

# **FALLS IN OLDER PEOPLE**

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## **Background / Introduction**

The number of persons above the age of 60 years is fast growing, especially in India. India as the second most populous country in the world has 76.6 million people at or over the age of 60, constituting above 7.7% of total population. The problems faced by this segment of the population are numerous owing to the social and cultural changes that are taking place within the Indian society. The major area of concern is the health of the elderly with multiple medical and psychological problems. Falls are one of the major problems in the elderly and are considered one of the “Geriatric Giants”. Recurrent falls are an important cause of morbidity and mortality in the elderly and are a marker of poor physical and cognitive status.

Evaluation of the morbidity profile among elderly people, and the impact of chronic conditions on functional disability and psychological well-being are an essential part of comprehensive assessment of the elderly. It will have implications for providing health care for the elderly population and its costs. There are few studies in Northern India which identify specific diseases that cause disability and consequent distress. Only three large-scale national surveys have been carried out exclusively with the aim of understanding the magnitude and pattern of various physical disabilities among the elderly population (Reddy and Surender, 1992).

## **Methods**

The review of studies relating to falls, falls prevention, unintentional injuries, fractures among elderly in India was made by internet searches, Medline search and hand searches of indexed journals. The research conducted by the Department of Geriatric Medicine, Government Hospital, Tamil Nadu is also included. Efforts were taken to follow the cross references by the authors of various studies specific to India.

Only Indian studies were chosen to be incorporated in this report. Researches carried out with the aging population only are included.

## **Results**

### **Epidemiology of falls in older population**

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.

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.

In a Multi-centric Community Study, evaluating Health Problems in the Elderly (Year 2003), in 10 states across India, covering a total population of 10,200 elderly with equal rural and urban distribution, the incidence of falls (History of a single fall in the last 6 months) was found to be 14% (Data to be published)

Among the 35 states and union territories in India, Kerala has registered the highest proportion of elderly. The aged in Kerala constitute 11% of the population. Between 1961 and 1991, there has been 160% increase in the population of older adults, the majority of them being women. Their population, which was 9% in 1991, is expected to increase to 37% by 2051.

The Kerala Aging Survey (KAS), conducted among more than 5,000 elderly (2,271 men and 2,722 women) in 14 districts of Kerala, was the keystone of the study. The results of the survey have shown that the age of participants ranged

from 60 to over 100 years of age with 54% being women. The results of the study show that falls and fractures are a significant issue among older adults

Joshi, Rajesh Kumar and Avasthi (2003) conducted a cross-sectional survey of 200 subjects over 60 years old (100 each from the urban population of Chandigarh City and the rural population of Haryana State of India) was carried out using a cluster sampling technique. The study period was July 1999–April 2000. Various socio-demographic characteristics were recorded at baseline. A clinical diagnosis was made by a physician based on reported illness, clinical examination, and cross-checking of medical records and medications held by the subjects. Psychological distress and disability was assessed using the PGI-Health Questionnaire-N-1 and the Rapid Disability Rating Scale-2, respectively. ANOVA, Kruskal–Wallis H test, correlation coefficient, and multivariate analysis were used to assess the relationship and association of morbidity with other variables.

Assessment of the morbidity profile and its determinants will help in the application of interventions, both medical and social, to improve the health status and thus the quality of life of the elderly in Northern India. The distribution of history of fall among elderly people over 60 years old shows that, out of the total sample population, 103 (51.5%) subjects had fallen. Fracture was reported in 21.3%, and other injuries occurred in 79.6% of those who had fallen. Fractures among females (26.4%) were reported more frequently compared with males (16%) and fracture was seen more in urban subjects (29.4%) compared with rural subjects (13.4%).

