A Study Of Risk Factors Of Fall In Elderly

[1*]Dr. Rutuja Sadigale, [2]Dr. Rucha Sane, [3]Dr. T. K. Biswas, [4]Dr. B R Dhareshwar
[1]Resident, [2]Senior Resident, [3]Professor and H.O.D, [4]Associate Professor
Department of Geriatric Medicine, MGM Medical College, Navi Mumbai

*Corresponding Author:
Dr. Rutuja Sadigale
Junior Resident, Geriatric Medicine,
MGM Medical College, Navi Mumbai

Abstract

Introduction

Falls and fall-related injuries among older people are major health and social care problem in the world, because of the rapid increase in life expectancy observed during the twentieth century. Fall-induced injuries are increasing more rapidly than can be accounted for by the increase in the elderly population. Falls also induce psychological consequences, including fear of falling, loss of confidence that leads to self restricted activity levels, reduction in physical function, social interactions, and major strain on family.

Materials And Methods

This is a Cross-sectional study performed in 100 elderly patients $\geq$ 60 years of age from 1st January 2020 to 31st July 2021 for non-accidental fall-related complaints in patients attending Geriatrics OPD for falls, any patient who has repeated falls, those experiencing gait or balance problems, those with previous fragility fracture.   RESULT

The study found that falls are more common in males with health conditions or medications affecting the normal gait and balance with associated complaints. CVA, hypertension and diabetes were common comorbidities. Diuretics were the most common medications.

Conclusion

Thus, an improved understanding of the epidemiological profile and risk factors for non accidental falls in the elderly, will surely help to devise strategies and effective programs for their prevention and help in improving the quality of life of this particularly vulnerable group of population.

Keywords: Fall, non accidental falls, psychological consequences

Introduction

A fall is usually defined as "an event which results in the person coming to rest inadvertently on the ground or other lower level, and other than as a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis, or an epileptic seizure".[1] Falls and fall-related injuries among older people are major health issues for health and social care providers in the world, because of the rapid increase in life expectancy observed during the twentieth century.[2] Fall-induced injuries are increasing more rapidly than can be accounted for by the increase in the elderly population.[3,4] Falls also induce psychological consequences in patients, including fear of falling and loss of confidence that can result in self restricted activity levels, reduction in physical function and social interactions, and put a major strain on the family. There are various risk factors for falls in elderly. Normal gait results from effective coordination of the following neural components: basal ganglia, brainstem system, regulated muscle tone, and

864

functional processing of sensory information such as vision, hearing, and proprioception.[5] The risk of falling is increased in the elderly because of the following reasons:

These functions decline with age

The probability of accumulating medical issues increases with age, and Associated medications are often increased as well.

With aging usually comes a wide-based gait, along with a decrease in gait velocity, step length, and lower limb strength.[6] A fall most often results from interactions between these long-term predisposing factors and short-term predisposing environmental factors such as an adverse drug reaction, acute illness, or a trip on an irregular surface. Risk factors for falls include a history of falls, impairment in balance, reduced muscle strength, psychoactive drugs, gait difficulty, depression, orthostasis or dizziness, functional limits, age over 80 years, female sex, incontinence, cognitive difficulties, arthritis, diabetes, and pain. Fall risk escalates as the number of risk factors increases. The 1-year risk of falling doubles for every added risk factor. It starts at 8% with no risk factors and increases by up to 78% with four risk factors.[7] Medications related to falls include antihypertensives, neuroleptics and antipsychotics, sedatives and hypnotics, antidepressants, nonsteroidal anti-inflammatory drugs, and benzodiazepines.[8] Upto 15% of falls may result in serious fall related injuries and increased morbidity. There might be an increased dependence in the post-fall period.[9] Depression, fear of falling and other psychological problems – "post-fall syndrome" – are common effects of repeated falls.[10,11] Loss of self-confidence as well as social withdrawal, confusion and loneliness can occur, even when there has been no injury. Thus, falls may affect the physical as well as the mental wellbeing of the patient.

A fall may be the first indication of an undetected illness. The prevention of falls is of major importance because though majority of the falls in themselves are not serious, however when combined with the increased vulnerability of health of the elderly population, they are associated with considerable mortality, morbidity and suffering for older people and their families, and incur social costs due to hospital and nursing home admissions. This strains the already burdened health system of a developing country, like ours. Thus, prevention of falls is, understandably, the need of the hour.

