

**SOCIO-DEMOGRAPHIC AND LIFESTYLE FACTORS  
ASSOCIATED WITH FALLS AMONG OLDER  
PEOPLE LIVING IN GATANGA SUB-COUNTY,  
MURANG'A COUNTY, CENTRAL KENYA**

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**Socio-Demographic and Lifestyle Factors Associated With Falls  
among Older People Living in Gatanga Sub-County, Murang'a  
County, Central Kenya**

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**A Thesis Submitted in Partial Fulfilment of the Requirements for the  
Degree of Masters of Science in Epidemiology of the Jomo Kenyatta  
University of Agriculture and Technology**

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## DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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## **DEDICATION**

To the older people of Kenya who gave me insight into the falls.

To my wife, Purity Kirimi and children, Carl Kimani and Roxanne Wambui for their unwavering support during the writing of this thesis.

To my parents, Humphrey Wainaina and Joyce Wambui for their gracious support and encouragement.

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## **LIST OF ABBREVIATIONS**

<b>BMI</b>	Body Mass Index
<b>CHW</b>	Community Health Workers
<b>DALY</b>	Disability Adjusted Life Years
<b>EPI</b>	Expanded Program of Immunization
<b>ERC</b>	Ethical Review Committee
<b>GOK</b>	Government of Kenya
<b>HALE</b>	Healthy Life Expectancy
<b>ICD-10</b>	International Classification of Diseases, Version 10
<b>KEMRI</b>	Kenya Medical Research Institute
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>MNA-SF</b>	Mini Nutritional Assessment – Short Form
<b>MOH</b>	Ministry of Health
<b>SCHRIO</b>	Sub-County Health Records Information Officer
<b>SERU</b>	Scientific and Ethical Review Unit
<b>SOP</b>	Standard Operating Procedures
<b>SQ. KMS</b>	Square kilometers
<b>UN</b>	United Nations
<b>WHO</b>	World Health Organization
<b>YDL</b>	Years Lived with Disability

## DEFINITION OF TERMS

**Activities of daily living** These are the activities that the participant engages in that maintain normal body function, such as bathing, grooming, feeding, toilet use, mobility.

**Body Mass Index (BMI)** BMI is a measure of the amount of mass of an individual. It is calculated as  $\text{Weight (Kilograms)} / \text{Height}^2$  (meters.)

**Case definition of fall** Any elderly person who experienced sudden unintentional coming to rest from a level ground including loss of consciousness, excluding fall from height, fall after a push by other moving objects.

**Co-morbid illnesses** are illnesses the participant had and was on medication for before or when sustaining a fall.

**Circumstance of fall** Describes the events surrounding the fall episode(s). Data was collected to capture activity done when/before falling and the immediate post-fall events.

**Day-to-day activities** are activities that elderly persons engage in for livelihood purposes, e.g., crop farming, animal husbandry, business activities, and house/home chores.

**Elderly** Any person aged 65 years old and above.

**Fall** a fall is unintentional coming to rest on level ground, according to World Health Organization. Falls from a height, road traffic accidents and high energy push were excluded from this study.

**Fall Outcomes** These are physical injuries sustained during fall requiring one to seek medical attention and other sequelae of falls such as

immobilization, fear of falling, abandonment of activities, blackout on falling, confusion.

**Fall triggering event** This immediate activity that leads to a fall.

**Place of fall** was identified as where one sustained a fall and was classified as the inside house, outside the house within the compound, outside the house in the garden, and road.

**Presence of caregivers** refers to living with another person to provide care to the older person. The caregiver must be 15 years and above. In this study, a caregiver was considered to be a person who is 15 years and above and spends at least 6 hours per day with the person daily.

**Pre-fall activity** This is the participant's activity immediately before sustaining a fall. Areas of interest included standing from a sitting position, walking, tethering animals.

**Syncope** Syncope refers to a sudden, brief loss of consciousness due to cerebral ischemia.

## ABSTRACT

Falls are associated with up to 60 percent of injuries sustained by older people above 65 years of whom a third fall every year worldwide. Many factors are known to contribute to falls. Varying environmental, socio-cultural, socio-demographic characteristics and increasing cases of injuries reported among older people necessitate further research in specific communities. In Kenya, there is no policy on falls prevention among older people yet there is limited data on the incidence, and associated factors among community-dwelling older individuals. This thesis highlights the findings of evaluating falls and related factors among older individuals residing in the Gatanga Sub-County. The study was cross-sectional and conducted with 420 older individuals aged 65 years and above residing in Gatanga Sub-County to determine the prevalence of falls and factors promoting or inhibiting their occurrence. Face-to-face interviews were conducted with the 420 individuals in their homes. Overall, 42.1% of older individuals sustained a fall in the preceding year. Of these, 45.3% were female, while 34.5% were male. Recurrent falls were 34.9%, while 79.5% had fallen outdoors and 79.6% had fallen during the daytime. After falling, 92.1% became afraid of falling, 49.7% sustained an injury, 40.5% abandoned their daily activities, 34.9% lost autonomy, and 31.6% went to the hospital. Other complications included immobilization (29.9%), fractures (23.1%), skin bruises (19.4%), confusion (13.4%), head injury (12.1%), and blackout (10.2%). From the study, it was clear that the most important risk factors for falls included being female ( $p < 0.001$ ), feeling dizzy (0.015), having a history of syncope (0.016), unsteadiness in gait (0.007), and being disabled or frail (0.007). Among women, experiencing dizziness ( $< 0.001$ ), unsteadiness in gait (0.039) and being disabled or frail (0.038) were the most significant risk factors for falls. Among men, alcohol consumption (0.003) was the most important risk factor for their fall. In conclusion, this study demonstrated that falls were a significant cause of morbidity among older persons living in Gatanga, Sub-County and possibly Kenya at large. Therefore, there is an urgent need to address falls in a broad, multifaceted way to mitigate the problem and improve the livelihoods of older individuals. Thus, there is a need to develop a national falls prevention policy to promote awareness of falls, mobilize resources for falls prevention, and encourage research on falls to understand environmental and individual factors that increase the likelihood of falls. Identifying evidence-based interventions to mitigate falls events would also help. Specific activities will involve developing culturally acceptable evidence-based fall prevention methods and building awareness among the community and hospital-based healthcare workers and older people and their caregivers. Improving access to healthcare services among older persons will also reduce morbidity due to falls.



## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the study

According to the World Health Organization (2022), in the International Classification of Disease-11, a fall is one of the external causes of morbidity or mortality. Unintentional falls on the same level or from less than a height of one meter are coded as PA60 (World Health Organization, 2022). A 'fall' is defined as 'inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects' (Sachiyo Yoshida, 2007).

Approximately one-third of older people worldwide sustain falls annually (Cevizci et al., 2015; Salari et al., 2022), and up to 20% of these fallers sustain injuries of which some require hospitalization (Pellicer-García et al., 2020; Rubenstein, 2006).

In Africa, various studies across different countries have shown a varying rate of falls among communities, such as a study in Ethiopia which recently showed a fall rate of 28% (Janakiraman et al., 2019), while in Nigeria, a 23% prevalence of falls among older persons was a little lower than other places of the world (Bekibele & Gureje, 2010). A recent study in Nigeria demonstrate a fall rate of 25.3% for rural dwellers compared to 41.3% for urban dwellers (Atoyebi et al., 2021). In South Africa the rate of fall is estimated to be 22% to 26% (Kalula et al., 2016).

According to Amuyunzu (1997), falls resulted in 69% of injuries among older persons in Kenya. Other causes of injuries were domestic violence, accidental poisoning, road traffic accidents, drowning, burns, animals' bites, electrocution, hit by animals, struck by lightning, walls, and structures collapsing on them. From that study, approximately 10 - 20% of falls resulted in fractures (of the hip, spine, distal radius, and ulna and femoral fractures), head injuries (24%), and open wounds (56%) (Amuyunzu et al., 1997). Another study conducted in Kenya's national referral hospital, the Kenyatta National Hospital, by Saidi and Mutiso (2013),

showed that falls were a leading cause of trauma and hospitalization among older people over 60 years with a frequency of 41.4%. 75% were due to falls on the same level among the fall (Saidi & Mutiso, 2013).

Approximately 10 - 20% of falls result in falls-related injuries (Lyu et al., 2022; Marcum et al., 2023), and these injuries were significantly higher in women than men. The trend of fatality due to falls has been increasing in many countries (Hartholt et al., 2019), and the incidence of hip fractures has been rising over the years (Dhanwal et al., 2011).

The fall-related mortality rate per 100,000 has been estimated to be 2.1 – 2.7 in sub-Saharan Africa (Sawe et al., 2023). According to a study conducted in Western rural Kenya (Odhiambo et al., 2013), falls contributed to 4% of all trauma-related deaths in a trauma mortality audit. These deaths were significantly higher in older age groups, with men having higher fall-related mortality than women.

World Health Organization (2007) report indicates that the number and frequency of falls episodes and injuries increase with age and frailty. These fall-related injuries are approximately 3.5% among 65-69-year-olds to 7.6% among persons over 80 years (Tsai et al., 2020).

According to World Health Organization (2007), falls are a result of a complex interaction of demographic, biological, environmental, behavioral, and physical factors. Demographic factors include race (whites are at a higher risk of falling than blacks, unfavorable socio-economic factors (limited access to health services, illiteracy, poor housing, and low income) are associated with increased risk of chronic diseases hence falls (Stewart Williams et al., 2015). Biological factors including old age, female gender, and medical conditions were associated with a higher risk of falling. Physical factors including general weakness, muscle weakness, visual impairment, foot problems, cognitive impairment, and low body mass index increase the risk of falling (Ambrose et al., 2013)

Consequences of falls are admission in nursing homes, depression, immobilization, loss of autonomy, abandonment of daily activities, isolation, confusion, fear of falling, and fractures (Kuhnnow et al., 2022; Nguyen et al., 2020), thus preventing falls can significantly reduce morbidity and mortality from fractures and other injuries and improve the quality of life among the elderly (Bruce et al., 2021).

## **1.2 Statement of the problem**

In the Gatanga sub-county, Muranga County falls significantly contribute to morbidity and mortality among older people. Local hospital reports from Thika sub-county hospital, the primary catchment for patients from the Gatanga area, and neighboring hospitals indicate that falls are a significant cause of morbidity and mortality among older patients. Most affected are women with resulting hip, spine, long bone fractures, head injuries, bruises, and long-term effects such as immobilization, loss of independence, dementia, and death (SCHRIO, MOH, Thika Subcounty Hospital, 2016). However, there have been little data on the incidence, prevalence, and associated risk factors at the community level owing to a lack of public health research into the subject.

Annually, an estimated 424,000 people of all ages die due to fall-related causes worldwide, of which over 80% are from low and middle-income countries. Globally 37.3 million falls require medical attention leading to over 17 million Disability Adjusted Life Years (DALYs) lost. In 2010, among elderly persons aged over 50 years, falls accounted for over 77% – 85% of Years Lived with Disability (YDLs) (World Health Organization, 2007).

Africa's elderly population is increasing with increasing living standards, and an anticipated population of older persons will be between 5 - 10% by 2050, with the total population increasing from 50 million in 2010 to 193 million in 2050. The current life expectancy of persons in Kenya (and Gatanga Constituency) is 66 years, with women at 68 years and males at 63 years. The current Health Life Expectancy (HALE) at the age of 60 is 12 years for males and 14 years for females (World Health Organization, 2020).

The incidence of hip fractures (an expected outcome of falls) has been increasing, with over 4.43 million (71%) cases estimated to occur in developing countries by 2050 (Hawley et al., 2022). Data across the African continent, including Nigeria, Egypt, and South Africa, indicate that a quarter of elderly persons fall annually, with significant numbers sustaining injuries severe enough to warrant hospital admission (Bekibele & Gureje, 2010; Kalula et al., 2016; Kamel et al., 2013).

Approximately there are 2 million older adults in Kenya and these are at risk of falls, fall-related injuries among other complications of falls. Gatanga constituency in Murang'a County is an area with a significantly high population density of elderly persons, with approximately 10,000 elderly persons living in the area (Kenya National Bureau of Statistics, 2019). The resulting economic and social burden is significant and bound to increase as the life expectancy of Kenyans rises which will most likely lead to increased stress on the healthcare system, with more resources needed to mitigate the problem.

Inadequate knowledge about falls and fall-related injuries results in failure to undertake preventive measures, thus contributing to the falls. Preventing them can significantly reduce morbidity and mortality from fractures and other injuries among the elderly in the population (A. Lee et al., 2013).

### **1.3 Justification**

In Kenya, data on the incidence and prevalence of falls and their associated factors among older persons living in the community is minimal. The few studies on the subject in this region have focused on patients with injuries in the inpatient and outpatient departments of the hospitals. The true incidence and prevalence of falls in the communities have remained unknown despite increasing awareness of the problem's existence and magnitude, which hinders planning and resource mobilization. As a result, no known policy interventions/ programs or initiatives recognizing falls as a significant problem of the elderly in Kenya have been pursued. This study focused on understanding the prevalence of falls and their associated factors and related injuries. This information has contributed towards estimating the

associated burden of disease. This knowledge will contribute to developing falls prevention strategies and policies that can be integrated into public health frameworks. Further, this study will raise awareness within the communities, and the data generated will add to the existing limited knowledge about the condition, especially in Sub-Saharan Africa. The findings may also be a foundation for future research in Kenya and the East Africa region.

#### **1.4 Study objectives**

##### **1.4.1 Broad objectives**

To establish the socio-demographic and lifestyle factors associated with falls among the older persons living in Gatanga Sub-County, Murang'a County, Kenya in 2016/2017.

##### **1.4.2 Specific objectives**

- i. To determine the proportion of older people living in Gatanga Sub-County sustaining falls;
- ii. To establish the person-level factors of the older people and their association with falls;
- iii. To investigate the clinical factors associated with falls among the older persons living in Gatanga Sub-County;
- iv. To characterize the types of falls, associated complications and injuries and circumstances of fall-occurrence;

#### **1.5 Research questions**

- i. What is the proportion of older people living in Gatanga Sub-County sustaining falls?
- ii. What are the person level factors of the older people and their association with falls?
- iii. What are the clinical factors associated with falls among the older persons?

- iv. What are the types of falls, associated complications and injuries and circumstances of fall-occurrence?

### **1.6 Scope of study**

The study was conducted among older persons living in 28 out of 41 sublocations of Gatanga Sub-County. These sub-locations are Gatanga, Chomo, Kirwara, Mugumo-ini, Mabanda, Mithanduku-ini, Kigio, Ithangarati, Mureke, Gathanji, Kihumbu-ini, Thuita, Nyaga, Kiunyu, Gituamba, Rugaita, Gatunguru, Mbungiti, Karangi, Kiganjo, Ndunyu-Chege, Gitiri, Giachuki, Ndakaini, Kanunga, Kigoro, Mwagu, Gatura, Mukarara, Gatiinguru.

### **1.7 Limitation of study**

Some sub-locations which were selected as one of the study sites were not possible to conduct the study due to lack of a community health worker from the area. However, a replacement was done with another sub-location to ensure equal distribution and representation of study participants from the entire sub-county.

The other challenge during field execution was ensuring that information given by the participants was an accurate representation of the situation. However, since there was the likelihood of memory loss as we were interviewing older individuals, hence recall bias, they were asked to provide evidence of medical records where applicable and other members of family or guardians were required to participate in the interview to collaborate and ensure that the information given was accurate.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Background

About one-third of older adults sustain falls every year, with studies indicating 30 – 40% of older adults dwelling in the community sustain falls annually (Cevizci et al., 2015; World Health Organization, 2007).

Across the African continent, studies have shown a varying rate of falls among different communities (Kalula et al., 2016). In Nigeria, falls had a prevalence of 23% among elderly persons dwelling in the Southwestern and North-central parts of Nigeria (Bekibele & Gureje, 2010). Women (24%) were more likely to fall than men (17.9%). In Egypt, older adults of the Suez Canal region reported a fall rate of 60.3%, with 36% of falls occurring outdoors, 24% occurring in staircases, and 17% occurring in the bathroom (Kamel et al., 2013).

According to Amuyunzu (1997), falls in Kenya account for 69% of injuries in older people (+55 years.) Fall-related trauma accounts for 5.3% of all hospitalization in older adults (Orces, 2013). Falls also cause a hospitalization rate of 13.5% per 1000 adults older than 65 years of age (Alexander et al., 1992). Among older adults sustaining trauma seen in a Level I facility, the main mechanism for admission of older people was falls resulting in 59% admissions. Further analysis shows that 16.2% were admitted to the ICU (Rau et al., 2014).

