ORIGINAL RESEARCH

Prevalence and risk factors for Falls among older adults in a primary care facility in Ghana

Madison Adanusa[1], Seth Kofi Pobee[2], Ebenezer Zaabaar[3], Vukey Mawuko[4], Kofi Asiedu[5], Solomon Kweku Amuzu[2], Wendy Adubofour[2], Celestine Bazayeya[2], Ethel Enam Yawo Senaya[2], Desiree Citsofe Ofori[2], Samuel Kyei[3]*

1. Division of Family Medicine, Directorate of University Health Services, University of Cape Coast, Cape Coast, Ghana.
2. Department of Physician Assistant Studies, College of Health and Allied Sciences, University of Cape Coast, Cape Coast, Ghana.
3. Department of Optometry and Vision Science, College of Health and Allied Sciences, University of Cape Coast, Cape Coast, Ghana.
4. Department of Imaging Technology and Sonography, College of Health and Allied Sciences, University of Cape Coast, Cape Coast, Ghana.
5. School of Optometry and vision science, Faculty of Medicine and Health, University of New South Wales, Sydney, Australia.

***Corresponding Author: Samuel Kyei**; E-mail: skyei@ucc.edu.gh.

Abstract

Background

Falls are a serious problem and are among the leading causes of morbidity, functional dependency, and death in older adults. Falls have become a social and global public health concern due to the current aging population in Africa and across the globe. However, their prevalence and risk factors have received little attention in Africa.

Purpose

Thus, this study aimed to provide a baseline survey to determine the prevalence and associated risk factors for falls among older adults attending a primary care facility in Cape Coast, Ghana.

Results

Participants (n = 244) were patients aged 60 years and older who visited the University of Cape Coast Hospital. The prevalence of falls identified in this hospital-based study was 40.2%. The following independent variables were found to be statistically significant predictors of risk of falls among the participants when compared with their respective reference categories; age 80 years and above [OR = 3.707, 95% CI = 1.738 – 7.907, p = 0.001], participants who had a history of falls [OR = 2.234, 95% CI = 1.326 – 3.765, p = 0.003], participants with three or more co-morbidities [OR = 16.456, 95% CI = 2.099 – 129.020, p = 0.008] and obesity [OR = 2.211, 95% CI = 1.151 – 4.250, p = 0.017].

Conclusion

The prevalence of falls among older adults is high. Thus, clinicians in the primary care setting should screen for, give fall prevention education, and prescribe appropriate interventions to at-risk patients.

Keywords: Falls; older adults; timed up and go; primary care

Introduction

Falls remain a significant cause of injuries among older adults[1], and these resultant injuries have become a public health problem worldwide[2]. Falls account for the most severe and frequent home accidents among older adults and are a significant reason for admission to a hospital or a residential care setting. It has been reported that fall-related injuries are increasing more rapidly than can be accounted for by the sheer increase among older adults[3]. The consequences of falls among older adults include hospitalization, impaired mobility, and premature death[4].

Along with these consequences, loss of independence and social isolation result in costs to individuals, families, and public services. Falls have immediate physical consequences, including bruises or even more severe fractures[5]. While falls in the general population usually come about due to dangerous work or leisure activities, older adults are at greater risk of falling in their day-to-day activities[6]. Major risk factors for falls reported include abnormal gait, polypharmacy, and a history of previous falls. Other risk factors, including advancing age, sex, visual impairments, cognitive decline, and executive dysfunction, can combine with environmental factors to put older adults in danger of serious injury[7].

According to the United Nations Department of Economic and Social Affairs[8], 703 million persons are 65 years and older. Africa's population is aging although slower than in other world regions. By 2050 the proportion of people aged 60 and older is projected to increase from 5 to 10 percent. The number of older persons is projected to increase dramatically: from 47.4 million in 2005 to 193 million by 2050[9]. In Ghana, older people have increased more than seven-fold from 213 477 in 1960 to 1 643 381 in 2010[10]. Data from the recent population and housing census from the Ghana Statistical Service puts those who are aged 60 years and above at 1,994,968 constituting 6.47% of Ghana's almost 31 million population. In Ghana, the life expectancy at birth has risen from 38 and 43(for males and females, respectively) in 1960 to 60 and 63 years as at 2010. The 2021 estimates of life expectancy from the Central Intelligence Agency put the figures at 67.33 and 70.74 years for males and females,

https://dx.doi.org/10.4314/mmj.v34i4.1

respectively (Life expectancy at birth- The world Factbook (cia.gov) unreferenced). Therefore, it is clear that the life expectancy of Ghanaians is increasing gradually as projected by the United Nations; hence, there is a need to prioritize the health needs of older adults. The increase in the number of older persons in Africa and longevity will expose a more significant number to the risk of falls.