However, as not many studies have been conducted to provide insight into the risk factor and epidemiological profile of falls, especially non-accidental falls, in the elderly age group, therefore, this study was conducted to assess the risk factors of falls in elderly population.

MATERIALS AND METHODS

Study Design: Cross-sectional, observational study

Duration Of The Study: 1 st January 2020 to 31st July 2021

Study population: Elderly patients attending the OPD for non-accidental fall-related complaints and meeting the inclusion and exclusion criteria.

Inclusion Criteria:

1. Elderly patients attending OPD for falls
2. Any patient who has repeated falls
3. Those experiencing gait or balance problems
4. Those with previous fragility fracture

Exclusion Criteria:

1. Patients less than 60 years of age.
2. Patients who do not consent to participate in the study.

Sample size: A sample of 100 elderly patients with complaints of fall were included in the study. Sampling technique: All the elderly patients who attended the Geriatric OPD during the study period and who met the inclusion and exclusion criteria, were included in the study. Ethical consederation: Prior approval of the Institutional Ethics Committee was taken before conducting the study.

Written informed consent: Written informed consent was taken from all the patients who were included the study. The consent form is attached in Annexure. The consent form was prepared in English and the vernacular language (Hindi and Marathi).

Method Of Data Collection:

All elderly patients who attended the Geriatric OPD with a complaint of fall during the study period were included in the study, provided they met the inclusion and exclusion criteria as above. A written informed

consent was taken from all the patients who were to be included in the study. They were assured about the maintenance of confidentiality and the nature of voluntary participation. Once consent was given, the patients were included in the study. A total of 100 patients were included in the study.

Materials:

1. Standard Weighing machine

2. Stadiometer for height measurement

3. Sphygmomanometer for blood pressure measurement

Method: All the demographic details were recorded. Detailed history of present fall was noted, including episodes of repetitive falls. Detailed personal and past history, including the presence of comorbidities and use of drugs were taken from all the patients and recorded. Weight was measured by the standard weighing machine. Height was measured by the Stadiometer available in OPD. BMI was calculated by the Quetlet Index (Weight (kg)/Height (m)2). All the parameters were recorded. The cut off for BMI was 24.9 kg/m2 . Any case having values more than

the cut offs were labelled to be "Overweight". Supine blood pressure was recorded for both arms, after 5 minutes of resting in a quiet room, and abstinence from smoking, tea and coffee for prior 2 hours. Blood pressure was taken twice at 5 minutes interval. The average of the two readings of higher arm was recorded as the subject's blood pressure.

Dependency status: The dependency status for the Activities Of Daily Living were evaluated by the Barthel's Index[12]

Statistical Analysis: The data was analysed using statistical software (IBM SPSS, IBM Corporation, Armonk, NY, USA). Descriptive statistics: The Numerical/Continuous data were expressed as Mean ± Standard Deviation and the Categorical data were expressed as Percentages. Analytical statistics: The Numerical/Continuous data were analysed by the 'Unpaired t test'. Bar charts and Pie diagrams were used for the presentation of the data as applicable. P value of less than 0.05 was considered as "statistically significant" and indicated by "*" in the Tables.

Table 1: Age (in years) and gender-wise distribution of the study population

AGE GROUPS	FEMALES		MALES		TOTAL	
	N	%	N	%	N	%
60 to 64	20	20%	9	9%	29	29%
65 to 69	24	24%	7	7%	31	31%
70 to 74	3	3%	14	14%	17	17%
75 to 79	0	0%	9	9%	9	9%
80 to 84	0	0%	7	7%	7	7%
85 to 89	1	1%	6	6%	7	7%
TOTAL	48	48%	52	52%	100	100%
Mean ± SD	65.33 ± 4.60		73.37 ± 7.94		69.51 ± 7.67	
Range	60 to 89 years					
P value	<0.001*					
Statistical Significance	Significant					