According to a study conducted at the Kenyatta National Hospital in 2013, the older adults comprised 4.5% of all admissions due to trauma, and of these, traffic accidents were 44%, and fall-related causes were 41%. The average duration of hospitalization was estimated to be two weeks among those aged between 65 - 69 years and longer for the older persons (Saidi & Mutiso, 2013).

A trauma-related mortality review in Western Kenya in 2013 among adults indicated that falls contributed to 4% of all causes of injurious deaths. Women had

a mortality rate of 65% compared to men, while the elderly had a mortality rate of 88% compared to other age groups (Odhiambo et al., 2013).

Falls lead to a significant number of deaths and injuries. Up to 40% of those who fall sustain injuries ranging from severe to moderate, including lacerations, hip fractures, and head injuries (Komisar et al., 2022). Ninety percent of hip fractures result from falls (Yang et al., 2020), while in the United States deaths from falls were 42% between 2000 to 2006 and 31% between 2007 to 2016. Fatal fall rates increase exponentially from +65 years onwards, with more men sustaining deaths from falls than women (Burns & Kakara, 2018).

## **2.2 Risk Factors of Falls**

Risk factors of falls are generally classified into three broad categories, namely:

Intrinsic factors, extrinsic factors, and risk exposure, yet according to Skelton and Todd (2004), falls are usually due to the interaction of all these factors.

### **Intrinsic risk factors:**

Age and gender are significant risk factors for falls. Women tend to fall more often than men with an estimated fall rate of 22% among women compared to 17% among men (Chang & Do, 2015). Among the elderly population, the younger ones tend to have a similar distribution in fall rates between men and women. However, as the age increases to over 80 years, women will tend to sustain more falls than men and more fracture-related injuries (Chang & Do, 2015). Local reports at Embu Level V Hospital and many other referral hospitals in Kenya have indicated that there are significantly more older women admitted at any one time in the orthopedic wards with fractures of hip and femur due to falls on level ground than men. Post-menopausal osteoporosis accounts for the main reason women are at a higher risk of hospitalization due to fractures than men (Zhou et al., 2020).

Older persons who have sustained a fall episode have a higher likelihood of falling than those who have not fallen before. This is most likely due to pre-existing



conditions like frailty and poor balance, which are known predisposing factors to falls (Bartosch et al., 2020). Other risk factors for recurrent falls include immobility, history of stroke, poor mental status, dizziness upon standing, and orthostatic hypotension. Individuals who live alone are also at a higher risk of sustaining falls and fall-related injuries than those living with families or caretakers (Faulkner et al., 2009).

Numerous medical conditions contribute to falls. Visual impairment reduces postural stability, increasing the risk of falling hence fractures in older people. Visual impairment constitutes poor visual acuity, posterior sub-capsular cataracts, and visual field deficits among other pathologies (Ouyang et al., 2022).

Persons with diabetes mellitus are at an increased risk of falling. Reasons attributed to this are likely complications of diabetes such as hypoglycemia, peripheral neuropathy, foot complications, and visual complications such as retinopathy (Azidah et al., 2012).

Lower limb arthritis is associated with a neuromuscular functioning impairment which significantly predisposes older adults to falls. Such impairment includes knee and muscle strength, loss of proprioception, balance, pain, and generally reduced limb strength (Doré et al., 2015; Ward et al., 2019).

The introduction of anti-hypertensive medications is associated with an increased risk of falls and subsequent hip fractures among the elderly. The main reason for falls in this category of patients was hypotension due to changes in position (orthostatic hypotension (Tinetti et al., 2014).

Lower limb dysfunction, neurologic conditions, barbiturate use, and visual impairment are well documented as risk factors for falls. Gait variability (more stride time) also increases the risk of fall. Factors that correlate significantly with stride time variability include strength, balance, gait speed, functional status, and mental health (Hausdorff, 2007).

Medication use such as sedatives, cognitive impairment, Palmo-mental reflex, abnormalities of balance and gait, Faulty vision, common household hazards, e.g., loose rugs and foot problems, has been identified as the risk factors for falls in the elderly. Impairments in cognitive and vestibular function, musculoskeletal weakness, use of multiple prescriptions and over-the-counter medicines, loss of physical conditioning, mobility, and balance contribute to falls. Alcohol use medical conditions affecting balance and walking ability, e.g., Parkinson's disease and stroke, have been associated with falls (de Jong et al., 2013).

Foot problems are known risk factors for falls. These include decreased ankle flexibility, more severe hallux valgus deformity, decreased plantar tactile sensitivity, decreased toe plantar flexor strength, and disabling foot pain (Awale et al., 2017; Menz et al., 2006).

### **Extrinsic factors**

External risk factors contributing to falls include environmental hazards such as poor lighting at night, worsened by impaired vision. Slippery floors, footwear such as high heeled, clothing, and inappropriate assistive walking devices increase the likelihood of falls among older persons (Todd & Skelton, 2004).

Environmental hazards are a common cause of falls accounting for 25% to 45%. Older persons fall mainly while at their homes. Although in some populations, falls were more frequent among older adults living in nursing homes than in communities (Magnuszewski et al., 2022)

Mining, farming, forestry, and construction are high-risk occupations for falls-related injuries. Elderly populations living in rural areas have a higher prevalence of falls than those living in urban areas (Orces, 2013).

Significant numbers of older adults visiting many Kenyan hospitals for fracture treatment report that a push or pull by domestic animals and being tripped by door frames cause falls. These factors are associated mainly with the subsistence farming lifestyle found in vast places in sub-Saharan Africa (Unpublished reports).

## **Exposure to Risk**

These are factors that precipitate elderly persons to fall. They include syncope attacks, trips, and slips and drop attacks. In elderly persons living in communities, involvement in certain activities such as walking in the steep wet environment could expose them to tripping (Adanusa et al., 2022; Bekibele & Gureje, 2010; Kalula et al., 2011).

## **2.3 Fall Prevention**

Whereas falls are the leading cause of injurious deaths among the elderly, most are preventable. Preventing falls requires broad, comprehensive, and multifaceted strategies. Such measures include prioritizing research to understand the causes of falls and variable risk factors and explore effective public health prevention strategies.

The WHO Falls Prevention Model recognizes the pillars of preventing falls as (1.) Awareness building; (2) Individual assessment of environmental and societal factors that increase the likelihood of falls and 3) Facilitating the design and implementation of culturally appropriate evidence-based interventions that will significantly reduce the number of falls among older persons (World Health Organization, 2007).

Developing effective prevention and intervention measures and programs require approaching falls and falls-related injuries within the framework of the determinants of Active Aging. Cross-cutting factors such as culture and gender need assessment to understand their role in contributing to falls. In some cultures, older persons must “rest,” limiting their physical activities. Reduced physical activity enhances body weakness contributing to falls (Fu et al., 2021).

Health and social services availability influences fall in the older adults. Lack of such services limits access to treatment for conditions that can predispose to falling, and this is made worse by aging, which comes with significant morbidities and frailty. Whereas the first fall incidence may not be preventable, the recurrent fall

episode can be preventable through understanding the individual factors predisposing to falls (Fernandes et al., 2021).

Behavioral factors such as physical activities, exercise, and physical therapy have significantly reduced the incidence of falls in the elderly. A systematic review conducted by Cochrane Collaboration showed that exercise programs involving muscle strengthening, balance training, and a walking plan significantly reduced the incidence of falls among the elderly (Rao, 2005).

Healthy eating and good nutrition promote physical strength, thereby reducing frailty. Medicines for the elderly should need to be prescribed by qualified personnel, factoring in the relevant side effects which could increase the risk of falling. Elderly persons should avoid activities that increase their risk of falling, such as climbing at high-risk places and use of ladders (Esquivel, 2017; Montero-Odasso et al., 2022). Personal factors such as attitudes, coping with falls, fear of falling, ethnicity, and race, should be assessed, and falls prevention strategies tailored to integrate the role of such (Goh et al., 2021).

Environmental-related factors such as slippery floors need addressing to reduce the incidence of falls. Older adults should live with others as living alone places them at a higher risk of falls than those living with relatives (Jiang et al., 2019; Kalula et al., 2011). Poverty among older people needs addressing. They require seeking good treatment for illnesses and have the ability to afford recommended interventions such as balance enhancing exercises and regimes to reduce the risk of falls (S. Lee et al., 2017).

Studies have listed various single and multi-factorial interventions as necessary for preventing falls. Such include single interventions such as exercise and physical therapy, home safety assessment and modification, medications withdrawal, cardiac pacemaker, and hip protectors. Equally multi-factorial interventions such as exercise programs incorporating gait and balance training; advice on the appropriate use of assistive devices by an occupational therapist; review and modification of medications; evaluation and treatment of postural hypotension; removal or

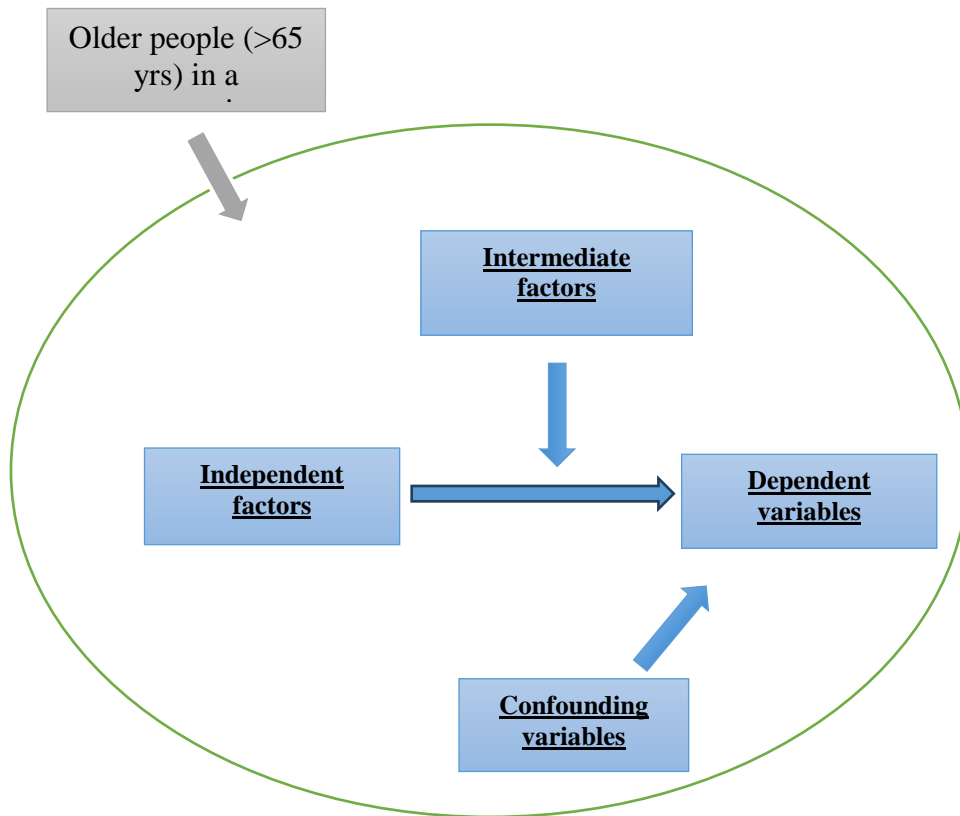
modification of environmental hazards; and targeted medical and cardiovascular assessment and treatments (Gillespie et al., 2012; Guirguis-Blake et al., 2018).

#### **2.4 Research gaps in falls in older people in Kenya**

The studies conducted in Kenya provided critical information on falls occurrence but used hospital populations. These studies have looked at injuries among older people in general as they present to the hospital setup. Therefore, it is crucial to understand the events and circumstances of falls in the community where the falls are occurring. Understanding the problem at the community level is undoubtedly the most logical step to mitigate the problem as preventive measures for falls can be implemented hence reducing the occurrence of falls in the community thus reducing the presentation at the hospital level.

#### **2.5 Conceptual framework**

The association between falls, and factors associated with aging are outlined in the conceptual framework, figure 1. Falls further result to injuries, hospitalization among other undesirable effects among older people.



**Figure 2.1: Conceptual framework showing association between falls, personal and clinical factors and confounders.**

## **CHAPTER THREE**

### **MATERIALS AND METHODS**

#### **3.1 Study design**

The study was a cross-sectional analytical study among older people over 65 years residing in their homes in Gatanga Sub-County that utilized qualitative and quantitative data collection methods.

#### **3.2 Study Population**

The study population was older people above 65 years of age living in Gatanga Sub-County.

#### **3.3 Study sites**

This study was conducted in Gatanga Subcounty of Murang'a County in September 2017. Gatanga constituency lies in the Central Region of Kenya and is essentially a rural region with hilly and mountainous terrain. The constituency has six administrative wards. Gatanga sub-county is one of the seven sub-counties in Murang'a County. It covers an area of 599 km<sup>2</sup> and borders Kiambu County to the South, Nyandarua County to the West, Machakos County to the East, and Kandara Sub-county to the North. The sub-county has a population of 178,248 persons with a population density of 366 persons per sq. km. (KNBS, 2016). Gatanga Subcounty was chosen from the other sub-counties based on a simple random sampling.

There are currently 9 323 elderly persons out of 182,248 persons, which is 5.7% of the total population living in the constituency. Murang'a County has the highest population of elderly persons living in Kenya. This data almost coincides with a recent household mapping exercise that identified 9146 elderly persons living in the area. (KNBS, 2016 & SCHRIO, Gatanga, 2016)

Gatanga constituency is among the leading constituencies with the highest population of elderly persons living per square km in Kenya. The majority of the

people living in this area are of Kikuyu ethnicity. The majority of the elderly persons live in their homes and are involved in economic activities such as subsistence farming and livestock keeping. Crops grown include coffee, maize, bananas, legumes, and vegetable farming. Livestock includes goats, cows, and chickens.

### 3.4 Sample size

The main objective of this study was to determine the proportion of falls among older adults living in Gatanga Subcounty. The sample size for the quantitative interviews was calculated using the formula below:

$$n = \frac{Z_{\alpha/2} \cdot P(1-P)}{d^2} \text{ (Cochran, 1963)}$$

Where:

$Z_{\alpha/2}$  = Critical value associated with 95 percent confidence interval (2 tailed test)

$d$  = absolute precision or margin of error

$\alpha$  = level of significance

$P$  = estimated prevalence of falls in older persons.

In the absence of baseline information on prevalence of fall in this region,  $P$  was estimated to be 50 percent to allow for a maximum sample size.

After substituting this formula, 'n' was found to be 385. At the end of the interviews, the final sample size was 424 due to an allowance of 10% to account for nonresponse.

### 3.5 Data collection tools

#### 3.5.1 Data collection tools

To collect quantitative data, we used a well-structured interview form. The questionnaire was developed based on the information of interest to the researcher.



Demographic information included participants' age, education level, and marital status, among others.

We conducted a pilot study to test the applicability of the structured interview form before we conducted the actual study.

Community-dwelling study participants who were older adults underwent interviewing to collect data. The structured data collection tool (Appendix 1.0) guided the interviews and was administered on face-to-face basis.

Interviewers visited the study participants in their homes, where they conducted the interviews.

Alongside the Structured Interview Form (Appendix 1, Part A), The Frail Non-Disabled (FiND) Questionnaire (Appendix 1, Part B) and a Modified Barthel Index form were administered to assess the Activities of Daily Living of the elderly persons (Appendix 1, Part C),

**The Mini Nutrition Assessment- Short Form (MNA-SF)** tool was used to assess the nutrition status of older persons (See Appendix 1, Part D).

The study participants underwent weight, height, and calf circumference measurement as a component of the MNA-SF tool. A health scale weighing machine measured the participants' weight. Study participants stood next to a wall where a 12-inch ruler was placed on the head, and the corresponding length to participant height was marked on the wall with chalk to measure their height. A three-foot Huanan measuring tape was used to measure the height. A tailors' tape measure was used to measure calf circumference at the mid-leg level for those who could not measure the Body Mass Index.

At the end of the interview, the participants who had reported falling were asked to explain the circumstances that led to their falling.

### **3.5.2 Quality of data**

The quality of the data collected for both quantitative and qualitative surveys was ascertained by undertaking the following steps during the data collection process: -

- Data collection tools were translated to Kikuyu, the interviewing language.
- Data collection tools developed were pre-tested to ensure that they were systematic and well understood by the potential participants. The pre-tests were done at selected homes, during which 10 participants were interviewed.
- Research assistants were duly trained and supervised by the student investigator and provided with written interviewing guidelines.
- Each Structured Interview form collected within the quantitative survey was checked for completeness, coherence, and accuracy on the same day of the interview.
- On receipt of the Structured Interview form from the field, the forms were recorded and handed over to the data entry team after secondary checks.
- All Structured Interview forms were double entered into an Epi-Info version 3.5.4 worksheet then transferred into Microsoft Access database and compared for accuracy. Anomalies in data entry were verified using the actual Structured Interview form.
- After data entry, quantitative data were transferred into Stata version 13.0 to compare the two data sets. After confirming the similarity of data sets, a single final one was retained for data cleaning procedures.