Although substantial knowledge exists on falls in older people in the developed world, very few published articles have reported on the prevalence and risk factors associated with falls in Africa, including the study in Malawi by Allain et al[11], who reported a prevalence of 41% and identified the previous history of falls in the past year, urine incontinence, and memory problems as significant risk factors. A study in Ghana reported that most injuries among older adults result from falls[12]. However, studies on the risk factors associated with falls among older adults are limited in Ghana, and therefore the need to investigate them. A study on the incidence and outcome of injury in all age groups in Ghana revealed that injury disability was higher among older people. Also, falls were the leading cause of injury in older people[13].

Furthermore, the WHO global report on ageing and adult health indicated that 3.74% of the participants had a non-traffic related injury, about half of whom had falls as the cause of the injury.12 This study, therefore, sought to investigate the prevalence of falls and their associated risk factors among adults attending a primary care facility in Ghana.

Materials and Methods

Study Design, Sampling Method and Sample Size

The study adopted a quantitative cross-sectional design. Consenting consecutive patients who visited the outpatient department of the University of Cape Coast Hospital from March to June 2021 were sampled. Unwilling patients and those unable to communicate well were excluded from the study. Assuming a margin of error of 5% and "p" as the predicted prevalence of falls in the elderly population, the sample size required for this study was estimated using the following formula: $N = Z^2P^* (1 - P)/d^2$. Assuming $p = 0.247$ based on average estimates from the previous studies[11,13,14], the sample size adequate for the required margin of error was 285.

Data Collection

A structured interview guide was used to collect data on socio-demographic characteristics, prevalence, and risk factors of falls. Anthropometric information collated included height and weight from which BMI was calculated. Also, participants completed the Timed Up and Go (TUG) test to assess mobility and falls risk; where participants were instructed to rise from a chair, walk on a marked distance of three metres, turn around, walk back to the chair, and sit down. A score of ≤ 12s indicates good mobility, whereas >12s indicates a risk of fall.

Statistical Analysis

The data obtained were processed and analysed using the IBM Statistical Package for the Social Sciences (SPSS) version 25. Data were summarized in tables and charts. Logistic regression, multiple linear regression, and Pearson's correlation were conducted to investigate risk factors of falls using the TUG test. All tests were considered significant if the p-value was less than 0.05.

Ethical Consideration

Ethical approval was sought from the University of Cape Coast Institutional Review Board (reference ID: UCCIRB/CHAS/2020/53), and permission was obtained from the Directorate of the University Health Service before the commencement of the study. Anonymity and strict confidentiality were ensured in accordance with the University of Cape Coast Institutional policies. Written informed consent was obtained from each participant.

Results and Analysis

Demographic Characteristics of the Study Population

Majority (59.4%) of the study participants were females. The modal age group was 60-69, and majority of the participants were married (Table 1). About a third of the participants had no formal education (Table 1).

Table 1. Demographic characteristics of the study sample

Variables	Male	Female	Total
Sex	99 (40.6%)	145 (59.4%)	244 (100.0%)
Age Group			
60-69	42 (35.9%)	75 (64.1%)	117 (47.9%)
70-79	41 (47.7%)	45 (52.3%)	86 (35.3%)
80 years and above	16 (39.0%)	25 (61.0%)	41 (16.8%)
Marital Status			
Single	12 (19.4%)	50 (80.6%)	62 (25.4%)
Married	85 (50.9%)	82 (49.1%)	167 (68.4%)
Cohabiting	1 (100.0%)	0 (0.0%)	1 (0.4%)
Divorced/ Separated	1 (7.1%)	13 (92.9%)	14 (5.7%)
Educational Level			
No formal education	14 (18.4%)	62 (81.6%)	76 (31.1%)
Basic Education	27 (47.4%)	30 (52.6%)	57 (23.4%)
Secondary	28 (49.1%)	29 (50.9%)	57 (23.4%)
Tertiary	30 (55.6%)	24 (44.4%)	54 (22.1%)
Occupation Status			
Unemployed	21 (25.3%)	62 (74.7%)	83 (34.0%)
Pensioner	59 (55.7%)	47 (44.3%)	106 (43.4%)
Employed	19 (34.5%)	36 (65.5%)	55 (22.5%)
Companion Status			
Spouse	52 (57.1%)	39 (42.9%)	91 (37.3%)
Alone	13 (37.1%)	22 (62.9%)	35 (14.3%)
Family	33 (28.7%)	82 (71.30%)	115 (47.1%)
Other	1 (33.3%)	2 (66.7%)	3 (1.2%)

