and intrinsic causative factors of falls, but a variety of non-hazardous indoor risk factors, plus outdoor situations and the ability of the individual to cope with these features effectively.

The present findings thus accord with the perceived need for a multidimensional prevention model incorporating the interaction of the manifold physiological, physical, environmental and behavioral determinants of falls [35,36]. Based on our current observations, to be effective, falls/hip fracture prevention programs that account for physiological factors, in addition to risk factors within the home and the surrounding environment, and are applied to adults of all ages, seem warranted.

Preventive interventions against first and subsequent falls that could lead to hip fracture might include attention to:

- Careful screening with a multifactorial instrument that assesses environmental falls risk, measures strength, functional mobility, and balance.
- Reduction of potential indoor and outdoor environmental hazards.
- Education to modify risky behaviors e.g., excessive alcohol use.
- Exercise, psychotropic medication withdrawal, vitamin D and calcium supplementation, and hip protectors.
- Re-education of hip fracture patients in basic household and outdoor activities.
- Gait training and appropriate use of walking aids and good footwear.

This multi-pronged approach, if enacted for community-dwelling adults, in general, may help to reduce morbidity and mortality rates attributable to hip fractures among community dwelling adults. Second, through its emphasis on health promoting behaviors, and the promotion of optimal neuromuscular function, it may provide an effective means of increasing an individual's threshold to injury both indoors and out-of-doors. Future research in this area to evaluate the relationship of health status, walking ability, muscle weakness, footwear, fear of falling, risk taking behaviors, mental status and social isolation to falls events that lead to hip fracture could help to identify the best strategies for implementing preventive measures against hip fractures due to falls that occur in the community.

REFERENCES

- 1 Sattin RW. Falls among older persons: A public health perspective. *Annu Rev Public Health* 1992;**3**:489-508.
- 2 Sattin RW, Lambert H, DeVito CA et al. The incidence of fall injury events among the elderly in a defined population. *Am J Epidemiol* 1990;**131**:1028-1037.
- 3 Tinetti ME, Speechley, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988;**319**:1701-1707.
- 4 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**:1020-1023.
- 5 Perry BC. Falls among the elderly. *J Am Geriatr Soc* 1982;**30**:367-371.
- 6 Englander F, Hodson TJ, Terregrossa RA. Economic dimensions of slip and fall injuries. *J Forensic Sc* 1996;**41**:733-746.
- 7 Dunn JE, Rudberg MA, Furner SE, Cassel CK. Mortality, disability, and falls in older persons: The role of underlying disease and disability. *Am J Public Health* 1992;**82**:395-400.
- 8 Foley CJF, Wolf-Klein GP. Prevention of falls in the geriatric patient with osteoporosis. *Clin Rheumatol Practice*, 1986;**4**:136-143.
- 9 Tideiksaar R. Preventing falls: How to identify risk factors, reduce complications. *Geriatrics* 1996;**51**:43-53.
- 10 NCIPC. National summary of injury mortality data, 1988-1994. Atlanta, CA: Centers for Disease Control and Prevention. 1996.
- 11 Sorock GS. Falls among the elderly: Epidemiology and prevention. *Am J Prev Med*, 1988;**4**:282-288.
- 12 Speechley M, Tinetti M. Assessment of risk and prevention of falls among elderly persons: Role of the physiotherapist. *Physiother Can* 1990;**42**:75-79.
- 13 Tinetti ME, Speechley M. Prevention of falls among the elderly. *N Eng J Med* 1989;**320**:1055-1059.
- 14 Tinetti M, Doucette J, Claus E, Marottoli R. Risk factors for serious injury during falls by older persons in the community. *J Am Geriatr Soc* 1995;**43**:1214-1221.
- 15 Wolfson L, Judge J, Whipple R, King M. Strength is a major factor in balance, gait, and the occurrence of falls. *J Gerontol* 1995;**50A**:64-67.
- 16 Branch LG, Katz S, Kneipman K, Papsidero JA. A prospective study of functional status among community elders. *Am J Public Health* 1984;**74**:266-268.
- 17 Tideiksaar R. Preventing falls: Home hazard checklists to help older patients protect themselves. *Geriatrics* 1986;**19**:26-28.
- 18 Kellog International Work Group on the Prevention of Falls by the Elderly. The prevention of falls in later life. *Danish Medical Bulletin* 1987;**34**(Suppl):1-24.
- 19 Binder S. Injuries among older adults: The challenge of optimizing safety and minimizing unintended consequences. *Inj Prev* 2002;**8**:iv2-iv4.
- 20 Nyberg L, Gustafson Y, Berggren D, Brannstrom B, Bucht G. Falls leading to femoral neck fractures in lucid older people. *J Am Geriatr Soc* 1996;**44**:156-160.
- 21 Berg WP, Alessio HM, Mills EM, Tong C. Circumstances and consequences of falls in independent community-dwelling older adults. *Age Ageing* 1997;**26**:261-268.
- 22 Aharonoff GB, Dennis MG, Elshinaway A, Zuckerman JD, Koval KJ. *Clin Orthop Rel Res* 1998;**348**:10-14.
- 23 Bergland A, Jarnlo GB, Laake K. Predictors of falls in the elderly by location. *Aging Clin Exp Res* 2003;**15**:43-50.
- 24 Naylor R, Rosin AJ. Falling as a cause of admission to a geriatric unit. *Practitioner* 1970;**205**:327-330.
- 25 Bath PA, Morgan K. Differential risk factor profiles for indoor and outdoor falls in older people living at home in Nottingham, UK. *Eur J Epidemiol* 1999;**15**:65-73.
- 26 Northridge ME, Nevitt MC, Kelsey JL, Link B. Home hazards and falls in the elderly: The role of health and functional status. *Am J Public Health* 1995;**85**:509-515.
- 27 Craven R, Bruno P. Teach the elderly to prevent falls. *J Gerontol Nurs* 1986;**12**:27-33.
- 28 Reinsch S, MacRae P, Lachenbruch P, Tobis J. Attempts to prevent falls and injury: A prospective community study. *Gerontologist* 1992;**32**:450-456.
- 29 Gallagher EM. Falls and the Elderly: A community paper. The Center on Aging, University of Victoria: British Columbia. 1994.
- 30 Cummings Sr. Treatable and untreatable risk factors for hip fracture. *Bone* 1996;**18**(Suppl 3):165S-167S.
- 31 Hill-Westmoreland EE, Soeken K, Spellbring AM. A meta-analysis of fall prevention programs for the elderly: How effective are they? *Nurs Res* 2002;**51**:1-8.

