

PREVENTION OF FALLS AND FALL INJURIES IN THE ELDERLY

Seema Singh¹

Address for Correspondence:

Physiotherapist, National Programme for Health Care Of Elderly, Division of Geriatric Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005

ABSTRACT

Objectives- Falls in older people are a major concern in terms of disability, institutionalization, mortality and socioeconomic burden. Studies on falls in Indian older adults were reviewed to determine the prevalence, consequences, risk factors, and interventional strategies for falls. **Data sources-** MEDLINE, PubMed, Google, Cochrane databases, Internet searches and IndMED. **Study selection-** Studies on falls in older adults published in last ten years were found using the key words: falls, Indian older adults or older adults, prevalence, circumstances and consequence, injuries, risk factors, health, balance, and mobility. **Data extraction-** A comprehensive literature search was done. The search resulted in 20 publications:- 10 national published and 10 international published research studies. **Data synthesis-** The prevalence of falls in Indian older adults ranges from 14% to 53%. Falls result in considerable morbidity and mortality. Indian elderly people are facing challenges secondary to the changing socio-economic scenario, economic dependency, and decreasing family support. Fall-related injuries impose a substantial financial burden on older adults and their families, in addition to dependency for daily activities and activity restriction. **Conclusion-** Falls are an emerging public health problem and a barrier to active ageing in India. There is an urgent need for coordinated and collaborative efforts of health professionals, researchers, policy makers, and health care delivery systems to prevent falls and promote active ageing. Falls are potentially preventable. For older adults in the community, exercise programs and vitamin D supplementation in those with deficiency are highly effective in preventing falls. Psychoactive drug withdrawal, home visits, vision optimization and a multifactorial approach are also effective.

Key words: Falls; Aged; Prevalence; Primary prevention; Risk factors; elder adults.

Introduction:

Ageing is a dynamic, progressive and physiological process accompanied by functional, morphological, biochemical and psychological changes. India being the second most populous country in the world has seen a sharp increase in the population of elderly and it has been projected that it would rise to about 324 million by 2050. Falls are a major public health problem in the elderly population. Falls among them are recurrent and multi-

factorial episodes. Every year accidental falls occur in nearly one-third of those aged more than 60 years, with 10% of these falls resulting in serious injury. Falling in elderly persons can lead to disability, hospitalizations, and premature death. It can also lead to reduced levels of independence, poorer quality of life, and high levels of anxiety.

Falls are one of the major problems in the elderly and are considered one of the

“**Geriatric Giants**” (immobility, instability, incontinence and impaired intellect/memory) (Kumar et al, 2013).

Definition of Fall:

Fall are coded as **E880-E888 in International Of Disease-9 (ICD-9), and as W00-W19 in ICD-10**, which include a wide range of falls including a wide range of falls including those on the same level, upper level, and other unspecified falls.

Falls are commonly defined as “inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects.”

Koski et al. (1998) defines “fall as a sudden, unintended loss of balance leaving individual in contact with the floor or another surface such as a step or chair.”

Falls among the elderly is increasingly being recognized as an issue of concern in both developed and developing countries. Falls in the elderly may precipitate adverse physical, medical, psychological, social and economic consequences. Falls are a major public health problem in the elderly population. Fear of falling (FOF) among elderly persons can compromise quality of life by limiting mobility, diminished sense of well-being and reduced social interactions. India is undergoing a demographic transitional phase with urban elderly population of 6.72% in 2001. The major challenge would be on the prevention of falls among them.

Inclusion/Exclusion Screening Criteria

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> Topic: Related to fall or fall injury 	<ul style="list-style-type: none"> Studies that target children or youth
<ul style="list-style-type: none"> Age Group: Seniors (majority of participants 60 years or older). 	<ul style="list-style-type: none"> Studies predominantly based on records of persons under 60 years of age.
<ul style="list-style-type: none"> Languages- English 	<ul style="list-style-type: none"> Records of trauma unrelated to falls.

Hence there is a need to highlight the problems related to fall faced by the elderly in India.