## **3.6 Sampling procedure**

### **3.6.1 Data sampling**

Data was collected through interviews with the participants being visited at their homes by a Community Health Worker. A random systematic sampling technique was used to select the participants to be included in the study, and written informed consent was obtained prior to participation. The following procedure was followed to recruit:

- ***Random selection of the first participant:*** Selection was based on the total estimated population of elderly persons living in Gatanga constituency, 9153, as based on a recent household mapping exercise and the sample size of 423. Thus, nth participant was every 21st participant.
- In selecting the first participant, a simple random sampling was used with  $1 \leq n \leq 21$ ; subsequently, every 21st household with an older individual was selected for sampling.
- The Interviewers were required to move in one direction from the first household nearing a market on the street.
- ***Systematic random selection of other participants:*** after a successful interview, the interviewers skipped the next 20 households (sampling interval was 21) and targeted the next household for interviewing. However, if the interview was unsuccessful, the team approached the next eligible household.

### **3.6.2 Inclusion criteria**

- Eligible elderly persons (65+ years old) who are residents of Gatanga area for more than 6 months will be included into the study.

### **3.6.3 Exclusion criteria**

- Older persons unable to support themselves independently, having sustained the disability prior to August 2016;
- Bed-ridden older persons who sustained their disability prior to August 2016;
- Older people who could not give information due to mental illnesses or any other condition were excluded from the study.

### **3.7 Data analysis**

Data cleaning was carried out. Data analysis was then conducted using descriptive analysis techniques, including means, medians, frequency counts, proportions, ranges, and inter-quintile ranges for quantitative variables. Chi-square and logistic models were used to determine associations. These data were presented in tables,

pie charts, and bar charts with a narrative analysis or interpretation of the results preceding the illustrations.

Descriptive statistics, including means with 95% confidence intervals, were computed to estimate the age distribution of participants while proportions were used to describe sex, marital status, and the level of education. Proportions were also used to describe the distribution of medical conditions and social factors associated with the falls and the frequency and the characteristics of falls and were reported as a percentage of the collected data.

Data on sex and falls occurrence was presented in bar graphs, while data on the level of education and various medical conditions was shown using pie charts. Data on medical conditions was as well shown using summary tables.

Chi-Square Test was used to compare categorical variables, and Students Independent t-test to compare continuous variables and  $p < 0.05$  was considered statistically significant.

Those variables statistically significant ( $P$ -value  $< 0.05$ ) in the bivariate analyses were entered into a logistic regression model for multivariate analysis between falls and the characteristics of the participants. Results of the regression model were presented as odds ratios (ORs) with their corresponding 95% confidence intervals (95% CI).

### **3.8 Ethical considerations**

- **Confidentiality:** research assistants were well trained to keep all information collected during the study confidential. No names or direct identifiers were recorded during data collection. All hard copies of study materials were stored in lockable cabinets, and electronic data was password-protected, both accessed only by the principal investigator.
- **Potential risks to participation:** Participants were assured of there being no risk to participation

- **Withdrawal from the study:** participants were free to decline to participate in the study or withdraw from participation at any time.
- Participation in the study was voluntary, and written informed consent was obtained from the participants in the form of a signature or thumbprint.
- On the consent form, participants were assured that the process was non-judgmental and that there was no wrong or correct answers. Rather interest was on their accurate opinions on the issues discussed.
- Research protocol was subjected to the KEMRI Scientific Steering Committee and KEMRI National Ethics Review Committee clearance process. This study was approved by the Scientific and Ethical Review Unit (SERU) of Kenya Medical Research Institute (Ref: KEMRI/SERU/CPHR/09/3509) (Appendix 3).
- Administrative approval was obtained from the local Sub-County Public Health Officer.

## CHAPTER FOUR

### RESULTS

#### 4.1 Response rate

The study targeted a sample size of 424 respondents from which there was adequate response. Out of the 424 participants interviewed, 420 were analyzed. Four study participants were dropped in the final analysis due to missing data.

#### 4.2 Socio demographics characteristics of the study participants

The mean age of the sample was 76.1 years, standard deviation of 8.2, range (65 – 103 years) and median of 74 years. Females (70.5%) were the majority compared to males (29.5%). The majority of participants were married (60.7%) Further details of the sociodemographic characteristics are shown in Table 1.

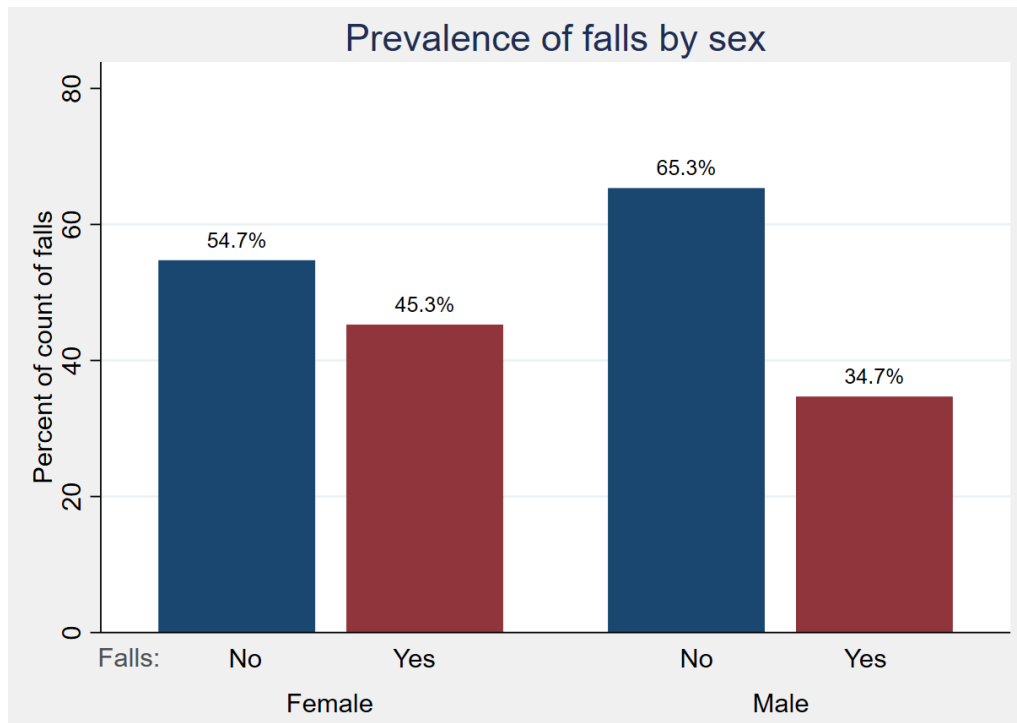
**Table 4.1: The sociodemographic characteristics of the study participants**

Variable	Response	Counts N=420	Percent
Age	65-74	222	52.9
	75-84	120	28.6
	85-max	78	18.6
Gender	Female	296	70.5
	Male	124	29.5
Marital status	Married	255	60.7
	Single	165	39.3
Highest level of education	No school	210	50.0
	Primary not completed	105	25.0
	Primary completed	75	17.9
	Secondary completed	30	7.1

#### 4.3 The Prevalence of falls among the Elderly.

Out of the 420 participants, 177 experienced falls in the last 12 months. The period prevalence of falls for period of study was 42.1% (CI 37.4 - 47%).

When further categorized by sex, falls were more common in females, with a frequency of 134/296 (45.3%) amongst females than males 43/124 (34.7%) (Figure 2).



**Figure 4.1: Bar Graph showing distribution (frequency) of falls by sex**

#### 4.4 The Characteristics of falls

The characteristics of falls included the number of times one fell in the last 12 months, the place of fall, the terrain of fall, whether somebody accompanied one during fall and time of fall (Table 2).

**Table 4.2: The summary of the characteristics of falls.**

<b>Characteristics of fall</b>	<b>Response</b>	<b>Counts N = 177</b>	<b>Percent</b>
Number of falls in the last 12 months	1	61	34.1
	2 or more (recurrent falls)	116	65.9
Place of fall in the last fall episode	Indoor	41	20.3
	Outdoor	136	79.7
Terrain of fall in the last fall episode	Flat	102	57.7
	Mildly steep	48	26.9
	Very steep	27	15.4
Time of fall in the last fall episode	Daytime	137	78.4
	Night	40	21.6
Whether accompanied by someone during last fall episode	No	120	67.4
	Yes	57	32.6

#### **4.5 Outcomes associated with the falls**

The outcomes associated with falls included the fear of falling, injury after fall, abandonment of daily activities, loss of autonomy after falls, hospitalization on falling among others. Their frequencies are indicated in table 3.

**Table 4.3: Summary table showing the frequency of outcomes associated with falls**

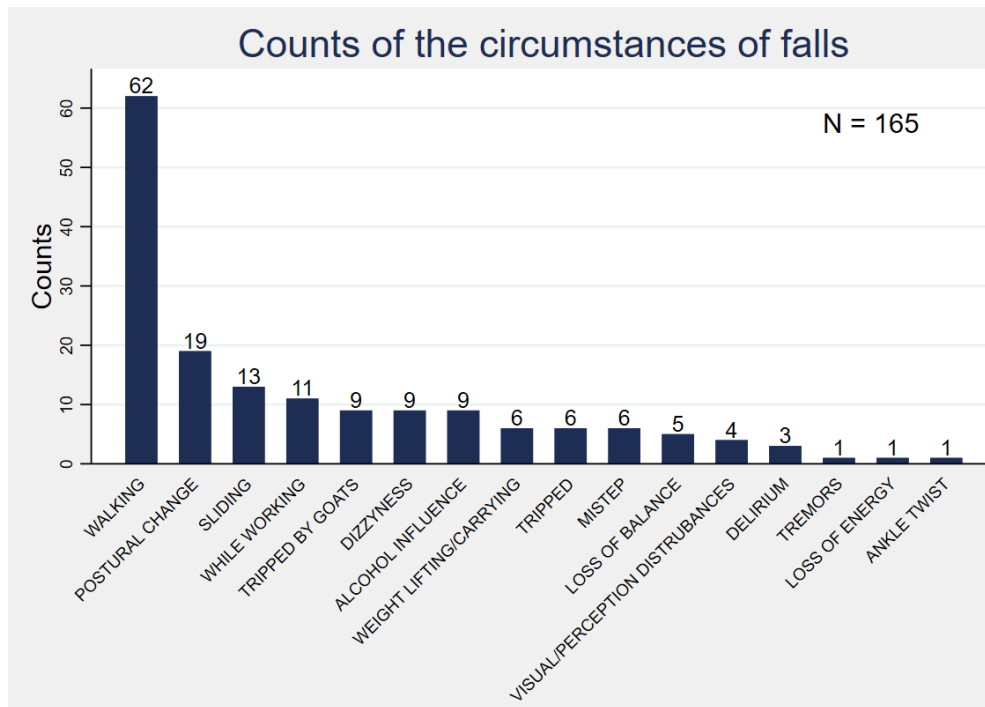
<b>Outcomes of falls</b>	<b>N</b>	<b>Counts</b>	<b>Percent</b>
Fear of falling	176	162	92.1
Injury after fall	177	88	49.7
Abandonment of daily activities	173	70	40.5
Loss of autonomy after falls	175	61	34.9
Hospitalization on falling	177	56	31.6
Immobilization after falling	177	53	29.9
Fractures on falling	177	41	23.1
Skin Bruises on falling	175	34	19.4
Confusion after fall	171	23	13.4
Head injury on falling	174	21	12.1
Black out on falling	177	18	10.2

#### **4.6 Circumstances of falls**

The participants reported various circumstances leading to falls, as outlined in Figure 15. These included fell while walking (40.0%), sliding (8.4%), fell while working (7.7%), felt dizzy then fell (7.7%), postural change (7.1%), tripped over



goats while attending to them (5.2%), under the influence of alcohol (5.2%), tripped over an object (3.9%), missed a step (3.2%), lost balance, lost perception of a place while in darkness, deliria like states, tremors, loss of energy, and ankle twist (Figure 3).



**Figure 4.2: The bar graph showing the numerical frequencies of circumstances of falls**

#### 4.7 The associations of falls in the bivariate analysis

The Chi-square test for independence was run to establish the associations between occurrence of falls and sociodemographic, lifestyle, social-economic factors, nutritional, medical, and frailty factors. Results were reported as Chi square value and corresponding p values where  $p < 0.05$  was considered statistically significant.

#### 4.7.1 Associations between falls and social-demographic factors

Sex was significant at  $P < 0.045$  (Table 4).

**Table 4.4: Bivariate associations between falls and socio-demographic factors**

Variable	Response	Falls prevalence N=420	$\chi^2$	P value
<b>Age</b>	65-74	89/222 (40.1)	1.1	0.590
	75-84	55/120 (45.8)		
	85-max	33/78 (42.3)		
<b>Gender</b>	Female	134/296 (45.3)	4.0	0.045
	Male	43/124 (34.7)		
<b>Marital status</b>	Married	113/255 (44.3)	1.3	0.263
	Single	64/165 (38.8)		
<b>Highest level of education</b>	No school	91/119 (43.3)	4.1	0.399
	Primary not completed	47/105 (44.8)		
	Primary completed	26/75 (34.7)		
	Secondary completed	13/30 (43.3)		

#### 4.7.2 Associations between falls and lifestyle factors

Pearson's Chi square was used to establish bivariate associations between falls and lifestyle & social-economic factors and reported as corresponding p values (Table 5).

**Table 4.5: Associations between falls and lifestyle & socio-economic factors**

<b>Lifestyle and socio-economic factors</b>	<b>Responses</b>	<b>Falls prevalence N = 420</b>	<b><math>\chi^2</math></b>	<b>P value</b>
Alcohol use	Yes	19/37 (51.4)	1.4	0.235
	No	158/383 (41.3)		
Cigarette smoking	Yes	18/40 (45.0)	0.1	0.700
	No	150/380 (41.8)		
Domestic animals rearing	Yes	134/325 (41.2)	0.5	0.484
	No	43/95 (45.3)		
Chicken rearing	Yes	68/189 (36.0)	5.9	0.015
	No	108/226 (47.8)		
Day to day activities involvement	Yes	117/295 (39.8)	2.4	0.120
	No	60/125 (48.0)		
Type of floor of residential house	Cement	107/262 (41.1)	1.8	0.398
	Earthen	68/150 (45.6)		
	Tiles	2/8 (25.0)		
Main source of lighting	Hydro-Electricity	101/235 (43.2)	0.2	0.926
	Kerosene lamp	72/174 (41.4)		
	Solar electricity	4/10 (40.0)		
Living status	Alone	32/77 (43.2)	0.03	0.873
	With someone	144/343 (42.2)		
Hospitalization bills payment mode	Own cash	83/224 (37.1)	10.2	0.006
	Health insurance	9/33 (27.3)		
	Relatives' contribution	83/164 (50.6)		

#### 4.7.3 Associations between falls and nutritional factors

There were no significant associations established between falls and nutritional factors (Table 6).

**Table 4.6: Table showing associations between nutritional factors and falls**

<b>Nutrition factors</b>	<b>sponses</b>	<b>Falls prevalence = 420</b>	<b><math>\chi^2</math></b>	<b>P value</b>
Modified Nutritional assessment score (MNA-SF)	Normal nutritional	241 (40.8)	0.8	0.664
	At risk of malnutrition	159 (43.7)		
	Malnourished	20 (50.0)		
Consumption of at least 3 meals per day	All/Most of the days	4/277 (41.1)	1.3	0.723
	Some of the days	67 (47.8)		
	Never	68 (45.6)		

#### 4.7.4 Associations between falls and medical factors

Various medical illnesses were significantly associated with the falls in the last 12 months. These included peripheral neuropathy (p-value = 0.019), Arthritis (0.010), Arthritis of the ankle (0.004), knees (0.003), and hip arthritis (0.000), lower back pains, current medications use, headache, dizziness, memory loss, hypertension, acute illness, hospital admission, bruises and cuts, diabetes, syncope, and blindness (Table 7).

