# Prevalence of fall and its associated factors among elderly population in India: Evidence from the Longitudinal Aging Study of India (LASI)

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## Evidence in Context

• 11.43% of 28,710 elderly individuals in India experienced falls. • Females had a higher fall risk (OR = 1.31). • Elderly aged 80+ were more prone to falls (OR = 1.16). • Bone/joint diseases (aOR = 1.25) and vision problems (aOR = 1.11) increased fall risk. • Poor self-rated health (aOR = 3.26) strongly predicted falls.

To view Article

## Abstract

**Background:** With the ageing population in India facing an increased risk of falls, understanding the detailed prevalence and nuanced risk factors is essential for developing effective prevention strategies. To assess the burden of falls and delineate associated risk factors among the elderly in India, leveraging data from the Longitudinal Aging Study of India (LASI).

**Methods:** This study analyzed LASI data from 2017-2019, focusing on individuals aged 60 and above. We assessed self-reported falls over the past two years and evaluated potential risk factors, including sociodemographic characteristics and chronic health conditions, through logistic regression models.

**Results:** Among 28,710 participants, the prevalence of falls was 11.43%. Detailed analysis revealed significant gender differences, with females (odds ratio = 1.31, p =0.000) experiencing more falls than males. The prevalence rates based on age groups indicated that individuals aged 80 and older were more prone to experiencing falls (odds ratio = 1.16, p = 0.011) in contrast to those aged between 60 and 69 years. Chronic conditions such as bone/joint diseases and vision problems markedly increased fall risk (aOR = 1.25 and aOR = 1.11, respectively). Notably, self-rated poor health emerged as a strong predictor for falls (aOR = 3.26), emphasizing the interplay of physical health and self-perception in fall risk.

**Conclusion:** The study identifies specific demographics and health conditions that significantly increase fall risk among India's elderly. Highlighting the disproportionate impact on females and the elderly above 80, alongside the critical role of self-rated health.

*Keywords: elderly fall prevention; ageing population health; geriatric safety; health equity; sustainable healthcare; age-related risk factors; quality of life in ageing*

## Introduction

The global aging population has led to a significant public health challenge associated with falls in older individuals [1]. Worldwide, there are approximately 96.2 crore people aged 60 and above (13% of the world population) [2]. The global population aged 60 and above is estimated to reach 200 crores by the year 2050, up from 90 crores in 2015. The percentage of individuals aged 60 and above in India grew from 5.6% in 1961 to 8% in 2017. Estimations suggest a persistent rise, with projections indicating that approximately 12.4% of the overall population will be reached by the year 2026. In rural India, around 64 out of every thousand elderly individuals experience one or more disabilities, while in urban areas, this figure is 55 per thousand. In this demographic, unintentional injuries such as falls are acknowledged as the fifth-most common cause of death globally. Two-thirds of deaths in this category are attributed to falls. Each year, around 646,000 individuals worldwide lose their lives due to falls, with over 80% of these occurrences taking place in resource poor countries. In 2010, the disability burden measured in years lived with disability (YLDs) with falls stood at 63.12 per one million population in India [3].

Falls pose a significant challenge for older individuals and are identified as one of the major health concerns in aging, commonly referred to as the "geriatric giants." Falls play a major role in morbidity, accounting for 20–30% of injuries in the elderly and comprising 10–15% of all emergency department visits. Additionally, falls are responsible for 50% of hospital admissions due to injuries among those aged 65 and older. The elderly population's vulnerability to falls is attributed to age-related declines in physiological responses, encompassing diminished visual acuity, auditory perception, mobility skills, cognitive capabilities, and reflex responses. Beyond causing health issues, falls are a prominent cause of mortality among the elderly [2]. Injuries resulting from falls can have fatal or non-fatal consequences, leading to a diminished quality of life and increased healthcare costs. As individuals age, the health impacts and expenses associated with falls are rising globally. Fall-related injuries may result in a decline in the ability to perform daily activities. Falls, particularly among older individuals, contribute to disability, with many injured individuals unable to regain their previous level of functioning as well as can lead to psychological repercussions. Those who have experienced a fall might develop a fear of falling, leading to decreased mobility. The decreased mobility resulting from a fear of falling can lead to various complications, including pneumonia, rhabdomyolysis, weakness, pressure ulcers, and a heightened susceptibility to additional falls. Serious injuries resulting from falls often involve fractures, particularly in the pelvic and thigh regions. Meanwhile, the majority of injuries affect the head, trunk, upper limbs, and lower limbs, resulting in conditions such as bruises, cuts, fractures, and dislocations [4]. Recurrent falls are common and contribute to considerable morbidity and mortality in older adults, reflecting an overall poor physical and cognitive status. Apart from physical injuries, recurring falls can induce fear and psychological trauma, often referred to as "post-fall syndrome," leading to a reluctance to move due to the fear of additional falls and injuries.