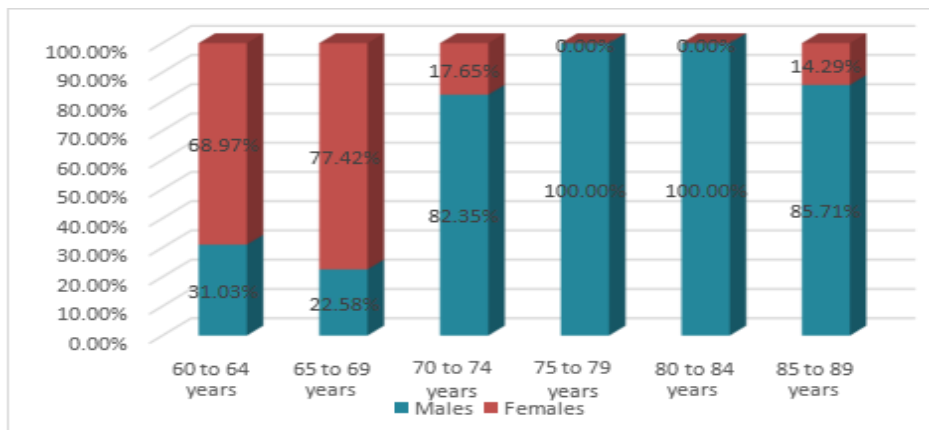**Figure 1: Age and gender-wise distribution of the study population**

Table 1 and Figures 1 show the age and gender-wise distribution of the study population. There was a slight male preponderance. The mean age of males was significantly higher than the females (73.37 ± 7.94 years vs 65.33 ± 4.60 years, respectively); P value: <0.00.

Table 2: Distribution of the study population according to the presence of various comorbidities

Comorbidity	Absent		Present	
	N	**%**	**N**	**%**
Hypothyroidism	96	96%	4	4%
RA	94	94%	6	6%
Osteoarthritis	90	90%	10	10%
IHD	90	90%	10	10%
COPD	86	86%	14	14%
DM	63	63%	37	37%
Hypertension	55	55%	45	45%
CVA	32	32%	68	68%

RA-RHEUMATOID ARTHRITIS

Table 2 and Figure 2 show the distribution of the various comorbidities in the study population. CVA was the most common comorbidity (68%) while hypothyroidism was the least common comorbidity (4%).

Figure 2: Distribution of the study population according to the presence of various comorbidities
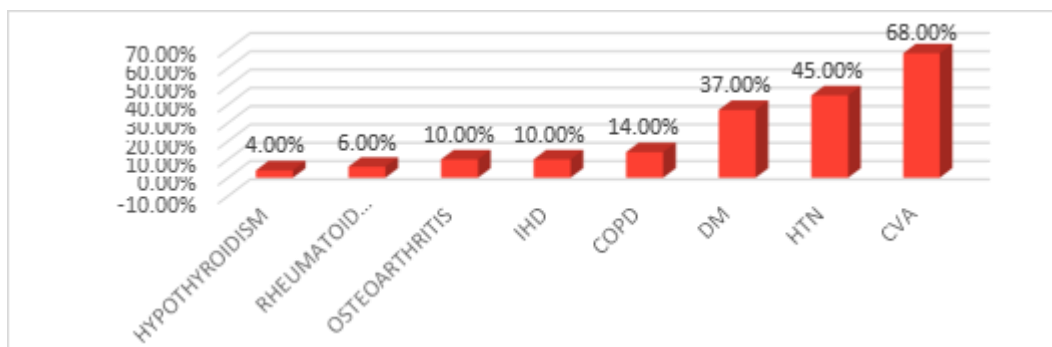

Table 3: Distribution of the study population according to the history of fall

PARAMETER	Absent		Present	
	N	%	N	%
HISTORY OF FALL	42	42%	58	58%

Figure 3: Distribution of the study population according to the history of fall
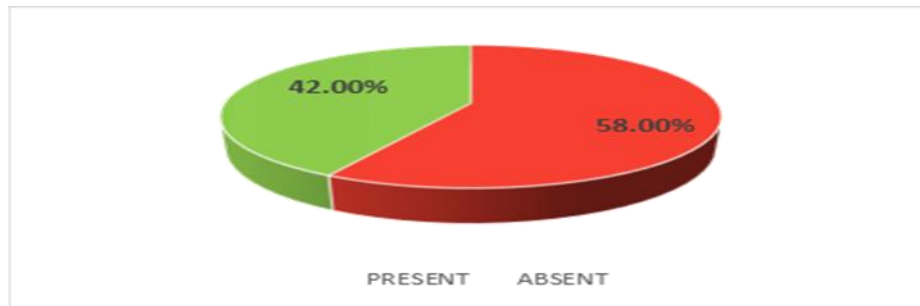

PRESENT   ABSENT

Table 3 and Figure 3 show the distribution of the study population according to the presence of history of fall. History of fall was present in 58% of the case.