Prevalence of falls and fall-related characteristics among the study population.

Data on the prevalence of falls, as depicted in Table 2, shows that 40.2% of the participants had experienced one or more falls in the past 12 months.

https://dx.doi.org/10.4314/mmj.v34i4.1

Table 2. Distribution of the prevalence of falls and fall-related characteristics among the study participants

Variables	Male	Female	Total
Fall			
Yes	42 (42.4%)	56 (38.6%)	98 (40.2%)
No	57 (57.6%)	89 (61.4%	1 4 6 (59.8%)
Number of falls			
Once	22 (52.4%)	26 (46.5%)	48 (49.0%)
Twice	12 (28.6%)	20 (35.7%)	32 (32.7%)
Three times	4 (9.5%)	4 (7.1%)	8 (8.2%)
≥ 4 times	4 (9.5%)	6 (10.7%)	10 (10.2%)
Place of fall			
Home	23 (54.8%)	37 (66.1%)	60 (61.2%)
Street	8 (19.1%)	9 (16.1%)	17 (17.4%)
Market place	1 (2.4%)	6 (10.7%)	7 (7.1%)
Farm	1 (2.4%)	1 (1.8%)	2 (2.0%)
Getting off a car	2 (4.8%)	1 (1.8%)	3 (3.1%)
Workplace	3 (7.1%)	0 (0.0%)	3 (3.1%)
Others	4 (9.5%)	2 (3.6%)	6 (6.1%)

Table 3. Falls and falls-related characteristics among the study participants

Variables	Male	Female	Total
Previous History of fall			
Yes	42 (42.4%)	56 (38.6%)	98 (40.2%)
No	57 (57.6%)	89 (61.4%)	146 (59.8%)
Health Condition			
Yes	83 (83.8%)	132 (91.0%)	215 (88.1%)
No	16 (16.2%)	13 (9.0%)	29 (11.9%)
Number of health conditions			
1	53 (63.9%)	71 (53.4%)	124 (57.4%)
2	24 (28.9%)	53 (39.9%)	77 (35.7%)
≥3	6 (7.2%)	9 (6.8%)	15 (6.9%)
Visual impairment			
Yes	52 (52.5%)	55 (38.0%)	107 (43.9%)
No	47 (47.5%)	90 (62.1%)	137 (56.2%)
Cause of visual impairment			
Glaucoma	9 (23.7%)	19 (27.5%)	28 (26.2%)
Cataract	21 (55.3%)	37 (53.6%)	58 (54.2%)
Short-sightedness	1 (2.6%)	0 (0.0%)	1 (0.9%)
Long-sightedness	6 (15.8%)	9 (13.0%)	15 (14.0%)
Blurred vision	1 (2.6%)	4 (5.8%)	5 (4.7%)
Long term medications			
1	29 (34.1%)	53 (40.5%)	82 (38.0%)
2	32 (37.7%)	41 (31.3%)	73 (33.8%)
3	18 (21.2%)	17 (13.0%)	35 (16.2%)
≥ 4	6 (7.1%)	20 (15.3%)	26 (12.0%)

Table 4: Sociodemographic determinants of risk of falls among the study participants

