Comparison of fall risk in rural and urban community-dwelling Indian elderly

ORIGINAL ARTICLE

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ABSTRACT

Background. To compare the intrinsic risk factors (health, balance, and mobility) and the prevalence, circumstances, and consequences of fall in urban and rural Indian elderly.

Method. A total of 148 older adults, 74 each in a rural and an urban area participated in a cross-sectional study from August 2012 to June 2013. A structured questionnaire was used to obtain information related to fall history in the previous year, health status, and socioeconomic and environmental details. The intrinsic risk factors were assessed using the Frailty and Injuries: Cooperative Studies of Intervention Techniques-4 (FICSIT-4) for static balance, Four Square Step Test for dynamic balance, Modified Clinical Test of Sensory Integration for Balance (mCTSIB), Timed Up and Go Test for functional mobility, 30-second Chair Stand Test, and the Balance Confidence Scale.

Results. The number of elderly reporting falls in the previous year was similar in urban (n=9) and rural (n=8) groups. Nonetheless, urban elderly reported more serious fall-related injuries, more medical consultations/hospitalisations, and more restriction in activity. The two groups differed in the type of health problems, number of medications taken, and socioeconomic and environmental characteristics that contribute to fall risk. Rural elderly had better performance on all tests of balance and mobility, particularly for FICSIT-4 ($p<0.001$) and m-CTSIB ($p=0.019$).

Conclusion. Urban and rural elderly differ in intrinsic risk factors, circumstances and consequences of fall, and also in socioeconomic and environmental risk factors. A fall prevention programme should be tailored specifically for the two populations for optimum results.

Key words: Accidental falls; Aged; Rural population; Urban population

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INTRODUCTION

The rapid growth of the elderly population is a concern for many economies around the world. One-eighth of the world's elderly population lives in India.[1] The ageing population poses a heavy burden of health care, economic and financial support on the young and independent population. To address the demands of an ageing population, the World Health Organization recommends prevention of non-communicable diseases and promotion of an active lifestyle.[2] Fall is identified as one of the major non-communicable diseases in the elderly that poses a serious threat to functional independence and active ageing.[2] The prevalence of fall in Indian older adults ranges from 14% to 51.5%.[3-6] Fall may result in significant mortality and morbidity,[3,5,7] and thus implementation of fall prevention programmes

is necessary.

According to the census of India in 2011, the rural-urban distribution of the population was 68.84% and 31.16%, respectively. Rural and urban populations have been found to differ in health-related aspects such as asthma[8] and physical fitness.[9] Rural elderly reportedly have more morbidities and less medical services available than the urban elderly.[3] These differences need to be considered when designing contextually relevant fall prevention programmes for the elderly. Studies of falls in Indian elderly have usually concentrated on the urban population[4,6,7] or have not specified rural or urban dwelling of its participants.[3]

Intrinsic risk factors for fall are those pertaining to the individual's body.[3,5,6] They are important predictors of fall in the elderly and include health, balance, and mobility.[10] The present study aimed to compare urban and rural elderly with respect to intrinsic risk factors for fall and also the prevalence, circumstances, and consequences of fall.

METHODS

This cross-sectional study was approved by our institutional ethical committee. The sample size was calculated by estimation of proportion. Using convenient sampling, the urban elderly were selected from the Indore city in the state of Madhya Pradesh, with a population of 1 960 631, whereas the rural elderly were selected from the Badgara village in the same state, 60 km from Indore.[11] Older adults aged ≥60 years living in either community who were able to walk and scored ≥23 on the Hindi Mental State Examination[12] were included. Those with any history of neurological (stroke, Parkinson's disease), orthopaedic (fractures, severe arthritis), or psychiatric conditions (mood disorders, schizophrenia) or any acute medical illness (fever, asthma) were excluded.

The participants' health-related information, circumstances and consequences of falls in the previous year were obtained using a semi-structured interview from August 2012 to June 2013. A fall was defined as 'losing balance such that your hands, arms, knees, buttocks or body touch or hit the ground or floor'.[6] Circumstances of fall included the cause, activity engaged in at the time, and place of fall.[6] The consequences of fall included resulting injuries, treatment undertaken, and consequent restriction in activity.[6] The health complaints and number of regular medications taken per day were based on reports by the participants, as medical records were unavailable for many. The demographic, socioeconomic, and physical environment details of the participants were also obtained.

Assessment of intrinsic risk factors included the Frailty and Injuries: Cooperative Studies of Intervention Techniques-4 (FICSIT-4) for static balance,[13] the Four Square Step Test for dynamic balance,[14] the Modified Clinical Test of Sensory Integration for Balance (mCTSIB) for assessing integration of various senses with respect to balance,[15] the Timed Up and Go Test for functional mobility,[16] the 30-second Chair Stand Test[17] for lower limb strength, and the Balance Confidence Scale for balance confidence.[18]

The level of significance was set at $p<0.05$. Age of the rural and urban elderly was compared using the independent t-test, whereas total number of health problems and number of regular medications taken by the 2 groups were compared using the Mann-Whitney *U* Test. The categorical variables (participant characteristics and fall prevalence) were compared using the Chi-square test. Two-way multivariate analysis of variance was used to compare the intrinsic risk factors of fall, with place of living and gender as the fixed factor, and age as the covariate.