**Table 4.7: Summary of associations of falls and medical factors**

Type of illness	Responses	Falls prevalence N=420	$\chi^2$	P value
Peripheral neuropathy	Yes	126/272 (46.3)	5.5	0.019
	No	51/148 (34.5)		
Arthritis / Joint pains	Yes	125/267 (46.8)	6.6	0.010
	No	52/153 (34.0)		
Acute stress/ depressed mood	Yes	102/228 (44.7)	1.3	0.259
	No	75/192 (39.3)		
Lower back pains	Yes	115/225 (51.3)	16.9	<0.001
	No	61/195 (31.4)		
Current medications use	Yes	107/214 (50.0)	10.8	0.001
	No	70/206 (34.2)		
Visual impairment	Yes	96/209 (45.9)	2.5	0.117
	No	81/211 (38.4)		
Headache	Yes	99/196 (50.8)	10.6	0.001
	No	78/224 (35.0)		
Dizziness	Yes	101/189 (53.7)	18.4	<0.001
	No	76/231 (32.9)		
Memory loss	Yes	91/184 (49.7)	7.2	0.007
	No	86/236 (36.6)		
Hypertension	Yes	89/180 (49.4)	6.9	0.009
	No	88/240 (36.7)		
Acute illness	Yes	72/132 (55.0)	12.9	<0.001
	No	104/288 (36.2)		
Neck pains	Yes	57/116 (49.1)	3.4	0.067
	No	119/304 (39.3)		
Hospital admission	Yes	54/101 (53.5)	6.9	0.009
	No	123/319 (38.7)		
Hearing impairment	Yes	44/89 (50.6)	3.1	0.081
	No	133/331 (40.2)		
Fractures	Yes	40/80 (50.0)	2.5	0.112
	No	136/338 (40.2)		
Spectacles use	Yes	30/75 (42.3)	<0.01	0.976
	No	143/345 (42.1)		

Type of illness	Responses	Falls prevalence N=420	$\chi^2$	P value
Bruises and Cuts	Yes	37/69 (53.6)	4.5	0.035
	No	140/351 (39.9)		
Altered mental states	Yes	27/53 (50.9)	1.6	0.203
	No	150/360 (41.7)		
Wounds	Yes	27/49 (55.1)	3.7	0.054
	No	150/369 (40.7)		
Diabetes	Yes	28/45 (62.2)	8.3	0.004
	No	149/375 (39.7)		
Syncope	Yes	29/39 (74.4)	18.3	<0.001
	No	148/381 (38.9)		
Anemia	Yes	17/36 (47.2)	0.4	0.544
	No	160/381 (42.0)		
Blindness	Yes	20/33 (62.5)	5.8	0.016
	No	157/387 (40.7)		
Lung disease	Yes	13/26 (50.0)	0.7	0.408
	No	164/394 (41.7)		
Heart Disease	Yes	9/23 (39.1)	0.08	0.774
	No	167/396 (42.2)		
Jiggers	Yes	6/17 (35.3)	0.3	0.556
	No	170/400 (42.5)		
Kidney Disease	Yes	6/13 (46.2)	0.08	0.772
	No	171/406 (42.1)		

#### 4.7.5 Associations between falls and frailty

Frailty was significantly associated with falls with significant P values in unsteadiness in gait, difficulty in doing usual activities, use of assistive walking device, and being frail or disabled in the Frailty for non-disabled index (Table 8).

**Table 4.8: Bivariate associations between falls and frailty factors**

<b>Frailty measure</b>	<b>Response</b>	<b>Counts N = 420</b>	<b><math>\chi^2</math></b>	<b>P value</b>
Unsteadiness in gait/problems with walking or balance	Yes	102/178	29.1	<0.001
	No	(57.3) /242 (31.0)		
Difficulty in doing usual activities	Yes	2/211 (48.3)	6.7	0.010
	No	/209 (35.9)		
Engagement in day-to-day activities	Yes	7/294 (39.8)	2.4	0.120
	No	/125 (48.0)		
Assistive walking device use (Walking stick / Clutches / Walking frame)	Yes	/131 (56.5)	16.1	<0.001
	No	3/289 (35.6)		
Frailty for Non-disabled (FiNd) Index	Disabled/Frail	9/276 (50.4)	21.8	<0.001
	Robust	/140 (26.4)		
Modified Barthel Index	14-20	0/392 (40.8)	2.9	0.091
	0-13	/ 28 (57.1)		

**4.8 The associations of falls in the multivariate Analysis**

The logistic regression model for multivariate analysis revealed the most significant risk factors ( $p < 0.05$ ) for falls in the overall group were female gender, dizziness, experiencing syncope, unsteadiness in gait, and being disable or frail on Frailty for Non-Disabled Index questionnaire and are listed in Table 9.

**Table 4.9: Summary of the multivariate model of the factors associated with falls**

<b>Odds Ratios for Categorical Predictors</b>		<b>Odds Ratio</b>	<b>95% CI</b>	<b>P-Value</b>	<b>Co-eff.</b>
Constant				0	-1.474
Level A	Level B				
Sex					
Female	Male	1.8	(1.1, 3.0)	0.025	0.578
Low back pains					
Yes	No	1.4	(0.9, 2.3)	0.134	0.354
Dizziness					
Yes	No	1.8	(1.1, 2.8)	0.015	0.562
Diabetes					
Yes	No	2	(1.0, 4.0)	0.065	0.674
Syncope					
Yes	No	2.8	(1.2, 6.7)	0.016	1.045
Unsteadiness in gait					
Yes	No	2.2	(1.2, 4.0)	0.007	0.803
Difficulty in carrying out usual activities					
Yes	No	0.6	(0.4, 1.1)	0.107	-0.462
Assistive walking devices					
Yes	None	1.5	(0.9, 2.5)	0.132	0.401
FIND questionnaire					
Disabled	Robust	2	(1.2, 3.3)	0.007	0.699

Odds ratio for level A relative to level B

Risk factors for falls were evaluated to assess sex specific risks using a binary logistic regression model, in women (Table 10) and men (Table 11). Among women, the most important risk factors for falls were history of dizziness, unsteadiness in gait, and being frail or disabled.

**Table 4.10: Summary of the multivariate model of the factors associated with falls among women**

<b>Odds Ratios for Categorical Predictors</b>		<b>Odds Ratio</b>	<b>95% CI</b>	<b>P-Value</b>	<b>Co-eff</b>
Constant				0.000	-1.72
Level A	Level B				
Dizziness					
Yes	No	2.7	(1.6, 4.6)	0.000	0.98
Diabetes					
Yes	No	1.8	(0.7, 4.5)	0.243	0.57
Syncope					
Yes	No	2.6	(0.9, 7.7)	0.083	0.96
Unsteadiness					
Yes	No	1.8	(1.0, 3.2)	0.039	0.59
Ankle arthritis					
Yes	No	1.5	(0.8, 2.8)	0.186	0.41
Hip arthritis					
Yes	No	1.7	(1.0, 3.1)	0.065	0.56
Find questionnaire					
Disabled/Frail	Robust	1.9	(1.0, 3.5)	0.038	0.64

Odds ratio for level A relative to level B

Among men, the most important risk factor associated with fall was regular alcohol consumption (Table 11)

**Table 4.11: Summary of the multivariate model of the factors associated with falls among men**

<b>Odds Ratios for Categorical Predictors</b>		<b>Odds Ratio</b>	<b>95% CI</b>	<b>P-Value</b>	<b>Coef</b>
Constant				0.003	-1.67
Level A	Level B				
Fractures					
Yes	No	3.7	(0.7, 19.3)	0.124	1.3
Confusion					
Yes	No	3.8	(0.3, 42.1)	0.272	1.34
Blindness					
Yes	No	9.2	(0.8, 99.8)	0.068	2.22
Unsteadiness					
Yes	No	2.3	(0.7, 7.5)	0.184	0.82
Alcohol consumption					
Yes	No	7.7	(2.0, 29.7)	0.003	2.04
Low back pains					
Yes	No	2.5	(0.7, 9.2)	0.17	0.91

Odds ratio for level A relative to level B



## CHAPTER FIVE

### DISCUSSION

#### 5.1 The prevalence of falls

An estimated one-third of the older adults fall annually. This study found the prevalence of falls of 41.4% (CI 37.37 - 47.02). This prevalence was consistent with many other studies in different places of the world, and Africa, which has shown a falls prevalence of 20-60% (Kalula et al., 2011; World Health Organization, 2007). In Nigeria, falls were reported to occur at 23% among older persons dwelling in Southwestern and north central parts of Nigeria (Bekibele & Gureje, 2010). Older adults of the Suez Canal region in Egypt reported a fall rate of 60.3% (Kamel et al., 2013). A recent study in Ethiopia found a fall rate of 28%, although their population included those aged 50years and above (Janakiraman et al., 2019).

#### 5.2 Characteristics of falls

One-time fallers represented 33.8%, whereas recurrent fallers represented 66.2%, having fallen twice or more. Recurrent fallers were at a higher risk of sustaining fractures after falls than one-time fallers ( $p$ -value = 0.038). Recurrent fallers with intrinsic factors are the most eligible for a fall prevention strategy (Bartosch et al., 2020).

Falls were experienced in different places by the fallers. Of the 167 participants who had fallen in the last year, 79.7% had fallen outdoors, while 20.3% had fallen indoors. This finding is consistent with other studies that show that most older people tend to fall outdoors (Li et al., 2006). Outdoor falls were equally reported in varying terrains. In this study, most falls, 133 (79.6%), occurred during the day, 6 am – 6 pm, whereas 34 (20.4%) occurred at night, 6 pm – 6 am. This is consistent with other studies that found that most falls occurred during the day (Sachiyo Yoshida, 2007). The higher frequency of falls in the morning was possibly due to dizziness as they woke up, wet slippery grounds in the morning, and while engaging in activities as most people tended to work in the morning.

### **5.3 Injuries and outcomes of falls**

Fear of falling was the most common complication of fall, with 58.5% of all the study participants reporting having a fear of falling. Almost 92.1% of fallers had a fear of falling after falling. Fear of falling is likely to influence the livelihoods of the elderly by limiting their engagement in physical activities. Studies have shown that fear of falling occurs approximately in thirty percent of those who have never fallen and sixty percent among fallers (Nguyen et al., 2020).

Injuries after falls were a common occurrence in this study. This finding was consistent with studies in different places, which have shown that the incidence of injuries among fallers ranges between 30-50% (Sachiyo Yoshida, 2007). Fractures were a relatively common occurrence of falls, with a quarter of the fallers sustaining fractures of the tibia (8.6%), femur (5.7%), radius-ulna (4.9%), humerus (3.1%), hip (2.6%), hip dislocation (0.8%). Other studies have shown that about 20-30% of falls lead to severe injuries which were immobilizing. Studies in India show that the incidence of fractures among fallers of Northern India was 21.3%. In this community, the prevalence of injuries among fallers was consistent with reports from other studies (Krishnaswamy & Usha, 2006). Several other complications of falls reported in this study included the abandonment of daily activities, loss of autonomy, hospitalization after fall, immobilization, confusion, head injury, and blackout on falling. Similar complications have been reported in other studies (World Health Organization, 2007)

### **5.4 The Socio-Demographic, Lifestyle, Socio-Economic Factors**

There were no significant associations established between age and falls in this study. Studies have shown that the incidence of falls increases with increasing age, with people aged 80 years and above at a higher risk of falling. Other reports do not consider advancing age as a risk factor for falls but rather the overall health status of an older adult (Grundstrom et al., 2012).

Falls occurrence varied across gender, with females showing a higher frequency of falls and females being at a higher risk of falling. Other studies across Africa and the world have shown a similar trend of falls prevalence, with women at a higher risk of sustaining falls than men (Bekibele & Gureje, 2010).

Alcohol use was significantly associated with falls in men. Other studies have associated alcohol use with falls (Sun et al., 2022; Wong et al., 2016), yet others have failed to detect any associations between alcohol use and falls (Mukamal et al., 2004). Smoking cigarettes was not as well associated with falls. This finding contradicts other studies that found smoking cigarettes was associated with falls (Abate et al., 2013; Tang et al., 2022).

Domestic animals are one of the primary sources of income in this community. 77.4% of the elderly had domestic animals in their homes, whereas 22.6% did not. Rearing chicken and sheep were significantly associated with the falls. Many elderly persons reported having sustained falls while tethering sheep due to being pulled suddenly by the animals' rope coupled with reduced balance and coordination. Other studies have not shown this association. However, this study has shown a significant association indicating that this lifestyle is a significant risk factor for falls.

### **5.5 The Medical, Frailty Factors and Falls**

In the multivariate analysis model, the most significant risk factors for falls in the overall group were, dizziness, experiencing syncope, unsteadiness in gait, and being disable or frail on Frailty for Non-Disabled Index questionnaire.

Syncope and fainting were significantly associated with falls in this study. There is a controversy that exists between syncope and falls. Nevertheless, the latest definitions of falls have included unexplained loss of consciousness as a cause of falls. Syncope is usually due to reduced blood flow in the brain's reticular activating system, which is involved with the loss of consciousness. Conditions associated with it among the elderly are carotid sinus syndrome. It has been postulated that

patient management will improve if syncope is considered as an unexplained cause of falls (McCarthy et al., 2020).

As indicated by the frailty for the non-disabled index and increasing difficulty in carrying out usual activities and use of assistive walking devices, frailty was positively associated with the falls. Frailty is a well-known cause of falls and the frailer an older person is, the more likely they are to fall. With frailty comes a loss of balance, incoordination, muscle and body weakness, which are likely to contribute to falls (Cheng & Chang, 2017).

According to this study, low back pain significantly led to falls. This finding was consistent with other studies that found similar associations between falls and lower back pains. Low back pain limits physical activity, which predisposes elderly persons to falls (Rosa et al., 2016).

The finding that the current use of medications were not significantly associated with falls in this study in the multivariate model yet they were associated in the bivariate model. An increasing number of medications, such as four or more, subsequently increases the likelihood of falling. Medications cause falls through sedation/ drowsiness, impaired postural stability, postural hypotension, drug-induced parkinsonism, visual interference, hypoglycemia, vestibular damage, tinnitus and deafness, confusion, hypothermia, and dehydration (Díaz-Gutiérrez et al., 2017; Tinetti et al., 2014).

## **5.6 Limitations**

Despite attempts to collect information that represented the actual health status of the elderly persons, some limitations could have interfered with the internal validity of the results, including challenges with memory. Indeed, 43.8% of the participants had memory loss. Hence, the cross-section design of the study where we measured exposure and outcome variables simultaneously could result in some level of bias, possibly understating the frequency of fall episodes. However, a study in Brazil tested the agreement between the self-reported method after 12 months versus the

prospective method and found that the global agreement was 79% for falls and 89% for recurrent falls (Garcia et al., 2015). These sources show that the self-report method at 12 months can provide reasonably reliable information to derive reliable estimates. However, caution is required when using such methods to investigate the epidemiology of falls.

Secondly, establishing the actual illness status in some conditions was difficult due to a lack of consistent medical records and medications. However, several methods were employed to address this.

1. The participants had to provide medications they were currently on and hospital records for the past year, such as prescriptions and visit cards at the time of the interview.
2. Collaborative information was sourced from close family members and close contacts to ascertain treatment for illnesses described by the elderly persons.

Almost all (over 95%) of our study participants had either of these information sources; nevertheless, there was still a chance of misclassification bias.

Establishing the actual mental status among the elderly may have lacked precision because of a lack of a validated tool in a largely illiterate population. However, we enquired on orientation to time, place, and person among the sampled study participants, any essentially abnormal behaviors noted recently, the ability to maintain a 'normal' interaction and conversation with close contacts and the interviewer, and the ability to undertake daily activities such as self-feeding, self-grooming, self-bathroom use; in addition, we also used the collective lifestyle history and the past medical history of the study participants, provided by their caregivers and close contacts.

The cross-section design of our study could not prove the temporal direction of association between some exposure variables and the outcomes; wounds and syncope would have occurred due to falls.

## **CHAPTER SIX**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **6.1 Conclusions**

Despite falls being a common occurrence among older persons and a pivotal contributor to morbidity and mortality, little has been studied on their occurrence and contributory factors in Kenya. The findings of this study raise a critical discussion on the need to address falls as a significant problem of the elderly. It found that the prevalence of falls among the older individuals in this region is high. The resulting burden of disease arising from the falls is also likely to be high.

Intrinsic and external factors are associated with falls among older people. Therefore, prevention measure ought to seek to identify these factors and place relevant interventions to mitigate falls occurrence. Personal factors such as sex, frailty, medical illness were associated with falls.

Majority of fall, were found to occur outdoors, were recurrent, occurred during daytime. These factors are necessary to identify the patterns of falls to apply interventions for mitigation.

#### **6.2 Recommendations**

Therefore, appreciating that falls are a significant problem of the older people in Gatanga Sub-County and possibly Kenya at large, the following recommendations are suggested.

There is an urgent need to develop a national falls prevention policy to promote awareness of falls and mobilize resources for falls prevention. Many developed countries have fall prevention policies in place, and it is time that Kenya adopted similar strategies to reduce the burden of disease from falls and their outcomes among older people.

Research on falls need to be prioritized and promoted to understand the environmental and individual factors that increase the likelihood of falling and identify appropriate evidence-based interventions to mitigate the situation.

There is an urgent need to develop public health intervention measures to identify those at risk of falling and provide culturally acceptable evidence-based solutions to fall prevention among older individuals.