Independent variables	β value	p*	OR	95% CI (Lower)	95% CI (Upper)
Sex					
Female					
Male	0.079	0.763	1.082	0.648	1.806
Age Group					
60-69					
70-79	0.496	0.085	1.643	0.933	2.892
80 and above	1.310	0.001	3.707	1.738	7.907
Previous History of Fall					
No					
Yes	0.804	0.003	2.234	1.326	3.765
Previous frequency of falls before one year					
Once					
Twice	-0.298	0.519	0.743	0.301	1.833
Three times	-0.934	0.236	0.393	0.084	1.841
More than three times	0.963	0.254	2.621	0.501	13.700
Health Condition					
No					
Yes	0.39	0.337	1.477	0.666	3.276
Number of health conditions					
One					
Two	-0.179	0.541	0.836	0.471	1.485
3 or more	2.801	0.008	16.456	2.099	129.020
Long term medications					
One					
Two	0.027	0.932	1.028	0.547	1.931
Three	-0.172	0.671	0.842	0.381	1.862

Table 4 Cont...

≥ 4	-0.154	0.733	0.857	0.354	2.075
BMI classification					
Normal weight					
Underweight	0.782	0.206	2.185	0.650	7.349
Overweight	0.242	0.441	1.273	0.688	2.356
Obesity	0.794	0.017	2.211	1.151	4.250

Table 4 shows the predictors of the risk of falls among the elderly in the study population. From the table, sex was not a statistically significant predictor of the risk of falls among older adults (p=.763). However, men have a relatively higher risk of falls in their old age than women with [OR = 1.082, 95% CI = 0.648 – 1.806]. There was a high risk of falls among participants aged 70-79[OR = 1.643, 95% CI = 0.933 – 2.892] and 80 and older [OR = 3.707, 95% CI = 1.738 – 7.907]. Additionally, being aged 80 and above was found to be a statistically significant predictive risk of falls with p=0.001.

Table 5: Predictors of TUG among the study participants

Independent variables	95 % CI						Correlations	
	B	Lower	Upper	β	t	p	Partial	Part (Sr2)
Normal								
BMI	0.134	0.055	0.213	0.203	3.354	0.001	0.212	0.200
Age Group	1.590	1.005	2.175	0.328	5.354	0.000	0.327	0.320
Falls history	-0.625	-1.501	0.251	-0.085	-1.406	0.161	-0.090	-0.084

Dependent variable: Time taken to complete timed up and go test (TUGT) Predictors: Falls history, BMI, Age Group