Around a third of these individuals undergo one or more falls annually, while 10% encounter multiple falls each year. Such recurring falls can have a profound impact on the elderly, causing significant morbidity and jeopardizing their independence. This, in turn, triggers a cascade of socio-economic and personal consequences. The impact of falls on older adults extends to healthcare costs and both direct and indirect expenses. Direct costs involve payments associated with treating falls, while indirect costs encompass financial losses due to work absence (of the individual and family caregiver), injuries related to disability, and dependence [5]. Hence, there is a need to investigate both the factors that contribute to falling and those that provide protection, followed by implementing suitable interventions. Elderly individuals with restricted activities of daily living often harbour a fear of falling, resulting in decreased physical function and limited physical activity, ultimately elevating the risk of falls. The current study's objective is to ascertain the prevalence of self-reported falls within the last two years and to delineate the risk factors associated with falls among older adults (age 60 & above). This research leverages information gathered from the LASI survey conducted across the country.

## Methods

**Data**

Our research is based on data collected during the initial phase of the LASI in India, which was carried out from 2017 to 2019. This data is publicly available for access. LASI serves as a nationally representative longitudinal survey, aiming to gather essential insights into the physiological, mental, physical and social aspects of well-being among aging population in India [6]. LASI represents a detailed national panel survey, targeting people aged 45 and above, along with their partners. The primary goal is to provide longitudinal perspectives on diverse aspects, including health, economic well-being and social, among the older people in India. The information gathered through LASI spans a broad spectrum of areas including household financial conditions, mental and physical health status, biomarkers, demographic factors, health insurance coverage, use of healthcare services, family and social networks, government welfare programs, occupational status, retirement planning, and overall well-being. The survey's indicators are specifically designed to reflect the unique conditions in India, yet they align with global studies on aging and retirement to maintain relevance and adaptability to the specific needs of the local populace [7]. LASI gathers data from more than 72,000. This study targets individuals who are 45 years old and older, as well as their spouses, covering every state and union territory in India, except for Sikkim. To collect data at the individual level, the survey employs a multistage stratified cluster sampling methodology, which includes 3 stages in rural settings and 4 stages in urban environments. Details regarding the sample design, questionnaires of survey, procedures of fieldwork, as well as collection of data and processing methods, are published in the LASI report [6].

**Description of variables**

**Outcome variable**

**Occurrence of fall**

The occurrence of fall in the past 2 years was asked in LASI using the question "In the past two years, have you fallen down?" with options of "Yes" or "No" as answer. Our study created the variable for occurrence of fall only among the elderly population, i.e. Age 60 & above.

**Independent variables**

**Chronic diseases**

In LASI, participants were inquired to report any diagnoses of various chronic conditions they have. We have included selected chronic diseases which are relevant with the occurrence of fall among the elderly population: Hypertension, Diabetes, Stroke, Chronic lung diseases, Cancer, Bone/joint diseases (osteoporosis, arthritis, rheumatism, and other diseases), Neurological/Psychiatric problems (Alzheimer's disease & dementia, Depression, neurological problems, psychiatric problems, and other problems) and Vision problems (Presbyopia, Cataract, Glaucoma, Myopia, Hypermetropia and Other problems). Chronic diseases and falls pose significant challenges to the well-being of the elderly, negatively impacting their quality of life. Serious falls can cause reduction in functionality, increased or permanent dependency, and, in severe instances, death. The intricate interplay of various risk factors contributes to falls, encompassing basic demographic characteristics such as gender, age, and residence. Chronic diseases further heighten the risk of falls, with conditions like hypertension, diabetes, arthritis, visual impairment, and chronic obstructive pulmonary disease increasing the susceptibility of the elderly to falls. Individuals with neurological conditions like Parkinson's disease and dementia face a higher rate and risk of falls. It's crucial to recognize that the diverse health statuses among the elderly carry distinct risks associated with falls [8].