Awareness building is critical to reducing the incidence and burden of disease on falls. There is a need to target health workers, the community, and older persons with relevant fall prevention messages and information on the need to seek early treatment when one sustains a fall.

Improved accessibility to healthcare among elderly persons is paramount. Older adults have a higher burden of diseases that are likely to make them prone to falling. Quality healthcare services should become more accessible to seek early professional interventions to prevent severe injuries and incapacitation.

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## APPENDICES

### Appendix I: Data Collection Tool

#### A. Structured Interview form

I) Questionnaire Number (*Namba ya fomu*)

\_\_\_\_\_

II) Participants initials (*Mariitwa ma Muihuria*)

\_\_\_\_\_

III) Phone (*Namba ya thimu*) \_\_\_\_\_

#### Part I: Biodata

IV) Year of birth (*mwaka wa guciarwo*) \_\_\_\_\_

V) Sex: M (*Mundurume*) / F (*Mutumia*)

VI) Residence Village (*itura*) \_\_\_\_\_

VII) Marital Status (*Uhikania*) (**Select one**)

0. Never married (*Nduri wa hika*)

1. Married (*Muhiku*)

2. Widowed / Divorced (*Muthuri /Mutumia gukua*)

VIII) Highest Level of education attained (*Githomo Kinene*) (**Select one**)

0. No school (*Nduri wathie shukuru*)

1. Primary not completed (*Kuthoma kia primary/mbere*)

2. Primary completed (*kurikia primary/kia mbere*)

3. Secondary completed (*Kurikia gia secondary/ gia keri*)

4. Tertiary (*Kuthoma gia college kana university*)

5. Technical course (*Kothi*)(specify)\_\_\_\_\_

#### Part II: Medical Status

IX) Have you sought medical care for any of the following conditions in the last 12 MONTHS? (*Niuri warigitwo niundu wa mirimu ino?*) (**Tick Yes or NO for all responses**)

0. Diabetes (*Murimu wa cukari*) Y = 1 / N =0  
Duration of illness (*kahinda ka murimu*) \_\_\_\_\_years / months
1. Hypertension (*thakame kuhaica*) Y = 1 / N =0 Duration \_\_\_\_\_ years / months
2. Heart Disease (*Murimu wa ngoro*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
3. Lung disease (*murimu wa mahuri*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
4. Kidney disease (*murimu wa higo*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
5. Arthritis/ Joint pains (*Ruo rwa marungo*) Y = 1 / N =0  
N =0  
i) Hip ii) Knees iii) Ankle iv) Foot  
pains (v) wrist (vi) fingers (vii) elbow  
(viii) shoulder  
ii) Duration \_\_\_\_\_ years / months
6. Lower Back pain (*Guturwo ni mugongo*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
7. Neck pains (*guturwo ni ngingo*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
8. Syncope (*kuringika*) Y = 1 / N =0
9. Dizziness (*kuigua thiorora*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
10. Anemia (*kwaga thakame*) Y = 1 / N =0

11. Headache (*guturwo ni mutwe*) Y = 1 / N =0
12. Altered Mental States /dementia (*kwirigwo*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
13. Acute stress / depressed mood (*gwiciria muno/kwaga gikeno*) Y =  
1 / N =0
14. Memory loss (*kuriganirwo muno*) Y = 1 / N =0
15. Stroke (*Murimu wa gwatuka mwiri*) Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
16. Fractures (*kuuneka mahindi*) Y = 1 / N =0
1. Type(*Mariku*)\_i) ankle ii) leg iii) femur iv)  
hip v) forearm vi) humerus  
vii) others \_\_\_\_\_
  2. When (*mwaka uriku*) \_\_\_\_\_
  3. Cause (*niki wekire*) \_\_\_\_\_
17. Visual impairment- reduced vision (*kwaga kuona wega*) Y = 1 /  
N =0  
Duration \_\_\_\_\_ years / months
18. Glasses (*niuhuthagira miwani*) Y = 1 / N =0
19. Blindness (*kuura maitho*) Y = 1 / N =0
- i) One eye ii) both eyes
- Duration \_\_\_\_\_ years / months
20. Hearing impairment (*murimu wa kwaga kuigwa*) Y = 1 / N =0
- i) Partial ii) complete
- Duration \_\_\_\_\_ years / months
21. Peripheral Neuropathy (*kuganda /guturwo ni maguru kana moko*)  
Y = 1 / N =0  
Duration \_\_\_\_\_ years / months
22. Jiggers (*Ndutu*) Y = 1 / N =0

23. Bruises and cuts (*kuumira / gutihio*) Y = 1 / N =0  
 Triggering event/ cause \_\_\_\_\_  
 \_\_\_\_\_
24. Wounds / pressure sores (*ironda*) Y = 1 / N =0  
 Location - specific \_\_\_\_\_  
 Duration \_\_\_\_\_ years / months
25. Cancer (*kanja*) Y = 1 / N =0  
 Location \_\_\_\_\_  
 Duration \_\_\_\_\_ years / months
26. Unsteadyness, problems with walking or balance Y = 1 / N =0
27. Difficulty in carrying our usual activities? Y = 1 / N =0
28. Acute illness (*kurwara muno*) Y = 1 / N =0 Specify the nature of  
 illness \_\_\_\_\_
29. Hospital admission (*gukoma thibitari*) Y = 1 / N =0  
 Duration (months) \_\_\_\_\_  
 Treatment type i) Medications (*dawa*)  
 ii) Major surgery  
 \_\_\_\_\_  
 iii) Minor surgery/ invasive diagnostic  
 procedures  
 \_\_\_\_\_
30. Others (*Thina ungi wa mwiri*) Y = 1 / N =0

X) Are you currently on any medication / drugs? (*He na dawa uranyua?*) Y =  
 1 / N = 0

XI) If YES(Y) in X above, for what illness (es) \_\_\_\_\_?

Illness	Number of meds	List of medications

XII) Do you consume Alcohol Y = 1 / N = 0 (*Ni-unyuaga njohi?*)

XIII) If Yes(Y) in part (XII). What kind of alcohol drinker are you?

1. Alcohol type (*Njohi iriku*) \_\_\_\_\_
  2. How many days per month (*Okorwo ni unyuaga-ri, mithenya igana kwa mweri?*) \_\_\_\_\_
  3. How many bottles/glasses per sitting (*shufa/ gilathi/ikobe cigana rita?*) \_\_\_\_\_
  4. How many years (*Miaka igana?*) \_\_\_\_\_
- Other information on alcohol use \_\_\_\_\_

XIV) Smoking cigarettes (*Ni – uhuthagira thigara?*) Y = 1 / N = 0

XV) If yes in (XIV). What kind of smoker are you?

1. How many sticks per day? (*Ciigana muthenya?*) \_\_\_\_\_
2. For how long in years (*kahinda kaigana atia?*) \_\_\_\_\_
3. Other information on cigarettes use \_\_\_\_\_

XVI) Do you use assistive walking devices? (*niuhuthagira indo ciaguthii*) (**Select one**)

0. None (*ndihuthagira*)
1. Walking stick (*mutirima*)
2. Walking frame (*ringa ya guthii*)
3. Clutches (*miti ya guthii/macerega*)
4. Wheel Chair (*Giti gia guthii*)
5. Other \_\_\_\_\_



Duration (years/months) \_\_\_\_\_

**Part III: Socio--cultural-economic factors**

XVII) What is the type of floor of the house you live in? (*Thi ya nyumba iria wiikaraga ithondeketwo naki?*) (**Select one**)

- 0. Earth (*Tiri*)
- 1. Cement (*Guthimindwo*)
- 2. Tiles (*Maturufari*)
- 3. Other \_\_\_\_\_

XVIII) What is the main source of lighting in the house at night? (*Niki uhuthagira utherini wa nyumba utuku?*) (**Select one**)

- 0. Kerosene Lamp (*tawa wa maguta*)
- 1. Candle (*mushumaa*)
- 2. Electricity (*thitima*)
- 3. Other \_\_\_\_\_

XIX) Whom do you live with mainly? (*muikaraga nau mucii kaingi?*) (**Select one**)

- 0. Close family member (*mundu wa mucii*)
  - i) wife/ husband
  - ii) Child
  - iii) brother / sister
  - iv) \_\_\_\_\_
- Other \_\_\_\_\_

- 1. Employed person (*mundu wa kwandikwo*) 
  - i) Daytime persons
  - ii) Day & Night person
- 2. Alone (*winyika*)

3. Other \_\_\_\_\_

XX) Presence of domestic animals (*Niukoragwo na mahiu muciiini?*) (**Select as appropriate**)

- 0. None
- 1. Goats( *mburi*)
- 2. Sheep (*ngondu*)
- 3. Cows (*ngombe*)
- 4. Chicken (*nguku*)
- 5. Others \_\_\_\_\_

XXI) What activities do you engage in on day to day basis? (*nikii wikaga*) (

- 0. No Activity (*guikara*)
- 1. Crop farming (*urimi*)
- 2. Animal husbandry (*urimi wa mahiu*)
- 3. Business (*biashara*)
- 4. House Chores e.g. washing, cooking (*wira wa kiimucie*)
- 5. Others(specify)\_\_\_\_\_ (*mangi*)

XXII) Do you consume at least 3 meals daily (breakfast, lunch, dinner) (*Niuriaga maita matatu o-muthenya? –kiroko, muthenya, na hua-ini?*)(**Select only one**)

- 0. Never (*aca*)
- 1. Some of the weekdays (*rimwe na rimwe*)
- 2. Most of the weekdays (*kaingi*)
- 3. All of the weekdays (*ni ndiaga o-muthenya maita matatu*)

XXIII) If Option 0 and 1 are given, what are the reasons? (*Niki gitumi gia kwaga kuria wega?*) (**Select One**)

0. Cannot cook (*ndingihota/ndioe kuruga*)
1. Lack of food to cook. (*niundu wa kuaga irio*)
2. Have food but lack someone to cook (*ningoragwo na irio no ndionaga mundu wa ku dugira*)
3. Lack of appetite due to illness or otherwise (*kuremwo ni kuria*)
4. Other \_\_\_\_\_

XXIV) In case, you get sick, how do you normally pay your treatment and hospital bills? (*Riria wa rwara ri, urihaga marihi ma thibitari atia?*)

0. Own Cash (*Kwiyethera besha*)
1. Health insurance eg. NHIF or other \_\_\_\_\_  
(*Mufango wa thirikari wa NHIF kana ungi*)
2. Relatives contribution (*Andu aitu makadeithya*)
3. Other \_\_\_\_\_

#### ***Part IV: Fall History***

XXV) Have you ever fallen since you attained 65 years *old*? (*Kuma utwike mundu mukuru-ri niuri wagua?*) Y = 1 / N = 0

If Yes, How many times? \_\_\_\_\_ When? \_\_\_\_\_

XXVI) Have you fallen in the last 12 MONTHS? (*niuri wagwa mwaka ucio urathirire*) Y = 1 / N = 0

(If NO, proceed to the MNA-SF & Modified Barthel Index Forms)

XXVII) How many times did you fall in the last 12 MONTHS? (*Waguire maita maigana mwaka ucio urathirire*) (***Select One***)

0. Once(*rimwe*)
1. Twice (*maita meri*)

2. Thrice (*maita matatu*)
3. Four (*maita mana*)
4. More than four (*makiria ya maita mana*)

XXVIII) Where did you fall in the last episode? (*waguire ku?*) (**Select one**)

0. Inside House (*thiini wa nyumba*) Y =1 / N = 0
1. Within Compound but outside house (*ja wa nyumba*) Y =1 / N = 0
2. In the garden(*muguda-ini*) Y =1 / N = 0
3. Road (*farafaraini*) Y =1 / N = 0
4. Other (specify) \_\_\_\_\_

XXIX) Terrain of fall (*haria waguire-ri haina-mite atia?*) (**select one**)

- 0 Flat ( *hati-ari na kamwabato*)
- 1 Mildly steep (*kamwabato kanini*)
- 2 Very Steep (*kamwabato kanene*)

XXX) What were the outcomes of the fall? (*wagwa-ri wumirire/ kuguthwo ku?*)

**(Select as appropriate)**

0. Injury (*Niwoomirire?*) Y =1 / N = 0
1. Do you know why you fell (*Niue gitumi gia kugua?*) Y =1 / N = 0
2. Blackout on falling (*kuringika wagua?*) Y =1 / N = 0
3. Head Injury (*mutwe*) Y =1 / N = 0
4. Fracture(specify)(*kuunika mahindi mariku*) Y=1 / N=0
  - i) Femur / thigh bone      RIGHT / LEFT
  - ii) Tibia / leg bone      RIGHT / LEFT

iii) Radius-ulna / forearm                      RIGHT                      /

LEFT

iv) Humerus                      RIGHT / LEFT

v) Hip injury                      RIGHT / LEFT

vi) Others \_\_\_\_\_

5. Skin bruises and lacerations (*iroda- ku?*) Y=1 / N=0

\_\_\_\_\_

6. Hospitalization (*guthii / gukoma thibitari*) Y = 1 / N = 0

Duration (Months)

\_\_\_\_\_

Treatment type. (i) Operation (*guthijwo*)

\_\_\_\_\_

(ii) Medications (*dawa*)

7. Fear of falling (*niwitigiraga kugua ringi*) Y = 1 /

N = 0

8. Immobilization (*niwaremerwo ni guthiaga*) Y = 1 / N = 0

9. Abandonment of daily activities (*niwaremerwo ni kurutaga wira*) Y = 1 / N = 0

10. Loss of autonomy (*niwaremirwo ni gwiteithagia*) Y = 1 /

N = 0

11. Confusion (*kuhingicika meeciria*) Y = 1 / N = 0

12. Others (*kuumira /kugi-ika kungi*)specify/*atia*) \_\_\_\_\_

\_\_\_\_\_

XXXI) Were you accompanied by someone during fall? (*ukigwa-ri nimwari na mundu*)

Y = 1 / N = 0

XXXII) What time did you fall in your last fall episode? (*ukigwa-ri kwari tha cigana?*) (select one)

0. Morning(*rucini*) (5am-12noon)
1. Afternoon (*matha ma huaini*) (12noon-6 pm)
2. Early Evening (*gugituka*) (6pm – 10 pm)
3. Late Evening (*utuku*) (10pm – 5am)

XXXIII) What were the circumstances of fall/ why did you fall? (Immediate Pre and post-fall Events or activities involved in while falling. Fall triggering event, under influence of alcohol?) (*ukugwa-ri nikiwekaga,*) \_\_\_\_\_

**B. FRAILTY INDEX FORM**  
**THE FRAIL NON-DISABLED (FIND) QUESTIONNAIRE\_KIKUYU**  
**TRANSLATION**

Domain	Questions	Answer	Score
Disability	A. Have you any difficulties at walking 400 meters? ( <i>Niugiakaga guthii kuma haha nginya _____</i> )	a. No or some difficulties( <i>ndiri na thina / o hanini</i> )	0
		b. A lot of difficulties or unable ( <i>Ngiakaga muno / ndingihota</i> )	1
	B. Have you had any difficulties at climbing up a flight of stairs? ( <i>Niukoraguo na thina kwa bata ngathi</i> )	a. No or some difficulties ( <i>aca / o hanini</i> )	0
		b. A lot of difficulties or unable( <i>Ngi e kaga muno / ndingi-hota</i> )	1
Frailty	C. During the last year, have you involuntarily lost more than 4.5 kg? ( <i>Mwaka ucio urathirire niutete makiria ya kilo inya na nuthu</i> )	a. No ( <i>aca</i> )	0
		b. Yes ( <i>ii</i> )	1
	D. How often in the last week did you feel that everything you did was an effort or that you could not get going? ( <i>Wiki iyo irathirire, ni uragikaga gwika undu o wothe?</i> )	a. Rarely or sometimes (2 times or less/week) ( <i>hanini kana rimwe na rimwe</i> )	0
		b. Often or almost always (3 or more times per week) ( <i>kaingi / mahinda moothe</i> )	1
	E. Which is your level of physical activity? ( <i>Niuhotaga kuruta wira</i> )	a. Regular physical activity (at least 2-4 hours per week) ( <i>Ni ndutaga wira</i> )	0
		b. None or mainly sedentary ( <i>aca / ndindaga njikarite thi</i> )	1

If A+B ≥1, the individual is considered as "disabled".

If A+B=0 and C+D+E ≥1, the individual is considered as "frail".

If A+B+C+D+E=0, the individual is considered as "robust".

## C. MODIFIED BARTHEL INDEX

### MODIFIED BARTHEL INDEX with Kikuyu translation

#### **Barthel Index of Activities of Daily Living / *Githimi kia muikarire wa mudu mukuru***

**Instructions:** Choose the scoring point for the statement that most closely corresponds to the patient's current level of ability for each of the following 10 items. Record the actual, not potential, functioning. Information can be obtained from the patient's self-report, from a separate party who is familiar with the patient's abilities (such as a relative), or from observation. Refer to the Guidelines section on the following page for detailed information on scoring and interpretation.