WHO (2008) reports that about 4,24,000 fall-related deaths occurred globally in 2004 and about one fifth of them (95,000 deaths) took place in India. Falls are second leading cause of unintentional injury mortality and they account for 11 percent of all unintentional injury deaths worldwide. About a third of community-dwelling people >65 years fall each year, and the incidence increases with age (Gillespie et al. 2012). Forty five percent elderly in a south (Gutta, et al., 2013) and 51.5 percent in a north (Joshi, et al., 2003). Injury related to falls also lead to significant disability in the population with an estimated loss of **375 Disability life Years per 1,00,000 population in India.**

Methods:

The review of studies relating to falls, epidemiology, risk factors, unintentional injuries, preventive strategies among elderly in India was made by Internet searches, Medline search, Cochrane databases, Pubmed, Google.

A comprehensive literature search was done. Efforts were taken to follow the cross references by the authors of various studies specific to India. Both Indian and International studies were chosen to be incorporated in this report. Researches carried out with ageing population only are included.

Epidemiology of Falls:

Approximately 28-35% of people aged of 65 and over fall each year increasing to 32-42% for those over 70 years of age. The incidence of falls appears to vary among countries as well. For instance, a study in the South-East Asia Region found that in Japan, 20% of older adults fell each year.

A study in the region of the Americans found the proportion of older adults who fell each year ranging from 21.6% in Barbados to 34% in Chile. Chu et al (2005) 24.5% of ambulatory Chinese elderly had recurrent falls with 1.3% of the fallers having four or more falls. Dandona, et al,(2010) reported the annual incidence of non-fatal fall related injury based on three months recall as 3.30% for men and 9.22% women with the incidence increasing with age.

Another study on Saudi community dwelling older people also reported the proportion of those who fell in the previous 12 months to be 37.5% for males and 62.5% for females (El-Sobsky, 2011). Community-based studies have reported prevalence of fall among 60 yrs and older adults to be 14-50% in India. In a study done by Shilpa et al (2015) the prevalence of falls in elderly was found to be 28.2% with the older elderly having higher prevalence of falls as well as recurrent falls.

Gutta et al conducted a study in Vellore, 45% elderly were found to have fallen more than once and one third having fallen four or more times with 77% of falls occurring between 60 and 70 yrs of age. More females (30.7%) than males(24.6%) amongst the study respondents had a fall. In a study done by SA Dsouza, et al prevalence of falls in Indian older adults ranges from 14% to 53%.

Jagnoor et al (2011) conducted a study in Chandigarh and concluded the prevalence of falls in elderly was found to

be 31%.Risk of fall was higher among females (OR 1.6, 95% CI 1.0-2.8, p 0.068), those taking four or more medications (OR 2.1, 95% CI 1.2-3.5, p 0.009) and having poor balance (OR 1.9, 95% CI 1.0-3.4, p 0.037). Joshi et al (2003) conducted a study in North India and found the prevalence of fall in elderly to be 51.5%.

The prevalence of past- year fall-related injuries ranged from 6.6% in India to 1.0% in South Africa and was 4.0% across the pooled countries. The proportion of all past-year injuries that were fall-related ranged from 73.3% in the Russian Federation to 44.4% in Ghana.

A review of studies of falls in India showed annual fall rates for older adults of between 14.7 and 34%.

Consequences of Falls:

Falls are a marker of frailty, immobility and acute and chronic health impairments in older persons. Falls in turn diminish function by causing injury, activity limitation, fear of falling and loss of mobility. Most injuries in the elderly are the result of falls; fractures of hip, forearm, humerus and pelvis usually results from the combined effect of falls and osteoporosis.

Other serious injuries resulting from falls include traumatic brain injuries, and upper limb injuries, haematoma, joint dislocation, severe laceration, sprain and other disabling soft tissue injury. Disabilities resulting from hip, wrist and other fractures in elderly found to be substantial.

The psychological and functional consequences of falls like depression and anxiety can be severe whether or not an injury occurs. Falls are the second leading cause of injury mortality worldwide. The 2010 Global Burden of disease and Injury study estimated that 12% of all unintentional injury deaths are due to falls.

Injury related to falls also lead to significant disability in the population with an estimated loss of 375 Disability Adjusted Life Years per 1,00,000 population in India.