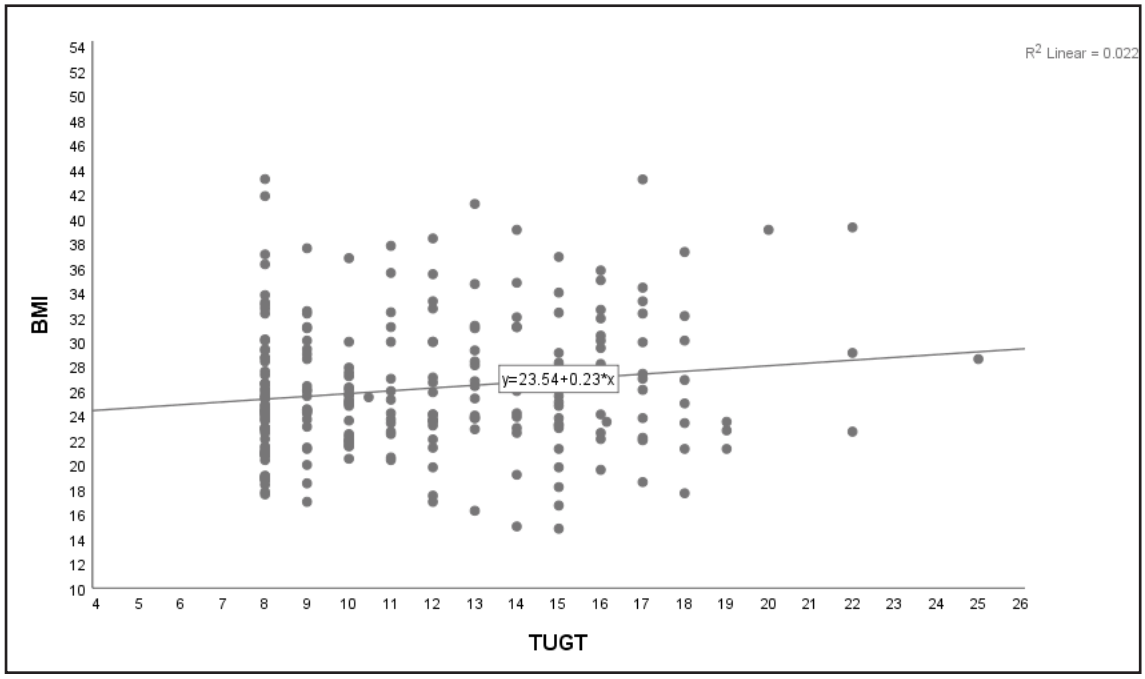

Figure 1. Scatter diagram showing the correlation between BMI and TUG test

The rates of falls were higher in males than females. Among the age groups, the rates of falls were higher among those aged 80 years and older. Most (61.2%) of the falls occurred at home during the day (6:00 am – 5:00 pm). Injuries associated with falls accounted for 51.0% and included head injuries, bone fractures, dislocations, and bruises.

Risk Factors for falls and fall-related characteristics among the study population

Most (88.1%) of the participants who had fallen in the past year had chronic medical conditions. More than a third were on only one long-term medication. About half of the participants reported visual impairments (Table 3).

Participants with a history of falls were found to have higher odds of risk of falls compared with those with no history of falls with odds of [OR = 2.234, 95% CI = 1.326 – 3.765]. History of falls was found to be a statistically significant predictor of the risk of falls among the study population (p=0.003).

Participants with known health conditions were found to have a higher risk of falls than participants without any known medical conditions [OR = 1.477, 95% CI = 0.666 – 3.276]. However, the presence of a health condition was not a predictor of the risk of falls among the studied population.

On the other hand, participants with 3 or more health conditions had a higher risk of falls than those without any known health condition [OR = 16.456, 95% CI = 2.099

https://dx.doi.org/10.4314/mmj.v34i4.1

– 129.020]. From this finding, three or more health co-morbidities are a predictive risk of falls (p=.008).

Multiple regression analysis of the predictors of TUGT

Table 5 shows the multiple regression analysis of the predictors of TUGT among the study population and their impact on TUGT. The model as a whole was significant to predict TUGT at $F(3,240) = 13.516$, $p < .001$ as shown by the ANOVA summary. The R2 for the overall model for TUGT was 14.5% with an adjusted R2 of 13.4%, a small effect size is reported by the model, of variations in the TUGT scores of the participants are accounted for by the linear combination of the predictor variables (BMI, age group and falls history). In the final model, two of the independent variables were statistically significant in predicting TUGT with BMI ($t = 3.354$, $p = 0.001$, $\beta = 0.203$) and age group ($t = 5.354$, $p < 0.01$, $\beta = 0.328$). History of falls was however not statistically significant in predicting TUGT with ($t = -1.406$, $p = 0.161$, $\beta = -0.085$). The final predictive equation of the model for predicting TUGT from table 5 was;

TUGT = 6.532 + BMI (0.134) + Age group (1.590) + Falls history (-0.625).

Correlation of BMI against the risk of falls using the TUG test

The Pearson correlation analysis was conducted to examine the relation between BMI and the risk of falls using the TUG test among the study participants. The relationship was positive, however weak in strength and statistically significant ($r(244) = .150$, $p = .019$). A scatter plot of BMI and risk of falls using the Time Up and Go (TUG) test is presented in figure 1.

Discussion

The prevalence of falls in this study was 40.2%. This is similar to the prevalence rate (41%) found in a study done in Malawi among community-based older adults[11]. A similar hospital-based study done in Brazil reported a higher prevalence rate of 54%[14]. However, other community-based studies reported much lower prevalence rates of falls among older adults[15-16]. The observed difference in the prevalence rate of falls could be attributed to the variations in social, cultural, and geographical settings of the participants as well as the methods employed for the study[17-18].

At baseline, homes were the commonest places of falls, with slippery floors accounting for most of the risk of falls at homes. This is consistent with the results of earlier studies conducted in Nigeria[19] and Thailand[20]. Slippery floors being a major risk of falls in the current study could be due to the increased use of polished surfaces like tiles in Ghanaian homes. A study by Kim et al. reported an increased likelihood of a slip on a tiled floor compared to a carpeted floor[21].

Medication use is a potential risk factor for falls and functional decline in older adults[22]. In this study, polypharmacy was not a risk factor for falls. This is inconsistent with the findings of most studies conducted on the subject[19,22]. Consistent with previous studies, we found falls to be associated with advancing age[23-24]. This could be explained by accelerated sarcopenia after age 60 that increases susceptibility to frailty, hence the likelihood to fall as documented in a review by Zhang et al[25].