History of fall and fall frequency was seen to be significantly associated with disability and psychological distress. Higher disability and consequent increasing distress was noted among those with a prior history of fall after 60 years of age and those with a history of three or more falls. The significance of falls among elderly people is that not only that the number of falls increases with age but the injury rate is highest among the oldest old (80 years) subjects with

history of falling more than twice. There is a vicious cycle where, due to poor perceived health and morbidity there is increased tendency to fall which itself leads to increasing disability and distress.

**Relationship of morbidity profile with disability and psychological distress**

Morbidity	Disability			Psychological distress	
	N	Mean (SD)	P-value	Mean (SD)	P-value
<b>History of falls</b>					
Yes	103	29.0 (7.6)	0.001	13.5 (6.8)	0.001
No	97	23.0 (3.7)		7.3 (5.5)	
<b>Frequency of falling</b>					
≤ 2	152	24.6 (5.5)	0.001	8.9 (6.3)	0.001
3 +	48	30.6 (4.5)		15.6 (6.4)	

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).

Johnson (2006) examined the frequency and nature of falls and fall-related injuries among older women in the state of Kerala, India. The study involved 82 community living and 63 institutionalized women aged 60 years or older in Trivandrum, Kerala, India. Demographic data and falls profile were collected through the use of a field survey. A significantly lower percentage (45%) of community dwelling participants suffered a fall in the previous year, compared to 64% of those in the Long Term Care (LTC) settings ( $p < .05$ ). Overall, of those who fell, 74% reported an injury (e.g., cuts and bruises, fractures) as a result of the fall, and 48% of older adults in the community and 70% in the LTC setting required medical treatment as a result of the falls. Falling is emerging as a significant public health problem facing older women in the state of Kerala. Fall

prevention strategies to address falls should be explored and implemented within the Indian context.

It is estimated that nearly 1.5 to 2 million persons are injured and 1 million succumb to death every year in India. Gururaj (2002) has found that road traffic injuries are the leading cause (60%) of traumatic brain injuries followed by falls (20%-25%) and violence (10%).

### **Health services impact and costs of falls in older people**

Falls are an important cause of morbidity and mortality in the elderly. Most often the cause of fall is multifactorial. Falls and their sequelae are potentially preventable and hence it is of importance to know the risk factors for falls in the elderly.

Asian elders make relatively heavy use of health services: this may be due to higher levels of morbidity, but controlled comparisons have not been carried out. A comparison of the prevalence and severity of chronic diseases and use of health services of Asian and indigenous elders were made. A sample of 59 Gujarati Asians of mean age 62.9 years and 59 indigenous subjects of mean age 63.9 years of whom 42% (25 in each group) were female drawn from a general practice was studied. Asian subjects had a higher prevalence of diagnosed diseases, with the exception of chronic obstructive airways disease, but lower risk of falls and urinary incontinence. Asian subjects had higher life satisfaction scores and lower prevalence of depressed mood. Asian women were more likely to have had contact with primary care services. Both Asian men and women had more frequent hospital admissions, but similar levels of out-patient attendance. Body mass index, blood pressure and shoulder joint range of movement were similar for both Asians and the indigenous population. Asian subjects had significantly lower peak expiratory flow rates and hand grip strength. Asian elders have a higher risk of chronic diseases, but the impact of disease (indicated by life satisfaction, mood, and common disabilities) is less than among the indigenous

population. Lower peak expiratory flow rates and grip strength among Asian elders are of concern since they may lead to premature arrival at age-related thresholds of physical capacity essential for independence in activities of daily living (Ebrahim et al. 1991).

Patterns of traumatic injuries due to fall from height certainly have an association with the amount of impact involved. A study of 63 medico-legal autopsies with the history of falls has been carried out during the period January 1974-July 1980. The injuries found were caused either by the direct impact, i.e., at the site of impact, or in a region distant from the site of impact of force as a result of transmitted force or indirect force. An attempt has been made to evaluate, generalize and correlate the characteristic pattern of the injuries to the various parts of the body with respect to various heights of fall. Stress has also been laid on the mechanism of production of these injuries in order to create a composite picture to help determine the most likely traumatic force in falls from height (Gupta, Chandra and Dogra, 1992).