**Sociodemographic factors**

Selected individual socio-demographic characteristics including, age category, sex, residence state, place of residence, attended school, highest level of education, current marital status, current working status, main job, and self-rated health were included in the analysis.

**Statistical analysis**

Continuous variables were characterized by their mean and standard deviation (SD) or median

Interquartile range (IQR), depending on their distribution. Categorical variables were presented as frequencies and percentages. Age was categorized into 3 categories (60-69, 70-79, 80 and above) and analysed as a categorical variable. Bivariate analysis was used to examine the relationship between falls and different socio-demographic factors and chronic conditions by calculating the Odds Ratio (OR) and a 95% Confidence Interval (CI). To obtain the adjusted odds ratio (AOR) and P-value with 95% CI, multivariate analysis was done between the occurrence of falls with socio-demographic characteristics and chronic diseases. Stata V.16 (Stata Corp) was utilized for the statistical analyses.

## Results

**Description of study population**

LASI comprised 34,704 individuals classified as middle-aged adults (45 to 59 years) and 31,915 classified as older adults (60 years and above). After excluding 6,789 participants with reported ages below 45 years, the final sample size included 28,710 older adults aged 60 years and older.
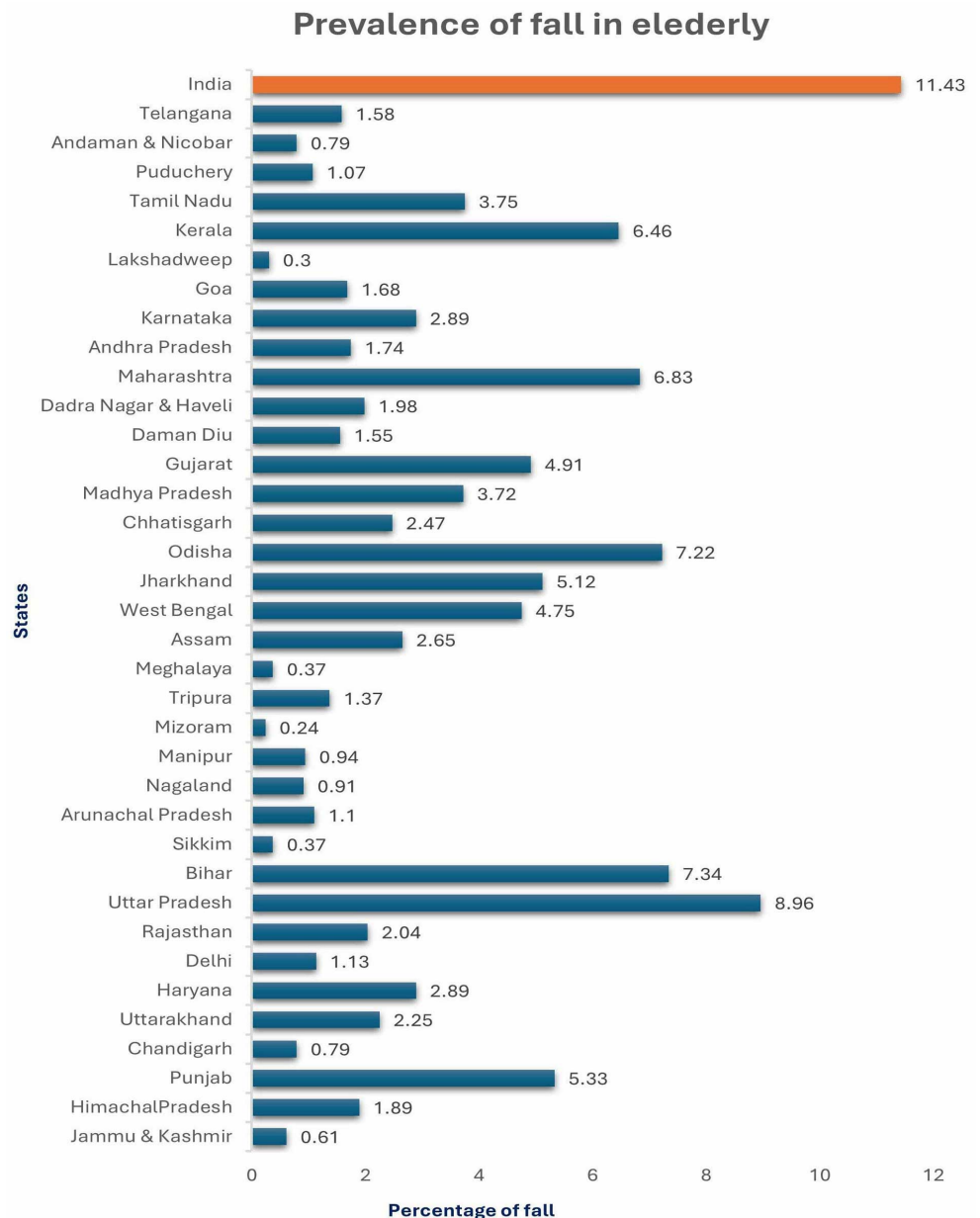