#### **The Barthel Index**

##### Bowels / *Guthii Kioro kinene*

0 = incontinent (or needs to be given enemata) / *kuremwo guthii kioro kinene wega mahinda moothe kana huthagira dawa niguo kioro kiume*

1 = occasional accident (once/week) / *kuremwo guthii kioro wega rimwe na rimwe*

2 = continent / *nithiaga kioro wega*

Patient's Score: \_\_\_\_\_

##### Bladder / *Guthuguma*

0 = incontinent, or catheterized and unable to manage / *gwithugumira/ kuhuthira mufira*

1 = occasional accident (max. once per 24 hours) / *gwithugumira rimwe na rimwe (rita rimwe o muthenya)*

2 = continent (for over 7 days) / *nithugumaga wega*

Patient's Score: \_\_\_\_\_

##### Grooming / *Gwitungatira utheru*

0 = needs help with personal care / *nomohaka ndeithyo gwithamba na gwikira nguo*

1 = independent face/hair/teeth/shaving (implements provided) / *ninii ndi thambagia*

Patient's Score: \_\_\_\_\_

Toilet use / *Kuhuthira kioro*

0 = dependent / *nomuhaka ndwarwo kioro*

1 = needs some help, but can do something alone / *maundu mangi nideithagio no mangi nidiikagira*

2 = independent (on and off, dressing, wiping) / *ninii nditwaraga kioro*

Patient's Score: \_\_\_\_\_

Feeding

0 = unable / *ndi-ikagirira irio na ndiriaga ndi nyika*

1 = needs help cutting, spreading butter, etc. / *nomuhaka ndeithyo kwi-ikirira irio*

2 = independent (food provided within reach) / *ninii ndi-ikagirira irio na ndiriithagia*

Patient's Score: \_\_\_\_\_

Transfer (Bed to chair and back)

0 = unable – no sitting balance / *ndinginyitirira ngiikara thi*

1 = major help (one or two people, physical), can sit / *nomuhaka ndeithyo kwi-ikaria thi*

2 = minor help (verbal or physical) / *nyitagirirwo o hanini ngiikara thi*

3 = independent/ *nini ndiikaragia thi*

Patient's Score: \_\_\_\_\_

Mobility

0 = immobile / *ndingithii*

1 = wheelchair independent, including corners, etc. / *huthagira giti gia guthii*



2 = walks with help of one person (verbal or physical) / *nomuhaka nyitirirwo ni mundu*

3 = independent (but may use any aid, e.g., stick) / *ninii nditwaraga*

*Patient's Score:* \_\_\_\_\_

### Dressing

0 = dependent / *nomuhaka njikirwo nguo*

1 = needs help, but can do about half unaided / *nomuhaka ndeithyo maundu mangi ma gwikira nguo*

2 = independent (including buttons, zips, laces, etc.) / *ninii ndiikagira nguo na ngehinga ifungo*

*Patient's Score:* \_\_\_\_\_

### Stairs

0 = unable / *ndingiabata ngathi*

1 = needs help (verbal, physical, carrying aid) / *nomuhaka ndeithyo kwabata ngathi*

2 = independent up and down / *nindiyabatagia na kwi ikorokia ngathiini*

*Patient's Score:* \_\_\_\_\_

### Bathing

0 = dependent / *nomuhaka thambio mwiri*

1 = independent (or in shower) / *ninii ndi thambagia*

*Patient's Score:* \_\_\_\_\_

(Collin C et al, 1988 and Mahoney FI, Barthel D, 1965)

## D. Mini Nutritional Assessment – short form with Kikuyu Translation

### Mini Nutritional Assessment – Kikuyu Translation

MNA<sup>®</sup>

Nestlé  
Nutrition Institute

Weight, kg:	Height, cm:
Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.	
<b>Screening</b>	
<b>A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties? / Murire wa irio ni unyihite mieri itatu mithiru niudu wa kwaga kuigua kuria, thina wa guthia irio, kuremwo ni gutanuka kana kumeri?</b> 0 = severe decrease in food intake / kuremwo ni kuria fiu 1 = moderate decrease in food intake / kuremwo ni kuria hanini 2 = no decrease in food intake / ndiaga wega	
<b>B Weight loss during the last 3 months / Uritu wa mwiri mieri itatu mithiru</b> 0 = weight loss greater than 3 kg (6.6 lbs) / gute uritu makiria ma kilo ithatu 1 = does not know / Ndioe 2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs) / gute uritu o hanini_ kilo imwe ginya ithatu 3 = no weight loss / ndire ndate kilo	
<b>C Mobility / Mithiire</b> 0 = bed or chair bound / njikaraga uriri-ini kana gitiini tu 1 = able to get out of bed / chair but does not go out / No nyume uriri-ini / gitiini no ndingitwaara nja 2 = goes out / ni thiaga nja	
<b>D Has suffered psychological stress or acute disease in the past 3 months? / niukoretwo na thina wa meciiria / gwiciria muno kana kurwara muno mieri itatu mithiru</b> 0 = yes                      2 = no	
<b>E Neuropsychological problems/ thina wa hakiri</b> 0 = severe dementia or depression / gute/ kuhingicika meciiria/ hakiri fiu / kwirigirirwo fiu 1 = mild dementia / kwirigirirwo hanini 2 = no psychological problems / hatiri thina wa hakiri	
<b>F1 Body Mass Index (BMI) (weight in kg) / (height in m)<sup>2</sup> / Uritu wa mwiri</b> 0 = BMI less than 19 1 = BMI 19 to less than 21 2 = BMI 21 to less than 23 3 = BMI 23 or greater	
IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2. DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.	
<b>F2 Calf circumference (CC) in cm / Utungu wa kuguru</b> 0 = CC less than 31 3 = CC 31 or greater	
<input type="checkbox"/>	
<b>Screening score</b> (max. 14 points)	
<input type="checkbox"/> <input type="checkbox"/>	
<b>12-14 points:</b>	Normal nutritional status
<b>8-11 points:</b>	At risk of malnutrition
<b>0-7 points:</b>	Malnourished

- Ref. Vellas B, Villars H, Abellan G, et al. Overview of the MNA<sup>®</sup> - Its History and Challenges. J Nutr Health Aging 2006;10:456-465.  
 Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). J. Geront 2001;56A: M366-377.  
 Guigoz Y. The Mini-Nutritional Assessment (MNA<sup>®</sup>) Review of the Literature - What does it tell us? J Nutr Health Aging 2006; 10:466-487.  
 Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment Short-Form (MNA<sup>®</sup>-SF): A practical tool for identification of nutritional status. J Nutr Health Aging 2009; 13:782-788.  
 © Société des Produits Nestlé, S.A., Vevey, Switzerland, Trademark Owners  
 © Nestlé, 1994, Revision 2009. N67200 12/99 10M  
 For more information: [www.mna-elderly.com](http://www.mna-elderly.com)

## **Appendix II: Informed Consent form**

**Title of the Research Study: Factors Associated with falls among elderly persons living in Gatanga Constituency**

**Principal Investigator:** Kimani Ernest Ng'ang'a, Jomo Kenyatta University of Agriculture and Technology

**Study location:** Gatanga Subcounty, Muranga County

**Purpose of the Research:** To assess the proportion (prevalence) of falls among elderly persons and factors and outcomes associated with the falls.

### **Description of the Research:**

a. *Brief description of the proposed research as it will be experienced by the research participants. Interventions or procedures that are part of standard care and those that are research must be distinguished.*

The research will involve asking and answering questions whose answers will be recorded in an interview form regarding falls, medical factors, nutritional factors, livelihood status and social factors that are related to falls. It will also involve taking measurements of weight, height, calf circumference and Blood Pressure reading.

b. *Specific testing (e.g. HIV testing, HLA typing) will be done as part of the research, this must be explained.*

No specific testing will take place during this study.

c. *Interference with ongoing therapies/treatments amongst study participants*

This study will not interfere whatsoever with ongoing treatments or therapies that you may be taking or intends to take.

d. *Need for randomization or sequential assignment is planned.*

As a participant, you have been selected randomly from an official list of elderly persons in this area. The study requires no further randomization or sequential assignment.

e. *Use of blood samples in this study, and other specimens (e.g. urine, stool, saliva etc)*

No blood or biological specimens such as blood, urine or stool will be collected from you as a participant.

f. *The frequency and duration of specific testing, as well as the duration of the entire study*

The study is expected to take an overall of 30 minutes, to respond to the interview questions and measurements of height and weight. The measurements of height and weight will only be taken once. As explained before, no specific testing will be required in this study.

g. *Information dissemination to study participants on changes in the study or addition of new information*

In case of any changes made to the study and any upcoming new information, you will be informed appropriately. However, this is unlikely as the duration of the study on onetime 30 minutes.

h. *Future use of the research data beyond the current study and whether or not data will be destroyed.*

Data from this research may be used in future and therefore it will be computerized and kept safely and in a confidential manner for use should it be required in future.

i. *Location of tests*

No special tests are required in this study. All the required information will be collected at the site of the study which is expected to be your home.

*j. Administration of questionnaire or interview to be conducted, a description of the questionnaire/interview, the length of time taken to complete the interview and on whether the participants may opt out from some questions or entire interview.*

This study involves an interview conducted by a person either known or not known to you; the interview takes 30 minutes to complete. You have the right to choose not to respond to any questions or withdraw at any time of the study although once you agree to start you are recommended to answer all questions and participate in all procedures. The interview forms are in 3 parts, the main interview form, an assessment of Activities of Daily Living form and a Mini Nutritional Assessment Short form (MNA\_SF).

*k. data abstraction from medical records or from other confidential sources,*

You may be required to produce existing data regarding medical care you have been undergoing including discharge summaries, treatment prescription, or medications or other documents necessary to ascertain their claims where verbal information is not clear. You may be requested to produce evidence of treatments such as hospital visit card or medications they have been taking.

*l. Use of videotaping, taking photographs or audio recordings during the study.*

No videotaping, taking photographs or audio recordings are required in this study.

*m. Development of products of commercial importance from blood samples, DNA, RNA extracted and the plans for benefit sharing.*

No products of commercial importance will be developed from this study.

**Potential Harm, Injuries, Discomforts or Inconvenience, Risks:**

*a. Unknown or known harm/risk to the study participants.*

There is no known harm / risk to you by participating in this study.

*b. known or anticipated risk to the study participants*

There are no known or known harm/risk to the study participants that this study will subject them to.

**Potential Benefits:**

*a. Benefits, direct or indirect to the study participants on participation in the study*

There will be no direct benefits that will arise as a result of participating in the study. The community/elderly persons may generally benefit indirectly through policy interventions that may be put in place following findings from this study.

*b. Benefits that may arise to the community or patients with a similar condition from the results of the study.*

There are no direct benefits that will arise as a result of participating in this study. However, results from the study will be shared with local authorities who may decide to implement programs beneficial to the communities.

**Alternative Procedures or Treatments:**

No alternative procedures or treatments will be administered in this study.

**Confidentiality:**

*a. No information that reveals the identity of any study participant should be released or published without consent.*

No information that reveals your identity will be released or published in this study.

*b. Access by a sponsor, ERC or other health regulatory authorities for the purpose of monitoring the study.*

Materials use in this study will be made available to health regulatory bodies should they be required.

- c. *The plan for maintaining confidentiality of research records.*

Confidentiality of records will be maintained in this study. This will involve but not limited to, handling of information by authorized personnel only and storage of information using passwords/encryption for softcopies and locking in a safe for hard copies.

**Reimbursement:**

No reimbursements will be made in this study. You will be required to participate voluntarily.

**Participation:**

a. Once you enroll into this study, you are encouraged to respond to all questions and participate in all procedures. However, should you feel unable to proceed with the interview, you are allowed to withdrawal at any stage of the interview.

b. You will be given a copy of the signed and dated consent form to keep.

c. In case you are found to be severely ill during the study, you will be referred to the nearby hospital. In this case, you are expected to be responsible for the costs of treatment which will be incurred during the referral and treatment process.

**Sponsorship:**

In situations where a study may be terminated at the discretion of the investigator or the study sponsor even if the study participants are benefiting, there should be provision for discussing the next course of action with the study participants and/or procedures for orderly termination.

**Contact:**

a. For any questions or concerns about the study or in the event of a study-related injury, the contact person is the principal investigator: Kimani Ernest N, 0721387448 and / or the principal investigator’s representative who shall provide his/her 24-hour contact telephone number. The physical address will also be provided.

b. For any questions pertaining to rights as a research participant, the contact person is: The Secretary, KEMRI Ethics Review Committee, P. O. Box 54840-00200, Nairobi; Telephone numbers: 020-2722541, 0722205901, 0733400003; Email address: erc-secretariat@kemri.org

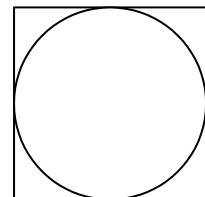
All data collected from you will be coded in order to protect your identity. Only the research study staff will have access to the information. At the end of the study, there will be no way to link your name with your data. Any additional information about the study will be provided to you including the final study results.

You are free to withdraw or refuse to answer any questions at any time without any consequences. Should you agree to participate in the study, please sign your name below, indicating that you have read and understood the nature of the study, your responsibilities as a study participant, the inconveniences associated with voluntary participation in the study and that all your questions and concerns concerning the study have been answered satisfactorily.

You will receive a copy of this signed consent form to take away with you.

Signature of Study Participant and Date

\_\_\_\_\_  
\_\_\_\_\_



\_\_\_\_\_  
Thumbprint of Study  
Participant and Date

Signature of Person Obtaining Consent and Date



## **Informed Consent with Kikuyu Translation**

**Ritwa Ria Mutaratara Uyu:** *Maundu maria matumaga andu akuru a Gatanga magwe*

**Mutwiria Munene:** Kimani Ernest Ng'ang'a, Jomo Kenyatta University of Agriculture and Technology

**Kuria mutaratara urekika:** Gatanga Subcounty, Muranga County

**Gitumi kia mutaratara uyu:** *Kurora ni andu aigana akuru Maguire mwaka ucio wa hitukire (kana maguaga o mwaka) na itumi cia kugwa kwao na thina uria magiire marikia kugua*

- a) **Mutaratara uria uhuana:** *(Brief description of the proposed research as it will be experienced by the research participants. Interventions or procedures that are part of standard care and those that are research must be distinguished.)*

Kuringana na mutaratara uyu-ri, ni ukurio ciuria iria ugucokia na macokia macio mekwadikwo fomu-ini yaku ya mutaratara uyu. Ciuria icio ni cia mirimu iria ungikorwo nayo, mirire yaku, muikarire waku na kana niuri wagua. Ni uguthimwo uraihu, uritu waku, utungu wa kuguru gwaku na kuhura kwa goro.

- b) **Ithimi cia thakame kana indo cia mwiri waku.** *(Specific testing (e.g. HIV testing, HLA typing) will be done as part of the research, this must be explained.)*

Gutiri thakame kana o kindu giothe kingionania murimu gikurutwo thi-ini wa mwiri waku kana ukwirwo uheane niguo githii gigathimwo.

- c) **Kuingirana / guthinia dawa iria ungikorwo ukinyua kana guthodekwo kimwiri** (*Interference with ongoing therapies/treatments amongst study participants*)

Mutaratara uyu ndu-kuingirana kana guthinia mirimu o yothe ungikorwo ugithodekwo kana dawa ungikorwo ukinyua kana ugifanga kunyua.

- d) **Kufangwo mutarataraini uyu** (*Need for randomization or sequential assignment is planned.*)

Ucaguritwo hatari umenyo o - wothe niguu oriu ciuria. Maritwa ma andu o the akuru a guku maria mena thirikari nimo mahuthirirwo gucagura andu aria me korigu ciuria. Hatiri mundu o-wothe woikaine niguu macaguruo.

- e) **Thakame kana indo cia mwiri waku kuhuthirwo** (*Use of blood samples in this study, and other specimens (e.g. urine, stool, saliva etc)*)

*Gutire thakame kana mathugumo kana o kindu giothe kiumaga mwiri waku gikurutwo niguu githimwo.*

- f) **Kahinda ka mutaratara uyu** (*The frequency and duration of specific testing, as well as the duration of the entire study*)

Mutaratara uyu ukuoya kahinda ka nuthu ithaa haria ugucokia ciuria na uthimwo uraihu na uritu waku. Gutiri maundu mangi kana ithimi ingi cikwendekana

- g) **Gucenjio kana kuongererwo kwa uhoro wa mutaratara uyu** (*Information dissemination to study participants on changes in the study or addition of new information*)

Hangikorwo undu o wothe ukwendekana gucenjio ni ukwirwo. No tondu mutaratara uyu uroya kahinda kanini, hatiri undu o -wothe uroneka ta ungicenjio

- h) Mahuthiro ma uhoru uria ukuheana makiria ma mutaratara uyu.** *(Future use of the research data beyond the current study and whether or not data will be destroyed.)*

Uhoru ucio ukuheana ni ukuigwo wega na no -uhuthirwo matuku magooka, no hatiri maundu maku mekuheanwo kuri andu angi

- i) Kuria ithimi cigwikirwo** *(Location of tests)*

Hatiri ithimi cigekirwo kundu kungi tiga iria uguthimwo guku mucii.