The first study to assess, Fracture Threshold by the use of T scores amongst the South Indian population was performed by Krishnaswamy and Usha (2001). This study aimed to assess the risk of fracture using dual energy X-ray absorptiometry, and to analyse whether the result, i.e. the T score, can predict an impending hip fracture. A prospective study for estimating BMD was done in 116 elderly patients (53 Males and 63 Females). Of them, 38 had sustained fractures. Mean BMD in fracture cases was 0.72 and in Non-fracture cases was 0.8. The study suggested a BMD value of 0.72 as a fracture threshold in South Indian Elderly, a population to be targeted for fall prevention strategies

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

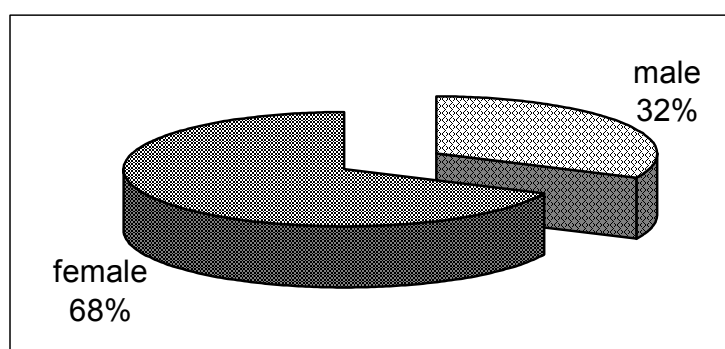


deficient, the Australian researchers examined the effect of vitamin D supplementation in 625 residents of 149 residential care facilities for a period of two years. The participants were randomly assigned to receive vitamin D supplements (ergocalciferol) or inactive 'placebo' for two years. All subjects 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.

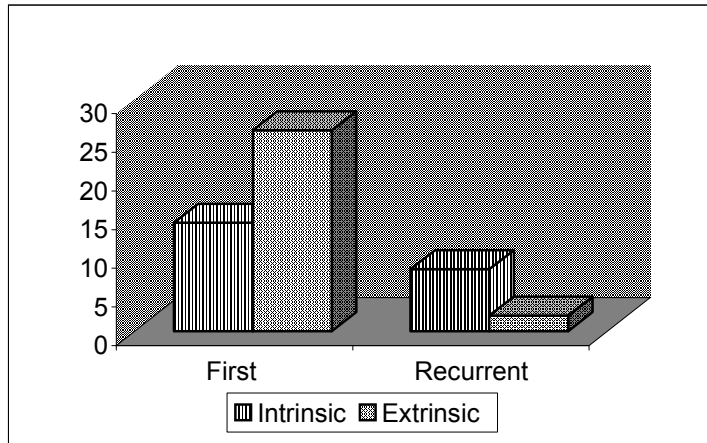
Krishnaswamy and Shanthi (2005) evaluated 100 patients above 60 years with falls. Comprehensive geriatric assessment including detailed history of fall, ADL using Barthel index, underlying medical disorders, medication history, was done. Examination included assessment of BMI, MMSE, Cardiovascular, neurological and musculoskeletal system. Patients with injuries then underwent relevant plain x-rays to diagnose fractures.

Of the 100 patients 68% were females. Among the causes for falls, intrinsic causes for falls were more prevalent in people >70 years. Among the medical conditions causing falls, musculoskeletal causes and visual defect were common. Multiple aetiologies were present in many individuals. The mean BMI was low in patients who sustained fractures. Fractures occurred in 48% of sedentary group as against 12% of exercising group. Drug induced falls were most commonly due to sedatives.