Table 4: Distribution of the study population according to the type of medications

Medications	Absent		Present	
	N	%	N	%
Beta Blockers	98	98%	2	2%
ACE Inhibitors	97	97%	3	3%
Sedatives	93	93%	7	7%
CCBs	91	91%	9	9%
Tranquilizers	90	90%	10	10%
ARBs	85	85%	15	15%
Analgesics	83	83%	17	17%
Diuretics	72	72%	28	28%
ACE- Angiotensin converting enzyme CCB- Calcium channel blocker				
ARBs- Angiotensin receptor blockers.				

Table 4 and Figure 4 show the distribution of the study population according to the use of various types of medications. Some cases were on multiple medications. Diuretics were the most common medication (28%) while ACE inhibitors and beta blockers were the least common medication (total 5% of cases).

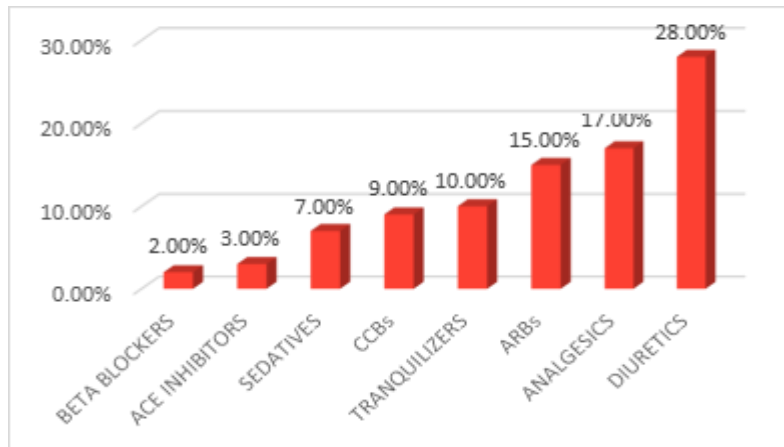**Figure 4: Distribution of the study population according to the type of medications**

Table 5: Distribution of the study population according to the examination findings and laboratory reports

PARAMETER	Absent		Present	
	N	%	N	%
Postural Hypotension	49	49%	51	51%
Gait Problems	25	25%	75	75%
Cardiovascular and Respiratory	76	76%	24	24%
Electrolyte Abnormality	89	89%	11	11%

Table 5 and Figure 5 show the distribution of examination and laboratory findings in the study population. Postural hypotension and gait problems were present in 51% and 75% of the study population, respectively. Abnormal cardiovascular and respiratory findings were present in 24% of the cases while 11% had electrolyte abnormalities.

Figure 5: Distribution of the study population according to the examination findings and laboratory reports
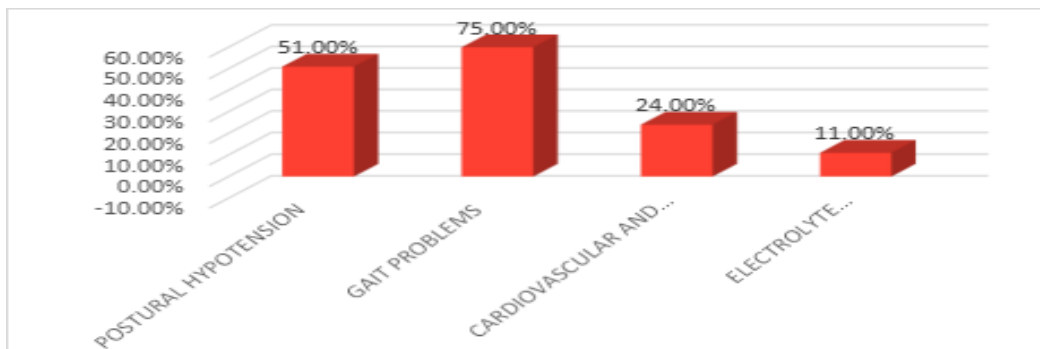

Table 6: Distribution of the study population according to the status of dependency by Barthel's score

DEPENDENCY	N	%
TOTAL DEPENDENCY	10	10%
SEVERE DEPENDENCY	26	26%
MODERATE DEPENDENCY	58	58%
SLIGHT DEPENDENCY	6	6%
TOTAL	100	100%

Table 6 and Figure 6 show the distribution of the study population according to the dependency status by Barthel's score. Majority of the patients were moderately dependent (58%).

