

Original Research Article

Contributory factors leading to fall among elderly staying in rural area

Manpreet Kaur^{1*}, Jasbir Kaur², Priyanka Devgun³, Sarit Sharma⁴

¹SGRD College of Nursing, Sri Guru Ram Das University of Health Sciences, Vallah, Amritsar, Punjab, India

²MM College of Nursing, MMU, Ambala, Haryana, India

Department of Community Medicine, ³Sri Guru Ram Das University of Health Sciences, Vallah, Amritsar, ⁴DMC & Hospital, Ludhiana, Punjab, India

Received: 21 August 2018

Revised: 04 October 2018

Accepted: 06 October 2018

*Correspondence:

Dr. Manpreet Kaur,

E-mail: manpreet_arora001@rediffmail.com

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ABSTRACT

Background: Falls are one of the major problems in the elderly and are considered to be one of the “geriatric giants”, result from a complex interplay of predisposing and precipitating factors in a person’s environment.

Methods: The study was undertaken in the rural field practice areas of Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. A pretested semi-structured interview schedule was administered to 500 elderly each from the each area.

Results: The elderly, who had fall in last one year (25.4%), reported varied intrinsic factors and extrinsic factors. On multivariate analysis, among intrinsic factors, tremors, vertigo, decline in visual acuity, blurred vision, myocardial infarction, arthritis, muscle weakness, sedative hypnotic, major tranquilisers, antihypertensive, cardiac medications and NSAIDs were significantly contribution to fall. While extrinsic factors like improper design of furniture, presence of rapid closing doors, high located shelves, lack of step ladder, absence of grab bars in bathroom and around toilet, low seated toilet seat, slippery floor of the bathroom, inadequate light from bedside to bathroom, improper height of bed and presence of outdated medication were leading to fall among rural elderly.

Conclusions: Factors contributing to fall are modifiable and treatable, hence early screening and remedial measures are required to prevent the fall among elderly.

Keywords: Fall, Extrinsic factors, Intrinsic factors

INTRODUCTION

Ageing is generally defined as a process of deterioration in the functional capacity of an individual that results from structural changes, with advancement of age. The ageing process is growing at an unprecedented rate. India’s elderly population is also showing a dramatic increase in its elderly population in the past decades. There has been a steady increase in the share of elderly population over decades. It has risen from 5.6% in 1961 to 8.3% in 2014.¹ Current statistics indicate that the total percentage of elderly population in Punjab is 10.3%. This proportion varies among different districts of Punjab,

9.28% in Ludhiana to 12.06% in SBS Nagar as per 2011 Census. Amritsar is categorized as having very low proportion of ageing population as 9.65%.²

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.³ 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. Indian

studies report varied prevalence of fall 13% to 38%.^{4,5} The associated risk factors for falls include older age, history of past falls, cognitive impairment, impairments of activities of daily living, lower extremity weakness or other disability, impaired balance and gait, dizziness, arthritis, history of stroke, poor visual acuity, low body mass index, increased number of medications and use of psychotropic medication. A variety of extrinsic factors, such as poor lighting, unsafe stairways and irregular floor surfaces, are involved in falls among the elderly. Literature also indicates various life style modifications to be adopted to prevent further reoccurrence. There is now compelling evidence that risk-factor for falling can be influenced by the implementation of targeted intervention strategies designed to modify the various intrinsic and extrinsic determinants known to increase the likelihood of falling.

Existing literature indicates vulnerability of elderly for fall owing to multiple modifiable and non-modifiable risk factors. There is a huge need to conduct the present study in North India, especially Punjab, where the morbidity profile and living conditions are altogether different. The present study was undertaken with an objective for identification of contributory factors leading to fall among elderly.

METHODS

An extensive review of literature was carried out from varied sources. To accomplish the objective, quantitative approach with retrospective survey was considered appropriate. Elderly were interviewed for history of fall since last one year and then exploration was carried out about intrinsic factors (physiological factors and history of drug intake). Through observation, data was collected about extrinsic (environmental) factors leading to fall among elderly. The study was conducted at field practice areas of Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah from November 2016 to June 2017. Eleven villages under rural health and training centre were chosen for the study because of their familiarity and convenience. Sample size was calculated and by means of systematic random sampling 500 elderly was selected for the study. The data was collected by pretested, valid and reliable tools by interviewing and observation. The study was approved by institutional ethical committee. The data was coded and analyzed by SPSS 20.0. The data was interpreted at 95% level of significance.

Inclusion and exclusion criteria

Considering the objectives of the study, following inclusion and exclusion criteria were made

Inclusion criteria

Inclusion criteria were above the age of 60 yr; both males and females; staying in selected communities of

Amritsar; willing to be part of study and those who will give written consent.