RESULTS

The study comprised a total of 148 older adults, 74 each from a rural and an urban area. The mean age of the rural elderly was older than that of the urban elderly (69.23±7.14 vs. 66.30±5.4 years, $p=0.006$, **Table 1**). Rural and urban elderly differed significantly ($p<0.001$) in living situation, level of education, bathroom inside home, employment status, and pension availing; this is consistent with another study.[19]

With respect to health characteristics, overall, 22 (14.9%) elderly did not report any health problems. Rural elderly most commonly reported joint pain (66.2%), followed by vision problems (44.6%), dizziness (23%), and hypertension (17.6%). Urban elderly most commonly reported hypertension (67.6%), followed by vision problems (35%), joint pain

Table 1
Characteristics of rural and urban elderly

Characteristics	Mean±SD or no. (%) of participants		p Value
	Rural elderly (n=74)	Urban elderly (n=74)	
Age (years)	69.23±7.14	66.30±5.4	0.006
Gender			<0.001
Male	56 (75.7)	43 (58.1)	
Female	18 (24.8)	31 (41.9)	
Marital status			<0.001
Married	61 (82.4)	62 (83.8)	
Widowed	13 (17.6)	12 (16.2)	
Living situation			<0.001
Nuclear family	11 (14.9)	21 (28.4)	
Joint family	63 (85.1)	53 (71.6)	
Level of education			<0.001
Illiterate	33 (44.6)	5 (6.8)	
1-8 grade	36 (48.6)	7 (9.5)	
9-11 grade	5 (6.8)	7 (9.5)	
12 grade and above	0	55 (74.3)	
Employment status			<0.001
Retired	0	32 (43.2)	
Agriculture	68 (91.9)	1 (1.4)	
Non-agriculture	6 (8.1)	41 (55.4)	
Pension availing	4 (5.4)	19 (25.7)	<0.001
Bathroom inside home	31 (41.9)	74 (100)	<0.001
Type of house			<0.001
Cemented	25 (33.8)	74 (100)	
Uncemented	49 (66.2)	0	

(31%), and diabetes mellitus (28.4%). Both groups reported a median of 2 (range, 0-5) health problems (p=0.055). Urban elderly reportedly consumed a median of 1.5 (range, 0-8) medications, compared with 0 (range, 0-3) by rural elderly (p<0.001). None of the rural elderly took ≥4 medications per day, whereas 14 (19.1%) urban elderly did.

Rural elderly had better balance, mobility, and balance confidence than urban elderly (with Wilk's Lambda of p<0.001), particularly on FICSIT-4 for static balance (p<0.001) and m-CTSIB for sensory interaction for balance (p=0.019), after adjusting for gender and age (**Table 2**).

Eight (10.8%) rural elderly and 9 (12.2%) urban elderly (4 males and 13 females) had a fall in the previous year; the difference was significant (p<0.001). Rural and urban elderly were comparable with respect to circumstances of fall, but urban elderly reported more serious fall-related injuries, more medical consultations/hospitalisations, and more restriction in activity (**Table 3**).

DISCUSSION

Elderly subjects were recruited in public places such as hospitals, parks, and community centres. The results indicated that more rural elderly were still active in the community or even engaged in agricultural labour, whereas more urban elderly had restricted outdoor mobility. With respect to intrinsic risk factors, rural elderly had better balance, mobility, and balance confidence than the urban

Table 2
Balance, mobility, and balance confidence of rural and urban elderly

Assessment	Mean±SD		p Value
	Rural elderly (n=74)	Urban elderly (n=74)	
Four Square Step Test†	12.32±2.40	12.68±3.39	0.007
Frailty and Injuries: Cooperative Studies of Intervention Techniques-4*	25.77±2.52	22.57±5.26	0.001
Modified Clinical Test of Sensory Integration for Balance (seconds)*	118.45±4.34	114±9.37	0.019
Timed Up and Go Test (seconds)†	11.03±2.14	11.46±2.43	0.000
30-second Chair Stand Test (count)*	11.10±2.02	10.08±2.31	0.000
Balance Confidence Scale (percentage)*	92.71±9.69	89.95±16.98	0.001

* Higher score indicates better performance
† Lower score indicates better performance

Table 3
Circumstances and consequences of falls in rural and urban elderly

Variables	No. of falls		p Value
	Rural elderly (n=8)	Urban elderly (n=9)	
Circumstances of fall			
Cause			0.153
Intrinsic	4	5	
Extrinsic	4	4	
Time			0.161
Morning	3	4	
Afternoon	4	4	
Night	1	1	
Activity engaged in			0.008
Others	2	1	
Ambulation	6	8	
Location			0.808
Indoor	4	5	
Outdoor	4	4	
Consequences of fall			
Injuries			0.392
None	4	0	
Minor	4	7	
Fractures	0	2	
Treatment taken			0.819
None	5	0	
First aid	2	4	
Medical consultation	1	3	
Hospitalisation	0	2	
Restriction in activity	1	5	0.090

elderly, especially in static balance (FICSIT-4) and sensory interaction for balance (mCTSIB). This could be due to their active lifestyle and an environment that requires and facilitates higher balance ability. The varying sensory stimuli (tactile, visual, and vestibular) in the rural area may facilitate better sensory integration for balance.[20]