Fall fatality rate for people aged 65 and older in USA is 36.8 per 1,00,000 population (46.2 for men and 31.1 for women) whereas in Canada mortality rate for the same age group is 9.4 per 10,000 population. Mortality rate for people age 50 and older in Finland is 55.4 for men and 43% for women per 1,00,000 population.

Costs of Falls-

The economic impact of falls is critical to family, community, and society. Healthcare impacts and costs of falls in older age are significantly increasing all over the world. The mean costs of falls are US\$3476 per faller, US\$10 749 per injurious fall, and US\$26 483 per fall requiring hospital admission.

The average health system cost per one fall injury episode for people 65 years and older in Finland and Australia was US \$3611 and US \$ 1049.

The average cost of hospitalization for fall related injury for people 65 year and older range from US\$ 6646 in Ireland to US\$ 17483 in the USA. These costs are projected to increase to US\$240 billion by year 2040.

Determinants of Falls: Risk Factors, Causes and Assessment-

Falls in the elderly are probably multifactorial, resulting from convergence of several intrinsic, pharmacologic, environmental, behavioural and activity related factors.

[a] Biological risk factors: Biological embrace characteristics of individuals that are pertaining to human body , for instance age, gender and race are non-modifiable

biological factors. These are also associated with changes due to ageing such as decline of physical, cognitive and effective capacities and the co-morbidity associated with chronic illnesses such as hypertension, diabetes, asthma, depression etc.

[b] Behavioural risk factors:

Behavioural risk factors include those concerning human actions, emotions or daily choices. They are potentially modifiable. For example-risky behavior such as intake of multiple medications, excess alcohol use and sedentary behavior can be modified through strategic interventions for behavioural changes.

[c] Environmental risk factors:

Home hazards include narrow steps, slippery surfaces of stairs, looser rugs and insufficient lighting. Poor building design, slippery floor, cracked or uneven sidewalks and poor lightening in public places are such hazards to injurious falls.

[d] Socioeconomic risk factors:

Are those related to influence social conditions and economic status of individuals as well as the capacity of the community to challenge them. These factors include low income, low education, inadequate housing, lack of social interaction, limited access to health and social care especially in remote areas and lack of community resources.

Fall risk factors are also categorized as Intrinsic and Extrinsic factors:-

Intrinsic	Extrinsic
Advanced age	Lack of stair handrails
Previous falls	Poor stair design
Muscle weakness	Lack of bathroom grab bars
Gait & balance problems	Dim lighting or glare
Poor vision	Obstacles & tripping hazards
Postural hypotension	Slippery or uneven surfaces
Chronic conditions including arthritis, diabetes, stroke, Parkinson's, incontinence, dementia	Psychoactive medications
Fear of falling	Improper use of assistive device

Key components of a multifactorial assessment include:

- A detailed falls history, medication review, risk factor assessment including osteoporosis, urinary incontinence and cardiovascular disease.
- Physical examination including gait and balance, neurological and cognitive function, lower limb strength, visual acuity, feet and footwear
- Functional assessment such as activities of daily living, perceived functional ability and fear of falling.

Preventability of Burden:

The cornerstone of effective falls prevention is identifying modifiable risk factors and intervening with effective strategies. In general, multiple strategies should be used for high risk patients, however for selected patients a single strategy may be equally effective and more acceptable. Osteoporosis diagnosis and management should also be addressed.

Research shows that through an improved understanding of the risks and by carrying out preventative measures, at least 25% to 30% of falls can be prevented.

Research on risk factors for falls and the causes of postural instability suggests many preventive strategies.

1. Exercise and physical activity:

Skeletal muscle strengths and mass decline with age and immobility. Impaired strength is a strong predictor of falls in most studies and may also increase the risk of injury from a fall. Exercise might prevent falls and injury by strengthening muscle and increasing endurance, maintaining and improving posture, joint motion and postural reflexes, stimulating cardio respiratory function and improving alertness.

Characteristics of effective exercise programs-

- Moderate or high challenge to balance (eg-single leg stance, balance boards, frenkel's exercise, dynamic balance exercises).
- Strength training: cognitive and functional benefits(eg- hip protectors, knee extensors, ankle strategies).
- Habituation exercises in patients with history of fall due to vertigo.
- 2 hours/week on an ongoing basis.
- Brisk walking is not recommended for high risk individuals.
- Home or group setting.
- Upgraded sitting exercises in patients with history of fall due to postural hypotension.