Exclusion criteria

Exclusion criteria were those who are migrants or are temporarily visiting the areas; those not present on more than two consecutive visits; those who are not willing to be part of study; those suffering from hearing disability or any Neurological or Psychiatric disorder.

RESULTS

Table 1 shows univariate and multivariate logistic analysis of intrinsic factors contributing to fall among rural elderly.

It reveals that among neurological factors tremors (OR=2.73, CI=1.61-4.65), vertigo (OR=8.35, CI=5.11-13.63), seizures (OR=21.22, CI=2.58-174.28), postural instability (OR=3.83, CI=1.91-7.71), were found to be statistically significant as $p < 0.05$.

Among visual factors, blurred vision (OR=14.51, CI=7.86-26.77), presbyopia (OR=2.01, CI=1.10-3.67), decline in peripheral vision (OR=21.23, CI=2.58-174.27), were significant ($p < 0.05$).

Both the auditory factors, presbycusis (OR=2.20, CI=1.38-3.51) and impaired speech discrimination (OR=16.14, CI=4.59-56.74) were significantly contributed to fall among urban elderly.

Hypertension (OR=2.71, CI=1.66-4.40) and myocardial infarction (OR=6.42, CI=2.67-15.40) were also significant cardiovascular factors toward causation of fall.

Among musculoskeletal factors, except for arthritis, other factors like sprains (OR=45.48, CI=2.57-802.33), Fractures (OR=39.1, CI=2.18-699.28), muscle weakness (OR=7.5, CI=3.89-14.46) were significantly contributing toward fall among elderly.

Regarding history of medication intake, consumption of sedative hypnotics (OR=8.81, CI=0.91-85.45) anxiolytic drugs (OR=3.10, CI=1.8-5.34), major tranquilisers (OR=4.02, CI=1.36-11.82) antihypertensive (OR=3.06, CI=1.81-5.2), cardiac medications (OR=88.94, CI=11.91-664.19), were found to be significant with fall.

The intrinsic factors were subjected to multivariate analysis which showed that only tremors, vertigo, decline in visual acuity, blurred vision, myocardial infarction, arthritis, muscle weakness, sedative hypnotic, major tranquilisers, antihypertensive, cardiac medications and NSAIDs were found to be statistically significantly contributing to fall among rural elderly.

Table 1: Showing univariate and multivariate logistic regression analysis of predictors of fall (intrinsic) among rural elderly.

Intrinsic factors	Univariate logistic analysis			Multivariate logistic analysis		
	Odd's ratio	95% CI	P value	Odd's Ratio	95% CI	P value
Neurological factors						
1. Tremors	2.73	1.61-4.65	0.00*	2.59	1.02-6.57	0.04*
2. Vertigo	8.35	5.11-13.63	0.00*	9.72	4.15-22.7	0.00*
3. Syncope	1.78	0.75-4.17	0.18 ^{NS}	0.33	0.05-2.27	0.26 ^{NS}
4. Seizure	21.22	2.58-174.28	0.00*	15.08	0.99-228.3	0.05 ^{NS}
5. Postural instability	3.83	1.91-7.71	0.00*	1.72	0.59-4.93	0.31 ^{NS}
6. Confusion	1.18	0.62-2.24	0.59 ^{NS}	0.14	0.08-0.26	0.59 ^{NS}
Visual factors						
7. Decline in visual acuity	1.35	0.91-2.02	0.13 ^{NS}	0.50	0.26-0.97	0.04*
8. Glare intolerance	1.42	0.77-2.59	0.25 ^{NS}	1.54	0.70-3.33	0.25 ^{NS}
9. Blurred vision	14.51	7.86-26.77	0.00*	25.27	10.21-62.52	0.00*
10. Presbyopia	2.01	1.10-3.67	0.02*	0.44	0.15-1.27	0.13 ^{NS}
11. Decreased night vision	1.05	0.51-2.18	0.87 ^{NS}	1.21	0.72-2.01	0.87 ^{NS}
12. Decline in peripheral vision	21.23	2.58-174.27	0.00*	1.89	1.15-3.11	0.00*
Auditory factors						
13. Presbycusis	2.20	1.38-3.51	0.00*	1.77	0.76-41.0	0.17 ^{NS}
14. Impaired speech discrimination	16.14	4.59-56.74	0.00*	5.86	0.85-40.06	0.07 ^{NS}
Cardiovascular factors						
15. Hypotension	1.65	0.95-2.87	0.07 ^{NS}	0.72	0.23-2.23	0.57 ^{NS}
16. Hypertension	2.71	1.66-4.40	0.00*	1.10	0.46-2.57	0.82 ^{NS}
17. Myocardial infarction	6.42	2.67-15.40	0.00*	3.92	1.09-14.04	0.03*
Musculoskeletal factors						
18. Arthritis	1.35	0.88-2.05	0.15 ^{NS}	2.49	1.21-5.15	0.01*
19. Sprain	45.48	2.57-802.33	0.00*	0.89	0.20-1.01	0.01*
20. Fractures	39.10	2.18-699.28	0.01*	1.39	0.74-2.04	0.01*
21. Muscle weakness	7.50	3.89-14.46	0.00*	6.42	2.42-17.06	0.00*
History of medication intake						
22. Sedative hypnotic	8.81	0.91-85.45	0.06 ^{NS}	40.43	1.91-852.80	0.01*
23. Anxiolytic drugs	3.10	1.80-5.34	0.00*	1.38	0.51-3.76	0.52 ^{NS}
24. Major tranquilisers	4.02	1.36-11.82	0.01*	6.12	1.24-30.21	0.02*
25. Antihypertensive drugs	3.06	1.81-5.20	0.00*	2.51	1.10-5.68	0.02*
26. Cardiac medications	88.94	11.91-664.19	0.00*	173.08	16.99-1762.47	0.00*
27. NSAID's	1.74	0.89-3.41	0.10 ^{NS}	2.83	1.01-7.87	0.04*
28. Anticholinergic drugs	1.14	0.63-2.05	0.64 ^{NS}	0.57	0.26-1.26	0.69 ^{NS}
29. Hypoglycemic agents	1.23	0.70-2.17	0.46 ^{NS}	1.52	0.75-3.33	0.46 ^{NS}
Personal habits						
30. Alcohol consumption	1.12	0.62-2.01	0.71 ^{NS}	1.35	0.64-2.86	0.71 ^{NS}
31. Drug addiction	2.91	0.40-20.84	0.28 ^{NS}	3.79	0.51-28.41	0.32 ^{NS}