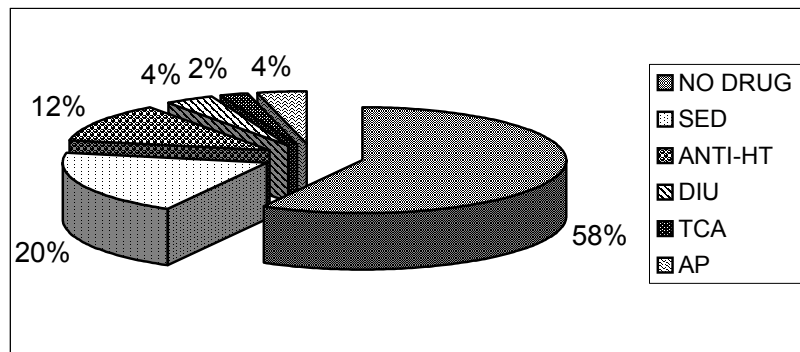
### **Sex Ratio :**



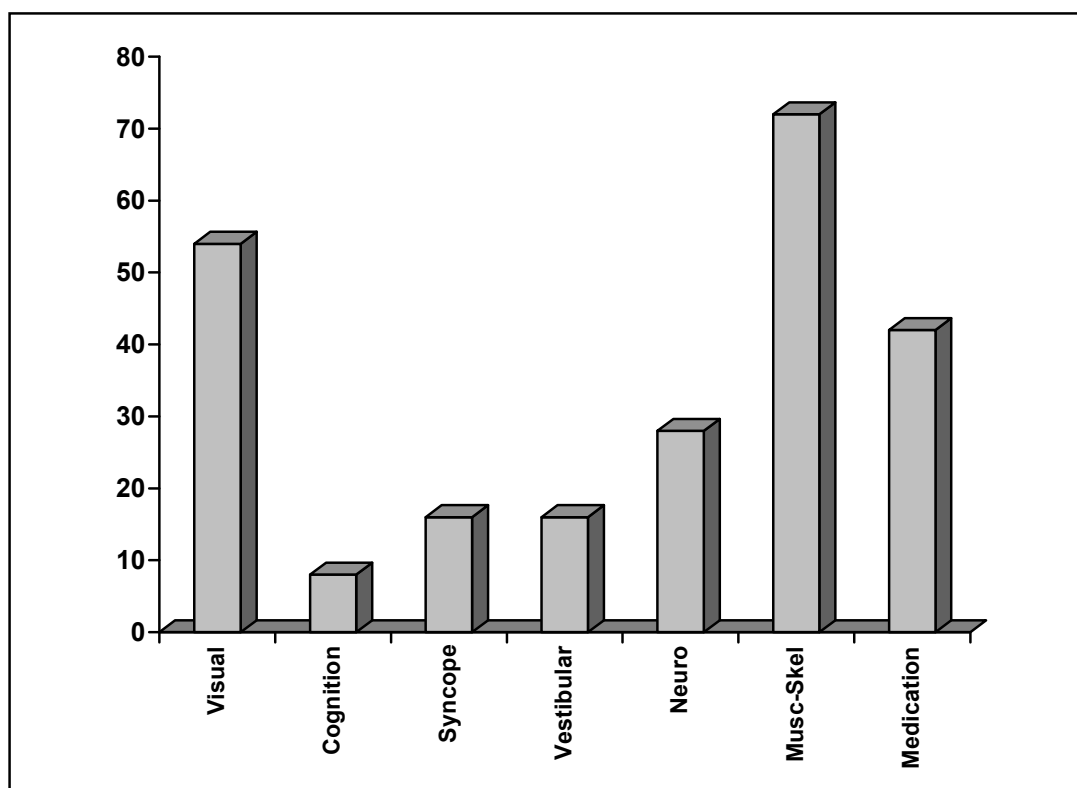
**Causes of Falls :**



**Drugs and Falls:**



### Intrinsic Causes of Falls:



Falls and fractures are more common in females (2:1). Falls due to intrinsic causes and recurrent falls were common in people > 70 years. The sedentary group fell more frequently than exercising group due to lack of stability. Of the medical conditions predisposing to falls, musculoskeletal problems rank first, followed by visual defect, neurological illness, syncope, vestibular causes, hypertension, postural hypotension and dementia. Drug induced falls were commonly associated with sedatives and hypnotics usage.