**Figure 1 indicates the prevalence on a state-by-state basis of falls in the elderly population**

### Prevalence of falls among the elderly

The prevalence of falls among the elderly population is 11.43% (N=3282) in India. Figure 1 indicates the prevalence on a state-by-state basis of falls in the elderly population. **Table 1** summarizes the prevalence of falls among the elderly with different socio-demographic characteristics. Among the older people who experienced falls within the last two years, the majority were female (56.95%) and 43.05% were male. In the age category, the majority (59.05%) were aged between 60-69. Regarding the place of residence, the majority (71.54%) resided in urban areas and 28.46% in rural areas. A total of 44.67% had attended school, the majority (32.06%) of them having the highest educational qualification as "Less than Primary (Standard 1-4)." The majority were currently married (60.48%). Regarding the current working status, the majority (58.29%) were not currently working, and 41.71% were working. The majority of them were engaged in farming/fishery/forestry by their own or family (38.24%).

**Table 1: Socio-demographic characteristics of elderly people with falls (N=3282)**

| Characteristics | Fall occurrence n (%) | Total number of cases (N) |
|---|---|---|
| Place of residence | | |
| Urban | 2,348 (71.54) | 3282 |
| Rural | 934 (28.46) | |
| Sex | | |
| Male | 1413 (43.05) | 3282 |
| Female | 1869 (56.95) | |
| Age | | |
| 60-69 | 1938 (59.05) | |
| 70-80 | 964 (29.37) | 3282 |
| 80 & above | 380 (11.58) | |
| Attended school | | |
| Yes | 1466 (44.67) | 3282 |
| No | 1816 (55.33) | |
| Highest level of education | | |
| Less than Primary (Standard 1-4) | 470 (32.06) | |
| Primary Completed (Standard 5-7) | 392 (26.74) | |
| Middle Completed (Standard 8- 9) | 207 (14.12) | |
| Secondary School/Matriculation complete | 206 (14.05) | |
| Higher Secondary/Intermediate/Senior | 74 (5.05) | 1446 |
| Diploma and certificate holders | 16 (1.09) | |
| Graduate degree (B.A., B.Sc., B. Com., etc.) | 67 (4.57) | |
| Post-graduate degree or (M.A., M.Sc., etc.) | 13 (0.89) | |
| Professional course/degree (B. Ed, BE, etc.) | 21 (1.43) | |

| | | |
|---|---|---|
| Current marital status | | |
| Currently married | 1985 (60.48) | |
| Widowed | 1224 (37.29) | |
| Divorced | 10 (0.3) | |
| Separated | 16 (0.49) | 3282 |
| Deserted | 13 (0.4) | |
| Live in relationships | 7 (0.21) | |
| Never married | 27 (0.82) | |
| Currently working | | |
| Yes | 1014 (41.71) | 2431 |
| No | 1417 (58.29) | |
| Main job | | |
| Farm/fishery/forestry (own/family) | 91 (38.24) | |
| Agricultural laborer | 72 (30.25) | |
| Non-agricultural business owner | 10 (4.2) | |
| Own account worker | 35 (14.71) | 238 |
| Wage-salaried worker | 27 (11.34) | |
| Paid family worker | 3 (1.26) | |
| Self-rated health | | |
| Excellent | 43 (1.33) | |
| Very good | 345 (10.71) | |
| Good | 1017 (31.57) | 3221 |
| Fair | 1224 (38.00) | |
| Poor | 592 (18.38) | |