NS –Not Significant, *Significant

Table 2 shows univariate and multivariate logistic analysis of extrinsic factors contributing to fall among rural elderly.

It reveals that lack of hand rails on both side (OR=0.43, CI=0.28-0.66), lack of hand rails on one side (OR=0.41, CI=0.27-0.62), improper arrangement of furniture (OR=0.29, CI=0.18-0.45), improper design of furniture (OR=0.17, CI=0.10-0.29), presence of rapid closing doors (OR=0.54, CI=0.36-0.81), high located

shelves (OR=0.48, CI=0.31-0.74), lack of step ladder (OR=0.02, CI=0.01-0.05), absence of grab bars in the bathroom (OR=6.44, CI=3.24-12.77), absence of grab bars in the toilet (OR=1.59, CI=1.01-2.51), Low toilet seat (OR=0.56, CI=0.37-0.85), Slippery floor of the bathroom (OR=0.36, CI=0.24-0.55), improper height of bed (OR=0.40, CI=0.18-0.86), and medicine not stored separately (OR=0.56, CI=0.36-0.88) were found to be statistically significant with fall among rural elderly as $p < 0.05$.

Table 2: Showing univariate and multivariate logistic regression analysis of predictors of fall (extrinsic) among rural elderly.

Extrinsic factors	Univariate logistic analysis			Multivariate logistic analysis		
	Odd's Ratio	95% CI	P value	Odd's Ratio	95% CI	P value
General household						
1. Lack of good lighting especially around stairwells	0.29	0.19-0.46	0.00*	0.32	0.08-1.17	0.08 ^{NS}
2. Lack of hand rails on both sides of the staircases,	0.43	0.28-0.66	0.00*	1.60	0.31-8.13	0.56 ^{NS}
3. Lack of hand rails on one side of the staircases	0.41	0.27-0.62	0.00*	0.38	0.09-1.56	0.18 ^{NS}
4. Electrical cords, footstools, and other low- lying objects kept on walkways	0.69	0.36-1.33	0.27 ^{NS}	1.76	0.33-2.39	0.26 ^{NS}
5. Furniture not arranged to allow for free movement in heavily travelled areas	0.29	0.18-0.45	0.00*	1.09	0.27-4.32	0.89 ^{NS}
6. Furniture not designed to accommodate easy transfers on and off	0.17	0.10-0.29	0.00*	0.04	0.00-0.25	0.00*
7. Presence of rapid closing doors	0.54	0.36-0.81	0.00*	5.28	1.60-17.39	0.00*
8. Slippers and shoes don't fit properly and have skid soles	1.18	0.73-1.92	0.47 ^{NS}	5.12	1.82-14.39	0.49 ^{NS}
Kitchen						
9. Presence of loose extension cords, small sliding rugs, and slippery linoleum tiles	0.69	0.43-1.06	0.11 ^{NS}	0.52	0.17-1.57	0.24 ^{NS}
10. Shelves not at eye level and not easily reachable	0.48	0.31-0.74	0.00*	19.45	4.43-85.36	0.00*
11. Lack of a sturdy stepladder for reaching shelves	0.02	0.01-0.05	0.00*	0.00	0.00-0.01	0.00*
Bathroom						
12. Absence of grab bars in the bathroom	6.44	3.24-12.77	0.00*	626.4	52.17-752.15	0.00*
13. Absence of grab bars around the toilet	1.59	1.01-2.51	0.04*	0.04	0.00-0.19	0.00*
14. Toilet seats not high enough to get on and off of without difficulty	0.56	0.37-0.85	0.00*	0.30	0.09-0.99	0.04*
15. Floor of bathroom made up of skid floor	0.36	0.24-0.55	0.00*	0.07	0.02-0.30	0.00*
Bedroom						
16. Inadequate lighting from the bedside to the bathroom	1.55	0.85-2.84	0.15 ^{NS}	18.47	2.78-122.3	0.00*
17. Lights not easily accessible	0.77	0.44-1.36	0.37 ^{NS}	1.16	0.55-2.45	0.37 ^{NS}
18. Beds not at the proper height	0.40	0.18-0.86	0.01*	11.45	0.55-32.74	0.04*
Storage of medicine						
19. All the medication of elderly not stored separately	0.56	0.36-0.88	0.01*	1.62	0.16-16.41	0.03*
20. All the medication not stored safely	0.68	0.43-1.07	0.10 ^{NS}	1.68	0.18-15.69	0.14 ^{NS}
21. All outdated medications has not been discarded	1.38	0.89-2.12	0.14 ^{NS}	15.64	4.31-56.72	0.11 ^{NS}