- j) Kurio ciuria, ciuria iriku, na uraihu wa mutaratara uyu na kana no utige mutaratara uyu wi gatagati-ini wago.** *(Administration of questionnaire or interview to be conducted, a description of the questionnaire/interview, the length of time taken to complete the interview and on whether the participants may opt out from some questions or entire interview.)*

Mutaratara-ini uyu ni ukurio ciuria ni mundu ugikorwo uui kana utoi. Kahinda ni nuthu ithaa. No wage gucokia ciuria ciothe, na no utigane nago ona wi gatagate wago. No unghota kurikia cioria ciothe -ri nigo wega. Ukorio ciuria kuringana na mirimu, miikiarie, mirire, yaku.

- k) Uhoru kuma kwi rifoti cia thibitari** *(data abstraction from medical records or from other confidential sources)*

Nigo tutigirine uhoru uria uraheana ni wa ma -ri, no urio uneane rifoti ciaku cia thibitari, kana wonanie dawa iria uranyua, no gutiri kindu giaku gigukuo kuma kuriwe.

- l) Kuhuruo mbica kana miario kunyitwo** (*Use of videotaping, taking photographs or audio recordings during the study.*)

Gutiri mbica ukukurwo kana miario ikunyitwo thimu ini kana handu o hothe.

- m) Guthondekwo kwa indo cia ki biashara kuma indo iria ukuheana cia mwiri-ini waku.**  
(*Development of products of commercial importance from blood samples, DNA, RNA extracted and the plans for benefit sharing.*)

Gutiri indo ciothe cia ki biashara cigothodekwo kuma mutarataraini uyu. Na gutiri indo uraheana kuma mwiri ini waku.

- n) Ku-umira, na kuigua uru niundu wa mutaratara uyu. (Potential Harm, Injuries, Discomforts or Inconvenience, Risks)**

- a. Maundu moikaine kana matoikaine mangituma umire kana unyaririke mutarataraine uyu. (Unknown or known harm/risk to the study participants.)**

Gutiri maundu o mothe moikaine maingituma uumire nigukorwo ni waingira mutarataraine uyu

- b. Maundu maroneka ta mangituma unyaririke (known or anticipated risk to the study participants)**

Gutiri undu o wothe uroneka ungituma ukorwo ukinyaririka nigukoruo wi mutarataraine uyu

- o) Kugwatika / kurathimika/ Iheo (Potential Benefits)**

a. **Maundu ma kugwatika kana kurathimika niundu wa gukorwo wi mutarataraine uyu.** (*Benefits, direct or indirect to the study participants on participation in the study*)

Hatiri maundu kana indo ukuheo we mwene niundu wa gukorwo wi mutarataraini uyu. Andu akuru a guku no mateithike mathina mao ma menyeka wega kuma uhoro uria ukuheana. Thirikari no ithodeke mawatho mega ma kurora andu akuru na mathina mao ma kimwiri.

b. **Kugwatika kuma uhoro wa mutarataraine uyu** (*Benefits that may arise to the community or patients with a similar condition from the results of the study.*)

Gutiri ukuheo we mwene no uhoro uria ukuma mutarataraini uyu niugutuma andu akuru mateithike tondu maundu mao maria matumaga magwe ni mekumenyeka.

p) **Guthondekwo kungi kana dawa ingi.** (**Alternative Procedures or Treatments**☺ )

Gutiri guthondekwo kungi kana dawa ingi ukuheo niundu wa gukorwo wi mutarataraini uyu.

q) **U-thiri (Confidentiality)**

a. (*No information that reveals the identity of any study participant should be released or published without consent.*)

Gutiri uhoro waku kana uhoro ungituma umenyeke we mwene ukuheanwo kuma kwi mutarataraine uyu.

a) *Access by a sponsor, ERC or other health regulatory authorities for the purpose of monitoring the study.*

Maundu maria mothe mari mutarataraini uyu ni maroretwo ni anene niguo gutigirira hatiri undu o wothe wa kunyarira andu.

b) *The plan for maintaining confidentiality of research records.*

Uhoru wothe ni ukuigwo na uthiri. Na gutiri andu matari na rutha megwitikirio kuona uhoru uyu. Uhoru ucio ukuigwo wega uria andu angi matangihota kuwona.

### **Kurihwo (Reimbursement)**

Gutiri marihi o mothe maraheanwo nigukorwo wi mutaratara-ini uyu.

### **Kuingira mutaratara-ini uyu (Participation)**

a. Wetikira kuingira mutarataraini uyu, wagirirwo nigucokia ciuria ciothe. No ungi-igua ndurenda -ri, no otigane naguo na ndukurio ciuria o ciothe cia gitumi kiria wa rega.

b. Ni-ukuheo iratathi riri ria kuonania niwanyita mawatho ma mutaratara uyu wiige.

c. Ungikorwo wi murwaru muno-ri kahinda karia urorio ciuria cia mutaratara uyu-ri, ni - ugutumwo thibitari, no niwe ukwirihira.

### **Contact:**

a. Ungikorio wina ciuria o ciothe cia mutaratara uyu no urie kana uhure thimu namba iria iheanitwo ni mutwiria munene kana munini wake. *(For any questions or concerns about the study or in the event of a study-related injury, the contact person is the principal investigator):* Kimani Ernest N,

0721387448 and / or the principal investigator's representative who shall provide his/her 24-hour contact telephone number.

Name \_\_\_\_\_ Phone \_\_\_\_\_

b. Ungikoruo wina thina / kana kiuria kuringana na mawatho ma mutaratara uyu - ri, no urie namba ici iheanitwo. (*For any questions pertaining to rights as a research participant, the contact person is*): The Secretary, KEMRI Ethics Review Committee, P. O. Box 54840-00200, Nairobi; Telephone numbers: 020-2722541, 0722205901, 0733400003; Email address: erc-secretariat@kemri.org

Uhoru o wothu ukuheana kuringana na undu ungikumenyithia ni ugucenjio nigwo we mwene wa uhoru ucio ndukamenyeka. Muico wa mutaratara uyu-ri gutiri uria we ungimenyeka ati niwe waheaniere uhoru. Ni ukaheo kioneki kiria gikaumana na mutaratara uyu.

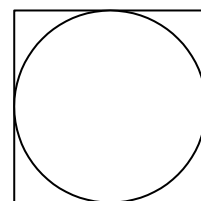
Niuhetwo rutha rwa gutigana na mutaratara uyu kana kurega gucokia ciuria ingi o tha ciothe hatari kuurio niki.

Okorwo niwetikira gukorwo mutaratara ini uyu-ri, wikire kirore haha thi, kuonania niwathoma rutha ruru na niwanyita uria mutaratara uyu uhana, maundu maria wagirirwo ni gwika, na niwetikira kuhingicika kwa maundu maku kuringana na kuingira mutaratara-ini uyu. Na ciuria ciothe cia mutaratara uyu iria ungikorwo nacio nicia cokio wega.

Ni ukuheo rutha ruru uthie naruo.

(Kirore) Signature of Study Participant and Date

\_\_\_\_\_ (Kiara)



Thumbprint of the study participant

Signature of Person Obtaining Consent and Date



## Appendix III: Ethical Approval letter



### KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840-00200, NAIROBI, Kenya  
Tel: (254) (020) 2722541, 2713349, 0722-205901, 0733-400003, Fax: (254) (020) 2720030  
E-mail: director@kemri.org, info@kemri.org, Website: www.kemri.org

KEMRI/RES/7/3/1

August 31, 2017

TO: ERNEST NG'AMBA KIMANI,  
PRINCIPAL INVESTIGATOR

THROUGH: THE DIRECTOR, CPHR,  
NAIROBI

Dear Sir,

RE: KEMRI/SERU/CPHR/09/0509 (RESUBMISSION OF INITIAL SUBMISSION):  
FACTORS ASSOCIATED WITH FALLS AMONG ELDERLY PERSONS LIVING IN  
GATANGA CONSTITUENCY, MURANG'A COUNTY.

*Forwarded with  
confidential  
protection 24/8/2017*

Reference is made to your letter dated August 15, 2017 submitted at the KEMRI Scientific and Ethics Review Unit (SERU) and acknowledges receipt of the revised study documents on the same day.

This is to inform you that the Committee noted that the issues raised at the 265<sup>th</sup> Committee A meeting of the KEMRI Scientific and Ethics Review Unit (SERU) held on 11 July, 2017 have been adequately addressed.

Consequently, the study is granted approval for implementation effective this day, August 21, 2017 for a period of one year. Please note that authorization to conduct this study will automatically expire on August 20, 2018. If you plan to continue data collection or analysis beyond this date, please submit an application for continuation approval to SERU by July 09, 2018.

You are required to submit any proposed changes to this study to SERU for review and the changes should not be initiated until written approval from SERU is received. Please note that any unanticipated problems resulting from the implementation of this study should be brought to the attention of SERU and you should advise SERU when the study is completed or discontinued.

You may embark on the study.

Yours faithfully,

DR. MERCY KARIME BHERO,  
ACTING HEAD,  
KEMRI/SCIENTIFIC AND ETHICS REVIEW UNIT

In Search of Better Health

**Appendix IV: Published Manuscript**

**International Journal of Sciences:**

**Basic and Applied Research**



**(IJSBAR)**



**ISSN 2307-4531**

**(Print & Online)**

<http://gssrr.org/index.php?journal=JournalOfBasicAndApplied>

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**Lifestyle Factors Influencing Falls among Older  
People in Central Kenya**

Ernest Kimani<sup>a\*</sup>, Simon Karanja<sup>b</sup>, Lawrence Muthami<sup>c</sup>

<sup>a,b</sup>*Department of Public and Community Health, College of Health Sciences, Jomo Kenyatta  
University of Agriculture and Technology, P.O. Box 60200, Nairobi, 01001, Kenya*

<sup>c</sup>*Center for Public Health Research, Kenya Medical Research Institute, P.O. Box 20778, Nairobi,  
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## **Abstract**

An estimated one-third of the older people worldwide sustain falls every year, which contributes to over 20% of injuries in this age group. In the central region of (Mount) Kenya, despite increasing awareness about this condition, the magnitude as well as the socio-demographic and lifestyle factors leading to falls in the older people are not well known. The main objective of this study was to investigate the prevalence of falls, their outcomes, and the factors influencing their occurrence among older persons aged 65 years and above living in Gatanga Sub-County, Murang'a County, central Kenya. An analytical cross-sectional study design was used. Using systematic random sampling, 403 out of 9247 study participants were identified and interviewed at home. Using a structured interview form, data was collected on socio-demographic, socio-economic, lifestyle, and medical factors, as well as on fall or non-fall status from September 2016 to August 2017. Proportions were used to evaluate the occurrence of falls, lifestyle factors and medical conditions. Pearson's Chi square and logistic regression were used to evaluate associations between lifestyle and medical exposures and falls outcomes. With 41%, the prevalence of falls amongst the older people in this region is high. The farming lifestyle involving animal husbandry and medical illnesses are significantly associated with falls. To reduce the occurrence of falls, we need to integrate relevant preventive measures that reduce the risk of falls in communities of the older people in Central Kenya.

**Keywords:** Africa; falls; fractures; injuries; Kenya; Older people

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## **1. Introduction**

A fall is a form of unintentional injury and one of the external causes of morbidity and mortality. In the International Classification of Disease-11 (ICD-11), unintentional falls on the same level or from less than height of one meter are coded as PA60 [1]. A fall is usually defined [2] as "inadvertently coming to rest on the ground, floor, or other lower level, excluding intentional change in position to rest on furniture, wall, or other objects." It is estimated that on a global level, approximately one third of older people aged 65 years and above fall each year. Studies across Europe [3], the Middle East [4], and Africa [5, 6] show fall rates ranging between 20 and 40%. In Kenya, falls are a significant cause of injuries among older people. A study [7] in the Kenyatta National Hospital, the largest referral hospital in Kenya, showed that falls were a leading cause of trauma and hospitalization among the older people aged over 60 years, with a frequency of 41.4%. Among the fall, 75% were due to falls on the same level. Falls were also cited [8] as a leading cause of domestic injuries among the older people aged over 55 years seen in health facilities in Nairobi area, Kenya, contributing to 69% of the injuries. A trauma-related mortality study in Western Kenya showed that falls were a leading cause of deaths, especially among females. Mostly affected (88%) were older people aged over 65 years, and sustained broken limbs, back, neck or pelvis, hence complications leading to death [9]. Other consequences of falls include admission into nursing homes, depression,

immobilization, loss of autonomy, abandonment of daily activities, isolation, head injuries, confusion and fear of falling [10, 11, 12]. The economic and social burdens arising from falls are also high [13, 14]. Falls occur due to complex interactions of biological, demographic, physical, and environmental factors. Old age, female gender [15], chronic medical conditions [16], unfavorable socio-economic factors such as limited access to health services, illiteracy, poor housing, and low income are associated with an increased risk of falls [17]. Environmental factors such as slippery floors, staircases, and reduced lighting are also associated with an increased risk of fall [18]. Identifying the modifiable risk factors and developing culturally appropriate and effective evidence-based fall prevention methods can significantly reduce morbidity and mortality from falls in the older people [2, 19, 20]. The availability of data on occurrence and risk factors of falls among community dwelling older people in the Sub-Saharan Africa is extremely limited as majority of reports are based on poorly compiled hospital records [21]. This has hindered proper understanding of the magnitude of falls and their specific causative factors in these communities which hinder prevention efforts. Gatanga Sub-County, Murang'a County, is located in the mountainous central region of Kenya (Mount Kenya region) and covers an area of 599 km<sup>2</sup> (square kilometers). The majority of the people living in this area are of Kikuyu ethnicity and engage in a farming lifestyle, involving crop farming and rearing of domestic animals [22]. Animal husbandry is hypothesized to lead to a higher incidence of falls in this area yet previous literature has not elucidated its influence on falls. This study had the following specific objectives: 1) To establish the prevalence of falls, their characteristics, associated complications, and circumstances of their occurrence among the older persons living in the Gatanga Sub-County of Central Kenya, 2) to assess the socio-demographic, lifestyle, socio-economic, and medical factors of the older people, and establish their association with falls.

## **1. Materials and Methods**

### **2.1 Study design**

A community-based cross-sectional study was conducted from September 4<sup>th</sup> to 15<sup>th</sup>, 2017, in Gatanga Sub-County, Murang'a County to investigate the prevalence of falls in the community dwelling older people and their associated risk factors and complications.

### **2.2 Sample size and sampling**

The following formula was used for sample size determination:

$$N = \frac{1.96^2 \times (P)(1-P)}{d^2} \quad (I)$$

where  $n$  is the sample size,  $Z$  (1.96) is the statistic corresponding to 95% level of confidence,  $P$  (50%) is expected prevalence, and  $d$  (0.05) is precision. A sample of 384 was arrived at and inflated to 422, assuming a non-response rate of 10%. From the existing records of households in the area, a total of 6,127 potential households were identified where older persons resided. The estimated number of older people in Gatanga Sub-County was 9,247 [24]. Using systematic random sampling, households where interviews would be conducted were selected. The first household to be interviewed was selected using simple random sampling from the 1<sup>st</sup> 15 households in the area. Interviewers were required to move in one direction, systematically starting from the main street of their study area. On encounter with a selected household, the interviewer, a local CHW, administered the inclusion and exclusion criteria. In case of more than one eligible member, a one-shilling coin was tossed with males as head and females as tail to select the member to be interviewed. If an eligible member was not present in a household during the initial visit, the interviewer was required to revisit the household at a later time or date to undertake the interview. If a household did not have an eligible member based on the inclusion and exclusion criteria, the next household with an eligible member on the sampling list was selected.