**Table 2** summarizes the prevalence of different chronic diseases among the elderly with fall occurrence. Among the people who had fallen in the past 2 years, 3.32% had suffered a stroke, 37.93% had hypertension, 0.79% had cancer, 7.59% had chronic lung disease, 21.91% had bone/joint diseases, 2.96% had neurological/psychiatric problems, and 58.9% had vision problems.

**Table 2: Prevalence of chronic diseases among the elderly population with fall occurrence (N=3282)**

| Chronic diseases | Prevalence n (%) | Total number of cases (N) |
|---|---|---|
| Stroke | 109 (3.32) | 3281 |
| Hypertension | 1245 (37.93) | 3282 |
| Diabetes | 546 (16.64) | 3281 |
| Cancer | 26 (0.79) | 3281 |

| | | |
|---|---|---|
| Chronic lung diseases | 249 (7.59) | 3281 |
| COPD | 52 (20.88) | 249 |
| Bronchitis | 28 (11.24) | 249 |
| Asthma | 177 (71.08) | 249 |
| Other | 4 (1.61) | 249 |
| Bone/Joint diseases | 719 (21.91) | 3281 |
| Arthritis | 377 (52.65) | 719 |
| Rheumatism | 241 (33.66) | 719 |
| Osteoporosis | 220 (30.73) | 719 |
| Other diseases | 7 (0.98) | 719 |
| Neurological/Psychiatric problems | 97 (2.96) | 3281 |
| Depression Alzheimer's disease & dementia | 20 (20.62) | 97 |
| Psychiatric problems | 24 (24.74) | 97 |
| Neurological Problems | 16 (16.49) | 97 |
| Other problems | 57 (58.76) | 97 |
| | 1 (1.03) | 97 |
| Eye/Vision problem | 1933 (58.91) | 3281 |
| Presbyopia | 312 (16.19) | 1933 |
| Cataract | 815 (42.29) | 1933 |
| Glaucoma | 93 (4.83) | 1933 |
| Myopia | 811 (42.09) | 1933 |
| Hypermetropia | 763 (39.6) | 1933 |
| Other problems | 1374 (41.94) | 1933 |

**Risk factors associated with the occurrence of falls**

Variables that have high risk factors for the occurrence of falls among the elderly, according to a study taken to find an association with fall occurrence in the elderly [8]. Variables "age," "sex," "self-rated health," "Hypertension," "Diabetes," "Cancer," "Chronic lung diseases," "Stroke," "Chronic bone/joint diseases," and "Vision problems" were taken for the analysis to find the association with fall occurrence among the elderly.

In the unadjusted analysis **(Table 3),** several factors emerged as statistically significant predictors of fall occurrence. Elderly individuals aged between 70 to 79 had a higher odd of 1.04 (OR) with 95% CI (0.96-1.13) and a p-value of 0.285, and elderly individuals aged 80 and above had a higher odds of 1.16 (OR) with 95% CI (1.03-1.30) and a p-value of 0.011 compared to elderly individuals aged between 60 to 69 (reference group). Being female also demonstrated an association with a higher risk of falls (OR = 1.31, 95% CI: 1.21-1.41, p < 0.001) compared to males. Regarding self-rated health, poorer health status was associated with an increased risk of falls, with the highest odds observed for those reporting poor health (OR = 3.56, 95% CI: 2.58-4.90, p < 0.001) compared to those with excellent health.

Chronic diseases such as hypertension (OR = 1.16, 95% CI: 1.08-1.25, p < 0.001), diabetes (OR = 1.10, 95% CI: 1.00-1.22, p = 0.043), and chronic bone/joint diseases (OR = 1.43, 95% CI: 1.13-1.78, p < 0.001) were also associated with an increased probability of falls in the unadjusted analysis. Additionally, the presence of neurological/psychiatric problems (OR = 1.26, 95% CI: 1.01-1.56, p = 0.037) and vision problems (OR = 1.19, 95% CI: 1.11-1.29, p < 0.001) showed a notable association indicating an increased risk of falls.