Fall is an event caused by age associated diseases like Parkinson's disease, cognitive decline and musculoskeletal problems in association with physiological changes like impairment of sensory system, impairment of righting reflex and decrease in lean body mass. The incidence of falls increases with advancing age. It is one of the leading causes of death in elderly due to its complications of which 50% is hip fracture. The morbidity due to falls include

serious injuries and fractures, restricted mobility and loss of independence leading to functional decline, psychological fear of falling (post fall syndrome) and permanent disability.

More than 90% of hip fractures are associated with falls in persons above 70 years of age and is associated with greater mortality.

The mean body mass index of fracture cases was lower (19.02) than BMI of non-fracture case (25.22). The incidence of falls was less in exercising group than sedentary group. Among the exercising group who had falls, 60% did not sustain hip fracture, indicating that muscle strength and endurance improves with regular exercise which prevents falls by better neuromuscular control and fracture by better dissipation of force (Rees and Neuhom, 1998; Cummings, 1998).

The study by Krishnaswamy and Shanthi has also indicated that musculoskeletal problems like osteoarthritis, rheumatoid arthritis, myopathy secondary to hypothyroidism, cervical and lumbar spondylosis were the cause for falls in elderly. Neurological illnesses, which cause deterioration of sensorimotor function of muscle, contribute to falls. Multiple factors are responsible for falls in our study group. Musculoskeletal disease, physical disability or limited activity increased the risk of fall by two to four times (Davis, Ross, Nevitt and Richart, 1999).

### **Interventions/best practice of falls prevention**

Multifaceted programs, including exercise, vision correction, medication review and adjustment, and environmental modification, appear to be effective in randomized control trials. Individually prescribed programs of muscle strengthening and balance retraining, and also Tai Chi (which combines strength and balance training) may be effective as sole interventions for preventing falls (Gillespie, Gillespie, Robertson, et al., 2002). Devices such as hip protectors,

which work by reducing the amount of energy absorbed by the bone during a fall onto the hip, appear to be efficacious among frail older adults, with a recent trial showing a 60% reduction in hip fractures among those randomized to receive the device (Kannus, Parkkari, Niemi, et al., 2000).

Sumita Rege and Anjali Joshi (2005) determined the effects of remedial therapy on visual perception(TVPS), depth perception and balance in the city of Mumbai on 20 community-dwelling, literate male (eight) and female (twelve) participants aged 60 years and over with an average age of 68 years. All the participants reported to have good visual acuity with or without a visual aid. The criteria for exclusion from the study included: Uncontrolled or untreated hypertension, diabetes mellitus, visual problems like cataracts, glaucoma and macular degeneration; Individuals with diagnosis of neurological or psychiatric or cognitive deficits or any orthopaedic condition or foot disorders.

Table 1 shows the changes, which occurred on the TVPS.

#### Comparison of the scores for the TVPS

	PRE-THERAPY		POST-THERAPY		p value
	Mean	SD	Mean	SD	
Visual Discrimination	12.93	1.71	14.5	0.92	0.005
Visual Memory	9.27	3.15	10.7	2.19	0.0039
Visual Spatial Relations	13.4	2.97	13.2	2.7	0.27
Visual Form Constancy	10.53	3.22	11.5	3.25	0.005
Visual Sequential Memory	9.6	3.48	10.3	3.65	0.156
Visual Figure Ground	10.87	3.07	11.4	2.85	0.013
Visual Closure	10.93	3.71	13.3	2.37	0.001

There was a statistically significant improvement in the performance of the participants for all the subtests of the TVPS except visual spatial relationships and visual sequential memory. There was no difference in the scores for depth perception. This could be because decreased depth perception with aging is related to anatomical and physiological changes occurring in the eyes. The

statistically significant results of improvement in balance are consistent with other similar studies like Lichtenstein et al (1989) and Campbell and Robertson (1997). All the studies state the need to concentrate on various aspects of the postural control system to maintain postural balance. The exercise program was designed on the basis of this principle.