### **2.3 Inclusion and exclusion criteria**

Those included in the study were older people aged 65 years and above and those who were Residents of Gatanga Sub-County for the last year as these were the target population for the study. Excluded from the study were older people with physical disabilities limiting the use of both feet for walking and the use of arms for support, occurring before the preceding year and persons not able to give information due to severe mental incapacitation. Disability limited their ability to walk hence falling thus recruiting disabled individuals would result in bias while mental incapacitation would result in wrongful information. These characteristics were assessed prior to undertaking the main interview. An eligible participant was assessed on the correct orientation of time, place, and person and on the ability to undertake general activities of daily living such as self-feeding, self-bathroom care, self-grooming, and maintaining a „normal“ interaction and conversation with close contacts and interviewer. Collaborative information (where applicable) on mental history, specifically bizarre behavior, was briefly sought from persons who were closely associated with the study participant. In other cases, the Community Health Workers (CHW) used their knowledge of participants based on past interactions with the participants. The CHWs were trained volunteers from their respective communities where they participated in the delivery of primary health care services.

### **2.4 Variables**

The main outcome variable for this study was a reported fall in the preceding year, from September 2016 to August 2017. A fall was defined as any sudden unintentional coming to rest from a level ground with or without loss of consciousness, excluding falls from heights, falls involving bicycles, motorcycles, and vehicles, and falls due to direct aggressive push by farm animals such as cows,

donkeys, and goats. Study participants were asked whether they had sustained a fall in the preceding one year. Further information collected included the number of fall events sustained, time and place of last fall, whether accompanied by someone or not during the fall, and the immediate circumstances leading to the fall. Complications of falls included immobilization, fear of falling, abandonment of daily activities, loss of autonomy, hospitalization, and associated injuries such as skin bruises, fractures, head injury, and confusion. Exposure variables were collected on socio-demographic characteristics including age, gender, marital status, education level, and medical factors as these were hypothesized to contribute to falls. Majority of elderly persons were known to be on follow-up in the local hospitals on treatment for chronic illnesses and these illnesses were thought to contribute to falls in this community. Information on medical risk factors for falls collected included current use of medications, alcohol consumption, cigarette smoking, undergoing current treatment for certain illnesses such as diabetes, hypertension, heart disease, kidney disease, joints pains, lower back pains, recent or recurrent syncope, cancer, stroke, anemia, depressed mood and acute stress, headache, peripheral neuropathy, wounds and pressure sores, bruises and cuts, recent acute illnesses, and altered mental states were considered. Foot problems also investigated included foot pains and infestation with jiggers. The frailty of older people as a cause of falls was established using the Frailty for Non-Disabled index questionnaire [25] (Appendix 1(B)), unsteadiness in gait/problems with walking or balance, and difficulty in doing usual activities. Frailty is well known to contribute to falls. Malnutrition as a possible cause of falls among the older people was evaluated using a Mini Nutrition Assessment – Short Form (MNA-SF) (Appendix 1(C)), which is frequently used [26, 27]. Social-economic, lifestyle and environmental factors were investigated where variables included the type of floor of the residential house, source of lighting at night, living alone or with someone, involvement in daily activities, attending to domestic animals, and source of funds to cater for healthcare expenditure.

## **2.5 Data collection**

Seventeen Community Health Workers (CHW) were trained to administer the structured interview forms at the study participants home (Appendix 1). The CHWs were recruited from their area of jurisdiction since they were previously involved in delivering primary healthcare services to their community members and had a good understanding of their localities. The data sources included the study participants, their caretakers, and past health records.

## **2.6 Statistical methods and data analysis**

Statistical analysis was done using the statistical Software Package STATA 13.0 (StataCorp, College Station, Texas). Occurrence of socio-demographic, lifestyle and medical factors associated with falls were computed and reported as percent proportions of the collected data. For significance testing in bivariate analysis, Pearson's Chi ( $\chi^2$ ) Square Test was used for categorical variables, and  $p < 0.05$  was considered statistically significant [28]. Subsequently, those variables statistically significant (p-

value < 0.05) in the bivariate analysis were entered into a multivariate logistic regression model to evaluate the independent associations between falls and characteristics of the participants. The results of the regression model are presented as odds ratios (OR) with their 95% confidence intervals (95% CI) [29].

## 2.7 Ethical considerations

The research protocol (ref. KEMRI/SERU/CPHR/09/3509) was approved by the Scientific and Ethical Review Unit (SERU) of the Kenya Medical Research Institute on the 21<sup>th</sup> of August 2017 [30]. The written informed consent form is outlined in the Appendix 2.

## 3. Results

### 3.1 Participation

For this study, 422 participants were selected for interviewing; analysis was performed for 403 participants. Non response rate was 4.5% with 19 participants being excluded for failing to give informed consent (11 participants) and data collected that did not meet inclusion criteria (8 participants).

### 3.2 Socio- demographic and lifestyle characteristics of the older people with their corresponding bivariate associations with falls

The socio-demographic and lifestyle characteristics of the study participants were computed using proportions.

Using Pearson's Chi ( $\chi^2$ ) square, gender, mode of payment of hospital bills and rearing of sheep and goats were significantly associated with falls as shown in table 1.

**Table 1:** Socio-demographic, lifestyle and socio-economic characteristics of study participants and the bivariate associations with falls.

Socio-demographic Response risk factors		Count, n (Total N = 403)	Proportion (%)	<i>p value</i>
Age groups	65-74	209	51.2	0.490
	75-84	119	29.5	
	85-103	75	18.6	
Gender	Female	285	71.0	0.048
	Male	118	29.0	
Marital status	Married	242	60.2	0.086
	Divorced/widowed	139	34.6	
	Never married	21	5.2	
Education level	No school	204	50.6	0.213
	Primary school not completed	102	25.3	

	Primary school completed	69	17.1	
	Secondary Completed	28	7.0	
Payment of hospitalization bills	Own cash/health insurance	244	61.6	0.008
	Relatives/well-wishers contribution	152	38.4	
Sheep/goats rearing	Yes	27	6.7	0.012
	No	375	93.3	

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### 3.3 Medical factors of the older people and their bivariate associations with falls

Medical and physical factors which were significantly associated with the falls in the bivariate (with Pearson's Chi ( $\chi^2$ ) Square) analysis are listed in Table 2.

**Table 2:** Medical risk factors of the older people and their bivariate associations with falls.

Medical Risk factor	No. with a risk factor (Total N = 403)	Proportion (%) of with a risk factor	<i>p value</i>
Frailty for Non-disabled (FiNd) Index (disabled or frail)	266	66.3	0.000
Peripheral neuropathy	259	64.3	0.014
Arthritis/Joint pains	267	62.9	0.011
Knee arthritis	138	48.0	0.006
Hip arthritis	103	25.8	0.000
Ankle arthritis	102	25.5	0.003
Lower back pain	214	53.4	0.000
Current medication use	203	50.5	0.001
Difficulty in doing usual activities	203	50.4	0.009
Headache	187	46.6	0.001
Dizziness	177	44.0	0.000
Memory loss	177	44.0	0.007
Hypertension	173	42.9	0.007
Unsteadiness in gait/ problems with walking or balance	171	42.4	0.000
Assistive walking device use	124	30.7	0.001
Acute illness	126	31.4	0.000
Hospital admission	96	23.9	0.008
Bruises and cuts	68	16.9	0.035
Diabetes	42	10.4	0.001
Syncope	38	9.4	0.000
Blindness	32	8.0	0.013

### 3.4 Fall associations in the multivariate analysis

Factors which were significantly associated with the falls in the bivariate analysis ( $p$  value < 0.05) model as

listed in Table 2 (see above) were advanced in a multivariate analysis model (logistic regression) to evaluate independent associations for risk of fall and are listed in Table 3.



**Table 3:** Factors which were significantly associated with the falls in the multivariate analysis.

Positively associated factors	Odds Ratios (95% CI)
Rearing sheep	117.9 (19.0 - 710.0)
Blindness	31 (7.9 – 129.9)
Diabetes	9.3 (2.7 – 31.8)
Syncope	8.6 (2.5 – 29.9)
Frailty Index for Disabled questionnaire (being frail or disabled)	8.1 (5.7 – 11.5)
Bruises and cuts	7.9 (3.3 – 18.3)
Female gender	6.6 (3.3 – 13.1)
Difficulty in carrying out usual activities	4.0 (2.1 – 7.7)
Low back pains	3.5 (1.9 – 6.5)
Arthritis	3.3 (1.7 – 6.1)
Current medications use	3.2 (1.8 – 5.9)
Memory loss	2.8 (1.6 – 5.1)
Use of assistive walking devices	2.0 (1.4 – 2.9)

### 3.5 Prevalence, characteristics, outcomes, and circumstances of falls

The prevalence rate of falls for the period of study, September 2016 to August 2017, was 41.4% (CI 36.7 - 46.3). In relation to gender, 44.7% of females and 33.9% of males had sustained a fall during the study period.

The characteristics of the falls investigated showed that the majority of fallers (65.1%) had recurrent falls. Most falls occurred in the outdoors (79.7%) and during daytime (79.0%), especially in the morning hours. The majority of the fallers (57.6%) reported to have fallen on a flat surface.

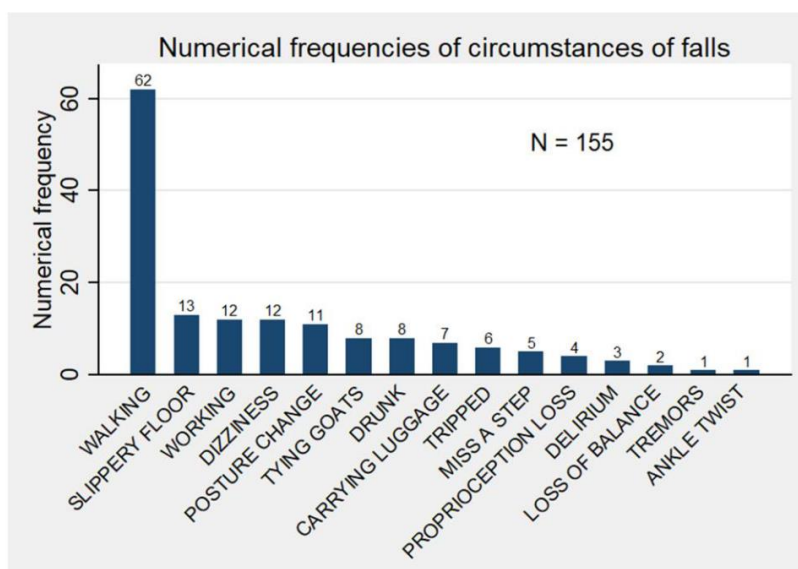
The outcomes of the falls as reported by the 167 fallers are listed in Table 4.

**Table 4:** Outcomes of falls.

Outcomes of falls	No. of participants with an outcome	Proportion (%) Outcome among fallers
Fear of falling	153	91.6
Injury after fall	83	49.7
Abandonment of daily activities	67	40.1
Loss of autonomy	57	34.1
Hospitalization	52	31.1
Immobilization	49	29.3
Fractures	41	24.6
Fractured tibia	16	9.6
Fractured femur	9	5.4
Fractured radius-ulna	7	4.2
Fractured hip	5	3.0
Fractured humerus	4	2.4
Hip dislocation	2	1.2
Skin bruises	31	18.6

Confusion	21	12.3
Head injury	19	11.4
Black out	18	10.8

The participants reported various circumstances leading to falls as outlined in Figure 1. These included walking (40.0%), sliding (8.4%), fell while working (7.7%), felt dizzy then fell (7.7%), postural change (7.1%), tripped over goats while attending to them (5.2%), under influence of alcohol (5.2%), tripped over an object (3.9%), missed a step (3.2%), lost balance, lost perception of a place while in darkness, delirium like states, tremors, loss of energy, and ankle twist.



**Figure 1: Numerical frequencies of circumstances of falls**

#### 4. Discussion

This study investigated the occurrence of falls amongst the older people in the Gatanga region of Central Kenya in the context of their socio-demographic, lifestyle, and medical influences. The results show that the interaction of these factors is likely to have a significant influence on falls in this age group. Understanding the root causes of falls in this population will provide potential areas to address when establishing suitable fall prevention measures. In this study, the prevalence of falls was 41.4% (CI 36.9 – 46.2), which is relatively high and consistent with other studies in different places of Africa and the world, showing a fall prevalence of 20-60% [6, 20, 21, 31). The introduction of robust fall prevention measures would likely reduce this prevalence. Socio-demographic, cultural, and lifestyle factors, such as engagement in sheep rearing, were significantly associated with falls. The interaction between older people and domestic animals was identified as a potential risk factor for falls in this community. Nine study participants reported to have fallen while attending to sheep

or goats, having been pulled or suddenly tripped over their tethering ropes (Figure 1). Other older people reported to have fallen while carrying fodder on the farms and when going to the farms. This shows that the farming lifestyle of older people in this region is a contributor to falls. Previous studies have not shown this association between the farming lifestyle and falls. Other factors which were significantly associated with the falls in this population included being female, on current medication use, lower back pain, memory loss, diabetes, syncope/fainting, blindness, arthritis, in carrying out usual activities, being frail as measured in the Frailty for non-disabled index tool, using assistive walking devices, and having bruises/cuts. Other studies have already shown association of falls with these physical and medical factors thus understanding their influence on occurrence of falls in the background of cultural factors is paramount to implementing an effective falls prevention strategy.

#### **4.1 Generalizability**

The socio-demographics and lifestyles of the older people in the central region of Kenya are generally similar. The region is mountainous and inhabited by people of the Kikuyu ethnicity, who mainly engage in crop and animal farming. An informal survey of older people admitted with fractures in the different hospitals in the region showed similar causes of fall-related injuries, including being female, tripping over goats, sliding on a wet surface, sustaining falls while walking or carrying farm materials, and other etiologies as elaborated in the discussion and shown in Figure 1. Thus, the findings of this study are likely to apply to other areas of central (Mount) Kenya.

#### **4.2 Conclusions**

The World Health Organization Fall Prevention Model [20] recognizes the pillars of preventing falls as: (1) awareness building, (2) individual assessment of environmental and societal factors that increase the likelihood of falls, and 3) facilitating the design and implementation of culturally appropriate evidence-based interventions that will significantly reduce the number of falls among older persons. Animal husbandry and medical illnesses were identified as significant contributors to falls in this region. Ideal fall prevention methods in this community needs to target older people and their care givers with relevant fall prevention messages which reduce exposure to the identified risk factors and health workers dealing with older persons to sensitize them on the need to assess, treat and advise them appropriately on their individual risk of falls. Older people were found to have a higher burden of diseases that are likely to make them prone to falling. Access to quality healthcare services should be made easier for them to ensure that they seek early medical intervention for these chronic illnesses to prevent falls, severe injuries, and incapacitation.

#### **4.3 Limitations**

Despite attempts to collect information which represented the true health status of the older people, there were limitations which could have interfered with the internal validity of the results, including challenges with memory, and indeed, 43.8% of the participants had memory loss. Hence, the cross-section design of

the study where we measured exposure and outcome variables at the same time could result in some level of bias, possibly understating the frequency of fall episodes. However, a study in Brazil tested the agreement between the self-reported method after 12 months versus the prospective method and found that the global agreement was 79% for falls and 89% for recurrent falls [32]. This shows that the self-report method at 12 months has a capacity to provide fairly reliable information to derive reliable estimates. However, caution is required when using such methods to investigate the epidemiology of falls. Second, the establishment of the true illness status in some conditions was sometimes difficult due to insufficient medical records and medications. However, several methods were used to address this. The participants had to provide medications they were currently on and hospital records for the past year such as prescriptions and visit cards at the time of the interview. Collaborative information was sourced from close family members and close contacts to ascertain treatment for illnesses as described by the older people. While most of our study participants had either of these information sources, there was still a chance of misclassification bias. The establishment of the true mental status among the older people may have lacked precision because of a lack of a validated tool to use in a largely illiterate population. However various methods were used to ensure optimum validity as outlined in the inclusion and exclusion criteria. The cross-section design of our study could not prove the temporal direction of association between some exposure variables and the outcomes; wounds and syncope would have occurred due to falls. Besides it could not be used to estimate the incidence of falls which would have best been addressed in a prospective cohort design. This occurred due to limitations in funding and time to conduct the study, among other logistical challenges. However, the cross-section design revealed key information on occurrence of falls and possible risk factors in this community which would be useful in raising awareness and when designing comprehensive studies on the subject in this region.

#### **4.4 Recommendations**

This study shows that falls are a significant cause of morbidity among elderly persons living in Central Kenya. To reduce the burden of falls among the elderly persons, the following recommendations are made; (1) There's need to research on ideal fall prevention methods in this population. These methods ought to be culturally appropriate and acceptable among the elderly persons. (2) Mobilize financial and human resources to target fall prevention efforts in these communities. The resources would be used to promote fall prevention activities among elderly persons in Central Kenya. (3) Develop strategies to increase accessibility to healthcare among elderly persons. This would help lower the burden of chronic diseases among the elderly which would likely lower the risk factors for falls among the elderly.

#### **4.5 Declaration of Conflicting Interests**

The authors declare that there is no conflict of interest.

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