A growing body of evidence indicates that the elderly respond to exercise training. In a study 73% subjects felt that during and at the end of therapy program, they experienced a feeling of well being.

2. Rehabilitative therapies-balance and gait training:

Balance and gait abnormalities are associated with falls and may be modified through focused rehabilitative interventions. Rehabilitative strategies include strength training targeted to impaired muscle groups, habituation exercises for person with vestibular problems, motor coordination and proprioception exercises for persons with balance problems and gait training for individuals with gait abnormalities with emphasis on heel strike.

3. Vitamin D:

Vitamin D supplementation for older adults with deficiency is an effective and simple strategy for fall and fracture prevention, with fracture benefits persisting with increasing age. Vitamin D supplementation can reduce falls by 17% and higher doses of cholecalciferol (800–2000 IU/daily) reduce hip fracture risk by 30%. Daily, weekly or 4 monthly regimens appear effective, but annual high dose administration should be avoided. A vitamin D level of >60 nmol/L is required for falls and fracture prevention. Those requiring anti-osteoporosis treatment should have supplemental vitamin D and calcium when dietary intake is inadequate.

4. Medications:

Medications should be reviewed in the elderly so as to identify medicines that may cause side effects or drug interactions such as dizziness or drowsiness. In a study it has been found that Psychoactive medications taken by 22% community dwelling older people and there is strong evidence they increase the risks of falls. Psychoactive drug withdrawal can reduce falls by 66%.

5. Environmental and Behavioural Interventions:

Making homes safer by reducing tripping hazards, adding grab bars inside and outside the tub or shower and next to the toilet, adding railings on both sides of stairways, and improving the lighting in their homes, non-slip mats, a raised toilet seat, use of assistive devices like cane or walker, properly fitting sturdy footwear with nonskid soles.

Rashmi and Lalita (2005) in a presentation has pointed out that hip fractures in elderly people are almost always the result of falls. Regular exercise increases muscle strength, coordination and flexibility and reduces the tendency to fall.

Exercise reduces the risk of falling by 10%, and balance training programs reduces the risk by nearly 20%. The elimination of environmental hazards, the avoidance of drugs which impair balance and management of neuromuscular disorders play a role in fracture prevention (Wark, 1993).

A recent study, published in the Journal of the American Geriatrics Society (2005), reveals that older people in residential care can reduce their incidence of falls if they take a vitamin D supplement for two years. To determine whether vitamin D supplementation can reduce the incidence of falls and fractures in older people in residential care who are not classically vitamin D deficient, the Australian researchers examined the effect of vitamin D supplementation in 625 residents of 149 residential care facilities for a period of two years. The participants were randomly assigned to receive vitamin D supplements (ergocalciferol) or inactive 'placebo' for two years.

Recommended Components of Clinical Assessment and Management for Older Persons Living in the Community who are at Risk for Falling-

Assessment and risk factors	Management
1. Circumstances of previous falls	Changes in environment and activities to reduce likelihood of recurrent falls.
2. Medication Use- - High risk medications (eg benzodiazepins, neuroleptics, antidepressants, Anti-convulsants or antiarrhythmics). - Four or more medications	Review and reduction of medications.
3. Vision - Acuity <20/60. - Decreased depth perception. - Decreased contrast sensitivity - Cataracts	Ample lighting without glare, avoidance of multifocal glasses while walking; Referral to an ophthalmologist.
4. Postural B.P.(after ≥5 min in a supine position, immediately after standing and 2 min after standing). ≥20 mmHg drop in systolic pressure with or without symptoms, either immediately or after 2 min of standing.	Diagnosis and treatment of underlying cause; adequate hydration; compensatory strategies eg-elevation of head of bed, rising slowly or dorsiflexion exercises; pressure stockings; pharmacologically.
5. Balance and gait - Patient's report or observation of unsteadiness - Impairment on brief assessment (eg Get up and Go test or performance-oriented assessment of mobility)	Diagnosis and treatment of underlying cause; increase in proprioceptive input with an assistive device or appropriate footwear that encases the foot and has a low heel and thin sole; reductions of medications that impede cognition; referral to Physiotherapist for gait, balance and strength training.
6. Targeted musculoskeletal examination, Examination of legs (joints and range of motion) and examination of feet.	Diagnosis and treatment of cause; Physiotherapy for strength, range of motion, gait and balance training; use of appropriate footwear, use of assistive devices.
7. Targeted Cardiovascular examination Syncope Arrhythmia (if there is known cardiac disease)	Referral to Cardiologist; Carotid Sinus massage (in case of syncope).
8. Home hazard evaluations after hospital discharge	Removal of loose rugs and use of nightlights, Non-slip bath-mats and stair rails; Other intervention as necessary.