- 32 Steinberg M, Cartwright C, Peel N, Williams G. A sustainable programme to prevent falls and near falls in community dwelling older people: Results of a randomized controlled trial. *J Epidemiol Community Health* 2000;**54**:227-232.
- 33 Campbell AJ. Preventing fractures by preventing falls in older women. *Can Med Assoc J* 2002;**167**:1005-1006.
- 34 Stelmach GE, Worringham CJ. Sensorimotor deficits related to postural stability. *Clin Geriatric Med* 1985;**3**:679-693.
- 35 Tinetti ME, Speechley M. Multiple risk factor approach to prevention of falls. In: R. Weinruch, EC Hadley, MG Ory (Eds.). *Reducing frailty and falls in older persons*. Springfield, IL: Charles, C. Thomas, 1991:126-132.
- 36 Simpson JM, Darwin C, Marsh N. What are older people prepared to do to avoid falling? A qualitative study in London. *Br J Community Nurs* 2003; **8**: 152, 154-159.
- 37 Lefauveau P, Fardellone P. Extraskeletal risk factors for fractures of the proximal femur. *Joint Bone Spine* 2004;**71**:14-17.
- 38 Sattin RW, Rodriguez JG, DeVito CA, Wingo PA. Home environmental hazards and the risk of fall injury events among community-dwelling older persons. Study to Assess Falls Among the Elderly (SAFE) Group. *J Am Geriatr Soc* 1998;**46**:669-676.
- 39 Lin JT, Lane JM. Prevention of hip fractures: medical and nonmedical management. *Instr Course Lect* 2004; **53**:417-425.
- 40 Tinetti ME. Clinical practice. Preventing falls in elderly persons. *N Engl J Med*. 2003; **348**(1): 42-49.
- 41 Ellis TJ. Hip fractures in the elderly. *Curr Womens Health Rep*. 2003;**3**: 75-80.
- 42 Aizen E, Dranker N, Swartzman R, Michalak R. Risk factors and characteristics of falls resulting in hip fracture in the elderly. *Isr Med Assoc J*. 2003;**5**: 333-336.