Additionally, being obese compared with normal weight was more likely to be associated with falls. This corroborates findings on the association between obesity and falls reported in previous studies[26-29].

Though not statistically significant in this study, the presence of chronic health conditions was found to be a potential risk factor for falls. This is supported by what was reported by Bao and his colleagues[30]. Comparable to earlier studies, each participant's number of comorbidities was statistically significant as a risk factor for falls. This was in conformity to previous studies done in various settings that shows a high prevalence of falls with increasing comorbid conditions[30-33]. Hence the greater the number of health conditions of an older adult, the higher the odds of falls.

Furthermore, findings from this study showed that about half of the participants who had fallen in the past 12 months had post-fall injuries, including fractures and bruises, and this finding is parallel to a previous study in Ghana by Udofia et al.,[12] which reported that falls account for most non-traffic related injuries among older adults. Finally, consistent with the literature, the study found the previous history of falls as a risk factor for falls among older adults[7].

Limitations of the study

The study had various limitations, including sampling from the general outpatient department of only one primary care facility rather than the community; hence there is a potential bias by only including patients with health issues who were more likely to fall.

The minimum sample size of 285 was not met due to the exclusion of incompletely filled forms/ missing data in some of the questionnaires. Due to the relatively smaller sample size, some potential predictors of falls among the study population with high odd ratios (OR) were not statistically significant in predicting falls. The turnout of this finding is most likely to be different with a much larger sample size. Apart from the TUG, the study relied on self-reporting, which is subject to recall bias, considering the ages of the participants. Also, this is a baseline study; hence the findings should be interpreted within context.

Conclusion and Recommendations

The prevalence of falls in this study was high. Significant risk factors of falls identified included advancing age, previous history of falls, number of co-morbidities, and class II obesity. Clinicians in the primary care setting should screen for, give fall prevention education, and prescribe appropriate interventions to at-risk patients. A community survey is further recommended to explore, and better estimate the prevalence and risk factors of falls among older adults to influence health policies and improve their quality of life.

References

1.DeGrauw X, Annest JL, Stevens JA, Xu L, Coronado V. Unintentional injuries treated in hospital emergency departments among persons aged 65 years and older, United States, 2006–2011. J Safety Res. 2016; 56:105-9.

2.Guard J. Ghana country assessment report on aging and health. (n.d.). W.H.O. global report on falls prevention in older age. J Women's Hist. 2004;5(4):117-40.

3.Todd C, Skelton D. What are the main risk factors for falls amongst older people and what are the most effective interventions to prevent these falls?. World Health Organization. Regional Office for Europe.2004. https://apps.who.int/iris/handle/10665/363812

4.Stevens JA. (2005). Falls among older adults—risk factors and prevention strategies. J Safety Res.2005; 36(4):409-411.

https://dx.doi.org/10.4314/mmj.v34i4.1

5.Roe B, Howell F, Riniotis K, Beech R, Crome P, Ong BN. Older people's experience of falls: understanding, interpretation and autonomy. J Adv Nurs. 2008;63(6):586-96.

6.Delivery path Service. Fact Sheet: Best Resources for Seniors. [cited 2021 May 28]. Available from: https://aging.com/ falls-fact-sheet/.

7.Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: a review of the literature. Maturitas. 2013;75(1):51-61.

8.United Nations, Department of Economic and Social Affairs, P. D. World Population Ageing 2019. In World Population Ageing 2019, 2019.

9.WHO. A WHO global report on falls among older persons Prevention of falls in older persons: Africa case study. 2005;1–31.

10.United Nations, World population prospects: The 2017 revision volume I: Comprehensive Tables. 2017: New York.

11.Allain TJ, Mwambelo M, Mdolo T, Mfune P. Falls and other geriatric syndromes in Blantyre, Malawi: a community survey of older adults. Malawi Med J. 2014;26(4):105-8.

12.Udofia EA, Aheto JM, Mensah G, Biritwum R, Yawson AE. Prevalence and risk factors associated with non-traffic related injury in the older population in Ghana: Wave 2 of the WHO Study on Global AGEing and adult health (SAGE). Prev Med Rep. 2019;15:100934.