In the adjusted analysis, which controlled for potential confounding factors, several risk factors remained statistically significant predictors of fall occurrence. Being female (aOR = 1.27, 95% CI: 1.17-1.37, p <0.001).

**Table 3: Logistic Regression Analysis for Associations Between Risk Factors and Fall Occurrences in Indian Elderly (N=3282)**

| Variables | Association with the occurrence of fall | | | |
|---|---|---|---|---|
| | OR [95% CI] | P-value | AOR [95% CI | P-value |
| **Age** | | | | |
| 60-69 | Ref | | Ref | |
| | | 0.285 | | 0.681 |
| 70-79 | 1.04 [0.96-1.13] | | 0.98 [0.90-1.06] | |
| | | 0.011 | | 0.504 |
| 80 & above | 1.16 [1.03-1.30] | | 1.04 [0.92-1.17] | |
| **Sex** | | | | |
| Male | Ref | | | |
| | | 0.000 | 1.27 [1.17-1.37] | 0.000 |
| Female | 1.31 [1.21-1.41] | | | |
| **Self-rated health** | | | | |
| Excellent | Ref | | | |
| | | 0.009 | 1.51 [1.09-2.09] | 0.013 |
| Very Good | 1.54 [1.11-2.14] | | | |
| | | 0.000 | 1.90 [1.39-2.61] | 0.000 |
| Good | 1.97 [1.44-2.70] | | | |
| | | 0.000 | 2.72 [1.99-3.72] | 0.000 |
| Fair | 2.91 [2.12-3.98] | | | |
| | | 0.000 | 3.26 [2.36-4.50] | 0.000 |
| Poor | 3.56 [2.58-4.90] | | | |
| **Hypertension** | | | | |
| No | Ref | | | |
| | | 0.000 | 1.01 [0.93-1.09] | 0.764 |
| Yes | 1.16 [1.08-1.25] | | | |
| **Diabetes** | | | | |
| No | Ref | | | |
| | | 0.043 | 0.99 [0.89-1.10] | 0.941 |
| Yes | 1.10 [1.00-1.22] | | | |
| **Cancer** | | | | |
| No | Ref | | | |
| | | 0.778 | 0.89 [0.58-1.36] | 0.606 |
| Yes | 1.06 [0.70-1.60] | | | |
| **Chronic lung diseases** | | | | |
| No | Ref | | | |
| | | 0.491 | 0.87 [0.75-1.01] | 0.071 |
| Yes | 1.04 [0.91-1.20] | | | |
| **Stroke** | | | | |
| No | Ref | | Ref | |
| | | 0.001 | | 0.066 |
| Yes | 1.14[1.165-1.76] | | 1.23 [0.98-1.53] | |
| **Chronic bone/joint diseases** | | | | |

| | | | | |
|---|---|---|---|---|
| No | Ref | | Ref | |
| | | 0.00 | | 0.000 |
| Yes | 1.43 [1.13-1.56] | | 1.25 [1.14-1.38] | |
| **Neurological/Psychiatric Problems** | | | | |
| No | Ref | | Ref | |
| | | 0.037 | | 0.666 |
| Yes | 1.26 [1.01-1.56] | | 1.05 [0.83-1.32] | |
| **Vision Problems** | | | | |
| No | Ref | | Ref | |
| Yes | 1.19 [1.11-1.29] | 0.000 | 1.11 [1.03-1.20] | 0.005 |

The findings from this logistic regression analysis highlight the importance of various risk factors, particularly sex, self-rated health, chronic bone/joint diseases, and vision problems, in predicting the occurrence of falls among the elderly population. These results provide valuable insights for developing targeted interventions and preventive strategies to reduce the risk of falls and associated adverse consequences in this vulnerable population.