Figure 6: Distribution of the study population according to the status of dependency by Barthel's score
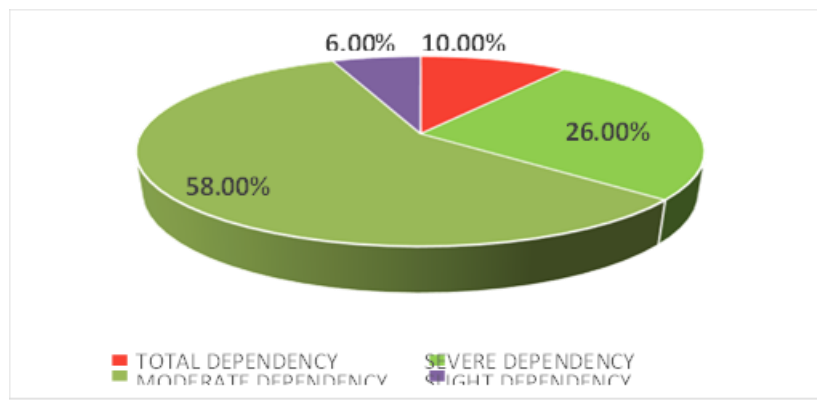
Discussion

Falls in elderly are a major public health problem. The prevalence of falls in India, above the age of 60 years, is reported to range 14%–53%.[13] However, all falls do not result in serious injuries. As per epidemiological data, up-to 15% of the falls may result in serious injuries. Elderly patients having hospital admission for falls have significantly increased morbidity and long hospitalized stays.[14] After recovery from fall injury, patients may continue to experience a greater functional decline in activities of daily living, which may increase their dependence and compromise the quality of life.[15] Falls also affect the psychological well-being of the patient and the effects include, but are not limited to, depression and fear of falling.

Though there are no established etiologies of non-accidental falls, a number of risk factors have been hypothesized over the years. These include chronic illnesses, acute infectious conditions, certain drugs, etc. However, as the studies in this regard are scarce, therefore, the present study was conducted to assess the risk factors associated with falls in the elderly.

A total of 100 patients were included in the study after obtaining a written informed consent. All the relevant history and examination findings were recorded and analyzed. The following were the findings in the present study:

Demographics: In the present study, there was a slight male preponderance (52%). The mean age of males was significantly higher than the females (73.37 ± 7.94 years vs 65.33 ± 4.60 years, respectively); P value: <0.001.

In the descriptive study by Pitchai P. et al,[16] they assessed the prevalence of fall and associated risk factors. They included a total of 2049 elderly patients (more than 60 years) with or without a history of fall. They found that the prevalence of falls was 24.98%. They further observed that amongst the patients having a history of fall, majority of the patients belonged to the age group of 70 to 79 years (46.5%), followed by 60 to 69 years (37.1%) and above 80 years (16.4%). They also found a slight male preponderance (51.4%). These findings were similar to the present study.

In another study by Kalula S. et al,[18] they included a total of 837 participants. They found that the mean age was above 73 years, similar to the present study. However, they found female preponderance in contrast to the present study.

This it can be concluded that most of the cases of falls in the elderly are in males with mean age of 73.37 ± 7.94 years.

Comorbidities: In the present study, comorbidities were present in 86% of the cases. CVA (68%) was the most common comorbidity followed by Hypertension (45%) and DM (37%). In the study by Pitchai P. et al,[16] they assessed the risk factors for falls in elderly.

In the patients having history of falls, they observed that hypertension was the most common comorbidity (169/512 cases), followed by diabetes (102/512 cases) and arthritis (63/512 cases). They concluded that chronic non-communicable diseases leading to sedentary lifestyle were the main reason reported for fall. This was almost similar to the present study.

In another study by Kalula S. et al,[17] they observed that hypertension (68%), arthritis (60%), cardiovascular disease (47%) and diabetes (33%) were the commonest reported comorbidities. These findings were similar to the present study. In the study by Senthil Kumar R. et al,[18] they observed that the prevalence of hypertension in the elderly patients reporting falls was 79.24% and diabetes was 49.06%.