NS –Not Significant, *Significant.

Further, the extrinsic factors were subjected to multivariate analysis which showed that only improper design of furniture, presence of rapid closing doors, high located shelves, lack of step ladder, absence of grab bars in bathroom and around toilet, low seated toilet seat, slippery floor of the bathroom, inadequate light from bedside to bathroom, improper height of bed and presence of out-dated medication was found to be statistically significant with fall among rural elderly.

DISCUSSION

In the present study almost all the neurological, visual, auditory factors were statistically significant and among musculoskeletal, sprains, fractures, muscle weakness, cardiovascular factors (hypertension and MI) were significant on univariate analysis, while on multivariate analysis tremors, vertigo, decline in visual acuity, blurred vision, myocardial infarction, arthritis, muscle weakness, sedative hypnotic, major tranquilisers, antihypertensive, cardiac medications and NSAIDs were found to be statistically significant.

Chacko TV on their study depicted that age (>80 years), females, low education (less than high school), having arthritis and defective vision were found to be statistically significant on univariate analysis. The variables showing $p < 0.2$ including age and sex were subjected to multivariate analysis which showed only age more than 80 years and dizziness to be statistically significant.⁶ Aniket et al in their study revealed that Falls were found to be significantly associated with urgency of micturition, presence of osteoarthritis, visual impairment, hearing impairment, functional disability, and depression.⁷ Other studies have also reported that musculoskeletal disorders, functional disability and visual impairment are associated with falls, Tripathy, D'souza, Johnson, Padubidri, Krishnaswamy.^{5,8-11}

In context of extrinsic factors, on univariate analysis, lack of hand rails, improper arrangement of furniture, improper design of furniture, rapid closing doors, high located shelves, lack of step ladder, absence of grab bars, low toilet seat, slippery floor of bathroom, improper height of bed and improper storage of medicine were significantly contributing to falls among rural households. In urban households, lack of hand rails, absence of grab bars, slippery floor of the bathroom, improper height of bed, improper storage of medicines and out-dated medicine not discarded were significantly contributing to falls. A study on home hazard assessment by Romli et al depicted that hazards were frequently identified (>30%) in the toilet and bathroom areas (no grab rail, no non-slip mat, distant toilet), slippery floors, no bedside light access and inappropriate footwear.¹² Home safety assessment study in US reported that most frequently unsafe aspects of the homes were: a lack of grab bars near toilets; no emergency numbers posted near phones; the presence of non-grip throw rugs; lack of fire extinguishers; and lack of step stools.¹³

Huang on assessment of home environmental hazards in Taiwan revealed that bathroom was the most common place for environmental hazards; similar findings were also documented in the present study.¹⁴

CONCLUSION

A comprehensive history should be taken regarding presence of intrinsic factors related to neurological, visual, cardiovascular and musculoskeletal system so that preventive health action can be taken. During home visiting, a detailed observation regarding home environmental hazards should be carried out by health professionals with a special emphasis on bathroom conditions. Further, families of elders should be sensitized regarding the required environmental modifications.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Kaur M, Kaur J, Devgun P, Sharma S. Contributory factors leading to fall among elderly staying in rural area. *Int J Community Med Public Health* 2018;5:4864-9.