All subjects received 600 mg of elemental calcium daily as calcium carbonate. The falls and fractures were recorded prospectively in study diaries by care staff. At the start of the study, patient characteristics were similar in both groups. The researchers found that that vitamin D use cut the risk of falls 27% to 37 %

compared with placebo. The study thus highlights the potential benefits of vitamin D supplementation in a population of elderly people in residential care. High risk patients with recurrent, unexplained or injurious falls should be considered for specialist referral and multidisciplinary intervention.

Key points

- Challenging balance exercise for 2 or more hours per week on an ongoing basis reduces falls risk in older adults living in the community.
- Daily 800–2000 IU vitamin D supplementation prevents falls and fractures in those with vitamin D levels <60 nmol/L, regardless of living location.
- Benzodiazepine extraction, occupational therapy home modifications, expedited cataract procedure and restricted multifocal spectacle use outdoors for active older adults are effective single interventions to reduce falls risk.

Recommendations:

In Indian older adults, falls are emerging as a prevalent public health problem. The rehabilitation needs of fall injured persons are significantly high and increasing from year to year. India and other developing countries face the major challenges of prevention, pre-hospital care and rehabilitation in their rapidly changing environments to reduce the burden of fall related injuries.

There is a need for developing a comprehensive care of providing preventive, curative and rehabilitative services to the elderly. Unlike the developed countries, India does not have well structured health services for the elderly, leading to a relatively ad hoc system of health care delivery to this vulnerable population. Specialized geriatric health services have to be developed, to educate, develop and maintain healthy lifestyles and to provide comprehensive health care. Falls are one of the most common geriatric syndromes threatening the independence of older persons.

There is a need for extensive education, proper assessment guidelines needs to be established to assess the older

adults who are prone to the risk of fall, free communication programmes to be undertaken through various media as well as governmental and nongovernmental organizations regarding fall events and preventive measures.

Proper training of healthcare professionals including Physicians, Physiotherapists, Nursing professionals, Health workers and Care givers in fall prevention programs, urgently needed. It is also necessary to investigate the effectiveness and feasibility of using new and innovative diagnostic and screening devices.

Proper assessment guidelines, specific balance tests like many elderly complaints of falling backwards while coming to standing from floor sitting, so balance tests including floor sitting to standing is to be made, these are not only cost effective and innovative but could provide a practical tool for identifying and preventing potential fallers.

Guidelines to address the prevention and treatment of fallers should be developed taking into account the cultural dimension to food choices and appropriate physical activity, such as Yoga, an ancient system of exercises originating in India. Dietary diversity should be promoted as a way of ensuring adequate amounts of nutrients to maintain bone health.

At community level, education about the preventive measures of fall through IEC material distribution in the form of posters, pamphlets, magazines ,charts on physical activity, balanced training and other activities like Yoga, ancient system of exercises originating in India, can be provided. Yoga involves 'asanas' which require stretching, maintaining positions and various stances that improve flexibility, strength (trunk and lower limb) and balance.

It is also important to design and implement culturally appropriate interventions to decrease falls.

Problems specific to Indian older adults such as osteoporosis, anaemia, poor nutrition and non-communicable diseases needs to be addressed. Effective fall prevention programmes should include assessment with targeted interventions, for

example, surgery for cataracts, vitamin D supplementation for vitamin D deficiency and iron supplements for anaemia.

Appropriate government investment is required for performing surveys and research studies on fall among elderly. Also in educating the importance of assistive devices like cane, walker and its free distribution is required to help the elderly to live healthy and disability free life.

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