History of falls: In the present study, a previous history of fall was present in 58% of the cases. In the study by Kalula S. et al,[17] they observed that most of the patients had no previous history of falls, with history of previous falls present in less than 40% of the cases and history of previous recurrent falls present in less than 20% of the cases.

Medications: In the present study, diuretics were the most common medication (28%) followed by analgesics (16%), ARBs (15%) and tranquilizers (10%). In the study by Stenhagen M. et al,[19] they observed that neuroleptic drugs were most commonly used (37.5%). The prevalence of the use of antihypertensives (21.3%) and diuretics (23.9%) amongst the patients reporting fall, was similar to the present study. Amongst the many classes of drugs, antihypertensive agents, diuretics, β blockers, sedatives and hypnotics antidepressants and benzodiazepines are generally associated with falls.[20]

A plausible explanation is that diuretics, especially loop diuretics, have side-effects of urinary urgency and frequency. This may be associated with increased risk of falls, commonly while toileting.[21] Furthermore, diuretics and antihypertensive drugs may increase the risk of postural hypotension causing dizziness which, in turn, increases the risks of falls.

Examination and Laboratory findings: In the present study, it was found that postural hypotension was present in 51% of the cases and 75% of the cases had gait disturbances. Abnormal cardiovascular and respiratory findings were present in 24% of the cases while 11% of the cases had electrolyte abnormalities. In the study by Senthil Kumar R. et al,[18] they observed that the balance was impaired in 45.28% of the cases and gait was abnormal in 37.74% of the cases. Understandably, conditions like postural hypotension and gait disturbances can lead to imbalance, resulting in falls.

Dependency status: In the present study, the dependency status was assessed by the Barthel's score. Most of the patients were moderately dependent (58%), followed by severe dependency in 26% of the cases and total dependency in 10% of the cases. In the study by Pitchai P. et al,[16] they observed that a decreased level of functional in dependence was seen in fallers, especially amongst those with fear of falling. Restricted functional activities have been reported to invite deconditioning effect leading to disuse muscle atrophy, decreased aerobic capacity, altered balance, social isolation, depression, increase the risk of fall, and affecting the QOL.[22-24]

Limitations: The present single-center study was limited by the OPD attendance of the patients. Therefore, the results may not be generalized.

Summary

This cross-sectional study included 100 cases of elderly people ≥ 60 years of age with complaints of fall, meeting the inclusion criteria attending the outpatient department of Geriatric medicine at MGM Medical college and Hospital during the period from 1st January 2020 to 31st July 2021.

Thorough clinical history, physical examination and anthropometric evaluation was done. Detailed personal and past history, including the presence of

comorbidities and use of drugs were taken from all the patients and recorded.

Activities Of Daily Living were evaluated by the Barthel's Index

1. Among the study population, 48(48%) were females and 52(52%) were males
2. There was a slight male preponderance. The mean age of males was significantly higher than the females.
3. Comorbidities were present in 86% of the cases.
4. CVA was the most common comorbidity (68%) while hypothyroidism was the least common comorbidity (4%).
5. History of fall was present in 58% of the cases.
6. Diuretics were the most common medication (28%) while ACE inhibitors and beta blockers were the least common medication (total 5% of cases).
7. Postural hypotension and gait problems were present in 51% and 75% of the study population, respectively.
8. Abnormal cardiovascular and respiratory findings were present in 24% of the cases while 11% had electrolyte abnormalities.
9. Majority of the patients were moderately dependent (58%).

Conclusion

Elderly population are a particularly vulnerable age group because of the significant physiological changes associated with aging and decline in certain bodily functions.

Falls increase the morbidity of the patients, lead to increased hospitalizations and put an additional burden on the already strained health system of a developing country, like ours. The present study found that falls are more common in males with health conditions or medications affecting the normal gait and balance. Commonly associated complaints include vision problems, limb weakness and impaired judgement. CVA, hypertension and diabetes were the commonly associated comorbidities. Diuretics were the most commonly associated medications.

Thus, an improved understanding of the epidemiological profile and risk factors for non-accidental falls in the elderly, will surely help to devise strategies and effective programs for their prevention and help in improving the quality of life of this particularly vulnerable group of population.