The subjective observations of the clients, their relatives and the therapist were noted. These included the following:

- 11 subjects, (73%) felt that during and at the end of the therapy program, they experienced a feeling of wellbeing. Their level of confidence, especially for outdoor mobility, had increased.
- 4 subjects, (27%) felt that the therapy program made no difference to them. Some of these also found the visual perception activities to be boring and childish.
- Family members of 3 subjects felt that the participants felt that the participants seemed to be more alert, more confident and less dependent on others, at the end of the six weeks of therapy programme.
- The therapist observed qualitative and quantitative improvements in all subjects on the TUG test.

In the study of Epidemiology of medication related falls and fractures, it was found that psychotropic drugs have two fold increased risk of falls due to their central depressant effect. Diuretic therapy by causing electrolyte imbalance can precipitate falls and increase risk of fracture. Among the drug-induced falls, psychotropic drugs have increased risk of falls and fracture due to central depressant effect. Diuretic therapy causes electrolyte imbalance, which precipitates falls (Heidrich, Stergachis and Gross, 1991).

### **Falls prevention policies & sustainability**

Falls are potentially preventable and hence much interest is being shown in the evaluation of falls and identifying the risk factors, which help in falls prevention programs.

As the population ages, the problems related to falls and fractures are expected to grow and pose an even greater challenge to the health care systems. Meeting these challenges requires a clear understanding of the prevalence and nature of falls, innovative planning to develop prevention programmes, systems and structures which will support falls prevention initiatives, and substantial reforms and policies at the local and national levels.

In many developing countries including India, Fall events resulting in fractures is not recognised as a preventable risk factor. Responding to the caution of world experts and addressing the issue will avert the burden of fall related fractures. A majority of falls are predictable and therefore preventable. Community-based falls registries and surveillance systems should be set up to better understand the prevalence, nature, and the trends of unintentional injuries at the population level in India.

Several promising strategies such as exercise programmes, environmental modification, and other educational opportunities for preventing falls and fractures exist. However, further research is needed to assess the effectiveness of these strategies for the Indian elderly. Osteoporosis is an emerging health issue in India resulting in the higher rate of fractures.

### **Conclusions**

Lack of social support increases the risk of mortality and supportive relationships are associated with lower illness rates, faster recovery rates and higher levels of health care behaviour (Dhar, 2001).

Falls and fracture are common in older women and men. Recurrent falls due to intrinsic causes need complete evaluation of the underlying medical condition and require preventive measures. Sedative use was most commonly associated with falls. In order to improve the health status of the elderly population it is important to carry out more studies in different areas to identify various factors that are related to disability, which should lead to efforts to develop effective programmes in fall prevention.

### **Recommendations**

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 and communication programmes to be undertaken through various media as well as governmental and non-governmental organizations regarding fall events and preventive measures.

Appropriate government investment is required to develop a screening tool appropriate for public awareness campaigns, in collaboration with academic institutions with expertise in research and development of screening tools. Training of Physicians, 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. 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, distribution of manuals on physical activity, balanced training and other activities like Yoga, an ancient system of exercises originating in India, can be provided. It is aimed at integrating mind, body and spirit to enhance health and well-being.

Setting up of health care facilities for the elderly, at both government and private hospitals and medical colleges, will provide comprehensive care and to develop, data, research methodology and intervention techniques for falls and other related morbidities.

Performing surveys on falls among the elderly living in institutions and replicating the aging survey in all parts of India, to obtain a comparative perspective and information to suggest suitable policies at regional and national levels, to help the elderly to live healthy and disability-free life.

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