13.Mock CN, Gloyd S, Adjei S, Acheampong F, Gish O. Economic consequences of injury and resulting family coping strategies in Ghana. Accid Anal Prev. 2003;35(1):81-90.

14.Fabrício SC, Rodrigues RA, Costa Junior ML. Falls among older adults seen at a São Paulo State public hospital: causes and consequences. Revista de saude publica. 2004;38:93-9.

15.Bekibele CO, Gureje O. Fall incidence in a population of elderly persons in Nigeria. Gerontology. 2010;56(3):278-83.

16.Kalula SZ, Ferreira M, Swingler GH, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatr. 2016;16(1):1-11.

17.Franse CB, Rietjens JA, Burdorf A, van Grieken A, Korfage IJ, van

der Heide, A, et al. A prospective study on the variation in falling and fall risk among community-dwelling older citizens in 12 European countries. BMJ open. 2017: 7(6), e015827.

18.Kimani E, Karanja S, Muthami, L. Lifestyle factors influencing falls

among older people in Central Kenya. IJSBAR. 2019;48 (5): 157-184.

19.Awokola B, Amusa G, Isiguzo G, Abioye-Kuteyi E. Prevalence and predictors of falls among elderly hypertensives in south-south Nigeria. J Hypertens. 2016;34:e299.

20.Sophonratanapokin B, Sawangdee Y, Soonthorndhada K. Effect of the living environment on falls among the elderly in Thailand. Southeast Asian J Trop Med Public Health. 2012;43(6):1537.

21.Kim HN, Lockhart TE. Fall Risk in Older Adults Transitioning between Different Flooring Materials. Sci. 2020; 2(2):25.

22.Hammond T, Wilson A. Polypharmacy and falls in the elderly: a literature review. Nurs Midwifery Stud. 2013;2(2):171.

23.Alfonso Mora ML, Bejarano Marín X, Sánchez Vera MA, García Muñoz LP,

Soto León IA. Association between the fall risk, age and educational level in active adult and older women. Revista Salud Uninorte. 2017;33(3):306-14.

24.Sharif SI, Al-Harbi AB, Al-Shihabi AM, Al-Daour DS, Sharif RS. Falls in the elderly: assessment of prevalence and risk factors. Pharm Pract (Granada). 2018;16(3).1206.

25.Zhang X, Huang P, Dou Q, Wang C, Zhang W, Yang Y, et al. Falls among older adults with sarcopenia dwelling in nursing home or community: a meta-analysis. Clin Nutr. 2020;39(1):33-9.

26.Himes CL, Reynolds SL. Effect of obesity on falls, injury, and disability. J Am Geriatr Soc. 2012;60(1):124-9.

27.Fjeldstad C, Fjeldstad AS, Acree LS, Nickel KJ, Gardner AW. The influence of obesity on falls and quality of life. Dyn Med. 2008;7:4. doi: 10.1186/1476-5918-7-4

28.Cho B-Y, Seo D-C, Lin H-C, Lohrmann DK, Chomistek AK. BMI and central obesity with falls among community-dwelling older adults. Am. J. Prev. Med.2018; 54 (4): e59-e66.

29.Jeon B-J. The effects of obesity on fall efficacy in elderly people. J Phys Ther Sci. 2013; 25(11): 1485–1489.

30.Bao W, Hu D, Shi X, Sun L, Zhu X, Yuan H, et al. Comorbidity increased the risk of falls in Chinese older adults: a cross-sectional study. Int J Clin Exp Med. 2017;10(7):10753-63.

31.Fu WW, Fu TS, Jing R, McFaull SR, Cusimano MD. Predictors of falls and mortality among elderly adults with traumatic brain injury: a nationwide, population-based study. PloS one. 2017; 12(4); e0175868.

32.Dokuzlar O, Koc Okudur S, Smith L, Soysal P, Yavuz I, Aydin AE et al. Assessment of factors that increase risk of falling in older women by four different clinical methods. Aging Clin Exp Res. 2020;32(3):483-490.

33.Dokuzlar O, Koc Okudur S, Soysal P, Kocyigit SE, Yavuz I, Smith L, et al. Factors that increase risk of falling in older men according to four different clinical methods. Exp. Aging Res. 2020;46 (1): 83-92.