References

1. Kellogg International Working Group. The prevention of falls in later life. Danish medical bulletin. 1987;34(Suppl 4):1-24.
2. Tinetti ME. Clinical practice. Preventing falls in elderly persons. New England journal of medicine. 2003;348(1):42-49.
3. O'Loughlin J, Robitaille Y, Boivin JF, Suissa S. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. American journal of epidemiology. 1993;137(3):342-354.
4. Freeman C, Todd C, Camilleri-Ferrante C, Laxton C, Murrell P, Palmer CR et al. Quality improvement for people with hip fracture: experience from a multi-site audit. Quality and safety in health care. 2002;11(3):239-245.
5. Takakusaki K. Functional Neuroanatomy for Posture and Gait Control. Journal of Movement Disorders. 2017;10(1):1-17.
6. Osoba M, Rao A, Agrawal S, Lalwani A. Balance and gait in the elderly: A contemporary review. Laryngoscope Investigative Otolaryngology. 2019;4(1):143-153.
7. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. N Engl J Med. 1988;319(26):1701–1707.
8. Al-Aama T. Falls in the elderly: spectrum and prevention. Canadian family physician. 2011;57(7):771-776.
9. Peel NM. Epidemiology of Falls in Older Age. Canadian Journal on Aging. 2011;30(1):7-19.
10. Butler M, Norton R, Lee-Joe T, Cheng A, Campbell A. The Risks of Hip Fracture in Older People from Private Homes and Institutions. Age and Ageing. 1996;25(5):381-385.
11. Murphy J, Isaacs B. The post-fall syndrome: A study of 36 elderly patients. Gerontology. 1982;28(4):265-270.
12. Collin C, Wade DT, Davies S. The Barthel ADL index: a reliability study. Int Disability Studies. 1987;10:61-3.
13. Dsouza SA, Rajashekar B, Dsouza HS, Kumar KB. Falls in Indian older adults: A barrier to

active ageing. Asian J GerontolGeriatr. 2014;9(1):33-40.

14. Haines TP, Hill AM, Hill KD, Brauer SG, Hoffman T, Etherton-Beer C et al. Cost effectiveness of patient education for the prevention of falls in hospital: economic evaluation from a randomized controlled trial. BMC Med. 2013;11:135-143.

15. Kelley-Quon L, Min L, Morley E, Hiatt J Cryer H, Tillou A. Functional Status After Injury: A Longitudinal Study of Geriatric Trauma. Am Surg. 2011;76(10):215-218.

16. Pitchai P, Dedhia H, Bhandari N, Krishnan D, D'Souza N, Bellara J. Prevalence, risk factors, circumstances for falls and level of functional independence among geriatric population - A descriptive study. Indian Journal of Public Health. 2019;63(1):21-26.

17. Kalula S, Ferreira M, Swingler G, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatrics. 2016;16(1):51-59.

18. Senthil Kumar R, Ravindran K. A cross sectional study on the prevalence and risk factors of fall among the elderly in an urban slum in Chennai. International Journal Of Community Medicine And Public Health. 2019;6(3):1102-1107.

19. Stenhagen M, Ekström H, Nordell E, Elmståhl S. Falls in the general elderly population: a 3- and 6- year prospective study of risk factors using data from the longitudinal population study 'Good ageing in Skane'. BMC Geriatrics. 2013;13(1):81- 88.

20. Leipzig R, Cumming R, Tinetti M. Drugs and Falls in Older People: A Systematic Review and Meta-analysis: I. Psychotropic Drugs. Journal of the American Geriatrics Society. 1999;47(1):30-39.

21. Uchida S. Primers of Nephrology-3. Jpn J Nephrol. 2002;44(1):18–28.

22. D'Souza SA, Shringarpure A, Karol J. Circumstances and consequences of falls in Indian older adults. Indian J OccupTher2008;1:3-11.

23. Tripathy NK, Jagnoor J, Patro BK, Dhillon MS, Kumar R. Epidemiology of falls among older adults: A cross sectional study from Chandigarh, India. Injury 2015;46:1801-5.

24. Sirohi A, Kaur R, Goswami AK, Mani K, Nongkynrih B, Gupta SK et al. A study of falls among elderly persons in a rural area of Haryana. Indian J Public Health 2017;61:99-104.