# Discussion

The present research investigated the prevalence and determinants of falls among the older population in India, drawing on data from the LASI, which represents a comprehensive national survey. The findings highlight the significant burden of falls, with a prevalence of 11.43% among individuals aged 60 years and above. This figure aligns with previous estimates suggesting that approximately one-third of older adults experience falls each year globally [9]. The study identified several key risk factors associated with a heightened likelihood of falls in the older population. Being female emerged as a significant predictor of falls, with women having a 27% higher risk compared to men (aOR = 1.27, 95% CI: 1.17-1.37, p < 0.001). This finding is consistent with previous literature, which has consistently reported a higher incidence of falls among older women [5,10]. Potential explanations for this gender disparity include differences in muscle strength, balance, and bone density, as well as a higher prevalence of certain chronic conditions among women [11].

Self-rated health status was another crucial risk factor for falls. Individuals reporting poorer self-rated health had significantly higher odds of experiencing falls compared to those with excellent self-rated health. For instance, those with poor self-rated health had an aOR of 3.26 (95% CI: 2.36-4.50, p < 0.001) for falls. This finding aligns with previous studies that have demonstrated a strong association between the risk of falls and self-rated health [12,13]. Self-rated health is a comprehensive measure that captures a person's general well-being, including physical, mental, and functional aspects, which could contribute to fall risk.

The presence of chronic bone/joint diseases, such as arthritis, rheumatism, and osteoporosis, was identified as a significant risk factor for falls (aOR = 1.25, 95% CI: 1.14-1.38, p < 0.001). This finding is consistent with existing literature, which has consistently reported an increased risk of falls among individuals with musculoskeletal conditions [5,14]. Chronic bone and joint diseases can lead to pain, reduced mobility, and impaired balance, thereby increasing the likelihood of falls.

Vision problems were also independently associated with an increased risk of experiencing falls (aOR = 1.11, 95% CI: 1.03-1.20, p = 0.005). This finding corroborates previous studies that have highlighted the role of visual problems as a significant risk factor for occurrence of falls in the ageing population [15,16]. Visual impairments can affect depth perception, contrast sensitivity, and the capability to identify potential environmental dangers, thus elevating the probability of experiencing falls.

Interestingly, this research did not find a substantial association between age, hypertension, diabetes, cancer, chronic lung diseases, stroke, and neurological/psychiatric problems and the risk of falls in the adjusted analysis. This stands in opposition to findings from earlier research, which have identified correlations between these conditions and an increased incidence of falls [17,18].

Nevertheless, it's crucial to acknowledge that the connection between these factors and falls might be affected by various confounding variables, as well as the particular study population and setting.

The outcomes of the current study carry significant implications for fall prevention strategies in India. Given the significant burden of falls and the associated morbidity, mortality, and healthcare costs, targeted interventions are warranted. Particular attention should be paid to addressing risk factors such as chronic bone/joint diseases and vision problems through appropriate medical management, exercise programs, and environmental modifications.

Additionally, efforts should be directed towards promoting the general health and quality of life of the older population, as self-rated health emerged as a strong predictor of falls. This may involve a multidisciplinary approach encompassing physical, mental, and social aspects of aging.

Furthermore, the higher risk of falls observed among older women highlights the need for gender-specific interventions and awareness campaigns to address this disparity.

While this study makes valuable contributions, acknowledging its constraints is essential. The cross-sectional nature of the study limits the ability to establish causality between the risk factors identified and occurrences of falls. Additionally, relying on self-reported data introduces the possibility of recall bias. Future longitudinal studies, incorporating objective measures and follow-up data, would be beneficial in further elucidating the complex interplay of risk factors and their temporal relationship with falls.

## Conclusion

The present study provides a comprehensive investigation into the occurrence and associated risk factors of falls among the elderly population in India. The results emphasize the necessity for specific interventions and preventive approaches, particularly addressing chronic bone/joint diseases, vision issues, promoting general health, and customizing strategies to tackle the elevated risk identified among older women. By implementing evidence-based fall prevention measures, the burden of falls and their associated consequences can be mitigated, ultimately improving the quality of life and independence of the aging population in India.

### Supporting information

None

### Ethical Considerations

None

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### Author contribution statement

All authors contributed equally and attest they meet the ICMJE criteria for authorship and gave final approval for submission.

### Data availability statement

Data included in article/supp. material/referenced in article.

### Additional information

No additional information is available for this paper.

## Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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