Joint pain, hypertension, diabetes, and cardiac problems were reported as common health problems of the elderly; this is consistent with other studies.[6,21] Nonetheless, the rural and urban elderly differed in the type of common health problems reported; joint pain was most common among the rural elderly and hypertension among the urban elderly. Hypertension and treatment-seeking behaviour are common in the urban elderly in Northern India.[3] Anaemia has been reported to be prevalent in the rural elderly with a greater number of comorbidities[3]; this was not consistent with the present study. This could be due to the self-report of health problems in our study, compared with diagnosis made by physicians based on clinical examination, review of medical records and medications. Self-report and clinical diagnosis may differ if a person views himself as healthy, but a physician may consider him ill. In addition, low literacy and health consciousness, social constraints, poverty, and poor access to health services in rural areas may attribute to the difference,[3] in contrast to lifestyle factors and inappropriate dietary habits in urban elderly.[22] In addition to age-related decline, the higher incidence of reported joint pain in rural elderly may be due to agricultural work that requires squatting for prolonged periods, carrying heavy loads, standing and walking for long duration. 19.1% of urban older adults took >4 medications per day, which is considered a risk factor for fall.[5,23] Nonetheless, this could also suggest that rural elderly were less aware of or had less access to medical treatment,[24] owing to monetary problems or limited access to health services.

The prevalence of fall in the present study was less than that reported in other studies of Indian elderly.[3-6] This could be due to the younger age of the older adults in the present study. The definition of fall history varied across studies; some report falls in the previous one year, some previous 6 months, and some all previous falls.[3,4,6,7] Although the prevalence of falls was significantly higher in urban older adults, clinically the prevalence was comparable. The rural and urban elderly were similar with respect to circumstances of fall. This was surprising as rural elderly are at higher risk of fall due to environmental features such as inadequate housing and electricity, uneven terrain, limited indoor bathroom/toilets. Falls commonly occurred at home, while ambulating and in the day time, which is consistent with previous studies.[6,25,26] Urban elderly had more serious fall-related injuries such as fractures that required medical consultation or hospitalisation and resulted in restriction in activity. This is consistent with previous studies.[3,5-7] Older adults in rural India may have under-reported fall-related injuries, because they tend to consider minor injuries as 'trivial' and seek no treatment because of poor access to hospitals or monetary problems.

The causes of fall are multi-factorial.[20] The fall risk model proposed by the World Health Organization identifies behavioural, socio-economic, environmental, and biological risk factors.[27] Although urban and rural elderly have a similar fall prevalence, they differ in fall risk factors. Urban elderly have better financial resources, access to health services, and better living conditions at home and outdoors, they may have higher behavioural and biological risk factors such as sedentary lifestyle, higher number of non-communicable diseases,[19,22,28,29] despite having inadequate balance and mobility. Rural elderly, despite being more active with better balance and mobility, may be at higher risk of fall due to salient socioeconomic factors such as lower literacy, inadequate financial support, limited access to health services, and most importantly environmental factors such as inadequate housing, lack of indoor bathroom/toilet, inadequate lighting due to limited electricity, and uneven terrain.[30] Most bathrooms/toilets in the rural area were located outside the house or even away the house in the open fields. In the event of a fall, they might be unable to seek help immediately. Inadequate lighting and walking on 'kacha' roads or uneven terrain, and lack of walking pavement are common problems in rural areas.

One limitation of the present study was the small sample size that limits generalisation. There may have been recall bias when completing the questionnaires. Access to health records was limited, and health problems were based on participants' report. Nonetheless, interviews were conducted with language familiar to the older adults, and their family

members were also interviewed, if available, to confirm accuracy of information. Most participants were of the young-old age, generalisation of the findings to older age groups should be with caution. Further population-based longitudinal studies are recommended.

CONCLUSION

Urban and rural older adults differ in their intrinsic risk factors for fall (especially static balance) and consequences of fall, as well as in socioeconomic, environmental, and behavioural risk factors. Fall prevention programmes for urban and rural older adults should be specific to the risk factors of each group. For rural elderly, the programmes should focus on improving health and nutrition, providing access to medical facilities, and improving socioeconomic and environmental (physical or built) risk factors such as recommending grab bars for stairs at house entrance, access to a bathroom/toilet inside house, low-cost toilet seat, increased illumination. For the urban elderly, the programmes should encourage an active lifestyle and incorporate exercise or activity to improve intrinsic risk factors of balance and mobility. Urban-specific risk factors such as diabetes and hypertension and related medications should also be emphasised.

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