Magnitude and Determinants of Elderly Falls in a Rural Community of Bangladesh

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DECLARATION

I declare that this thesis entitled "**Magnitude and Determinants of Elderly Falls in a Rural Community of Bangladesh**" is submitted to the faculty of Biological Sciences, University of Dhaka, in partial fulfillment of the requirements for the degree of Master of Philosophy (MPhil) in Epidemiology and Biostatisticswas carried out by me. No part of the work has been submitted for the award of any other degree or diploma.

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CERTIFICATE

This is to certify that Dr. Shamima Choudhury has completed this thesis entitled "**Magnitude and Determinants of Elderly Falls in a Rural Community of Bangladesh**" in the Bangladesh Institute of Health Sciences (BIHS), Dhaka, under the guidance and supervision of me. To the best of my Knowledge no part of the work has been submitted for any other degree or qualification.

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The undersigned certify that they have carefully read and examined the student on this thesis and being satisfied, recommended to the Faculty of Biological Sciences, University of Dhaka for acceptance of this thesis titled **"Magnitude and Determinants of Elderly Falls in a Rural Community of Bangladesh"** by Dr. Shamima Choudhury in partial fulfillment of requirements for the degree of Master of Philosophy in Epidemiology and Biostatistics.

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Date of Approval:

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ABBREVIATION

ADLs : Activities of daily living (ADLs)

COPD : Chronic obstructive pulmonary disease

DALYs: Disability-adjusted life years

Df   : Degree of freedom

KAS   : Kerala Aging Survey

NGO   : Non-government organizations

NHDS : National Hospital Discharge Survey

NITOR: National Institute of Traumatology and Orthopaedic Rehabilitation

OAA   : Old Age Allowance programme

OPD   : Obstructive pulmonary symptoms

OR   : Odds ratio

RR   : Relative risk

SPSS   : Statistical Package for Social Science

U.N.   : United Nation

WHO : World Health Organization

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ABSTRACT

An analytic type of case-control study was done among rural elderly people aged 60 years and above who had injury due to falls where 137 cases were from NITOR and from DMC as age and sex matched control of 274. It is aimed to determine the risk factors (socio-demographic, behavioral, environmental including morbidity related risk in particular) of elderly falls in rural Bangladesh.   Data were collected through convenient sampling technique by face to face interview using a semi-structured questionnaire. To estimate the prevalence of elderly falls in rural areas of Bangladesh a secondary analysis was done on BHIS Survey data which was collected from twelve districts of Bangladesh that had been covering   46157 elderly people. In secondary analysis it was found that the prevalence of elderly fall was 10/1000 population and death due to fall was 1.6/100,000 population, in rural area of Bangladesh. Fall rate was increased by age and it was more in female than in male among all the age group. Death due to fall among female was 1.84/100,000 population which was more than male that was 1.37/100,000 population. In case control study it was found that majority of fall among male caused by accidental fall (46%) and slipping was the second cause whereas in female slipping (16%) was the commonest cause of fall followed by accidental fall (12%). Common place of fall was bathroom in age group of 65-69 years whereas bedroom fall was the most common place for individual above 75year. Strong statistical association was revealed between types of family, physical activities, foot wear, mobility difficulties, extremity disability, limitation of activities, senile cataract, COPD and urinary incontinence. The odds ratios with 95% CI were estimated for   joint family (OR= 0.203, CI=0.085 – 0.484), educational

level, among physical activity - brisk walking, house work, carrying load were significantly associated with elderly fall which act as protective factors whereas gardening (OR= 1.634, CI= 0.525- 5.083) act as risk factor for elderly fall. Taking medicine (OR= 1.803, CI= 0.801- 4.057), foot wear not properly fitting (OR= 3.655, CI= 3.544 – 9.022) and slick sole (OR=1.944,CI=0.406 – 2.197) were significantly associated with elderly fall. Awareness about fall (OR= 0.210, CI= 0.128 – 0.347) represents a protective factor. Among environmental risk factors, mosaic floor (OR= 1.781, CI =0.584 – 5.792), wet and slippery bathroom, place around tube well that was kaccha (OR= 1.487, CI= 0.636 – 3.476), uneven sidewalk (OR= 1.132, CI=0.368- 3.485) and slippery condition (OR= **3**.018, CI= 0.561 – 16.248) are all associate with elderly fall. Among morbidity, mobility difficulties and extremity disability were significantly associated with elderly fall. Three main diseases associated with elderly falls were identified: senile cataract (OR= 1.229, CI=0.083 – 0.633), COPD (OR= 2.423, CI= 1.314- 31.400) and urinary incontinence (OR= 1.903, CI= 0.179 – 4.548). Fall prevention is a challenge to population ageing. The numbers of falls increase in magnitude as the numbers of older adults increase in many nations throughout the world. The information about the elderly falls is lacking in Bangladesh. It is important to estimate the magnitude of the elderly falls to convince policy makers to take necessary measures to address the problem. Determining the risk factors for elderly fall is also important to design appropriate interventions for prevention of elderly falls in Bangladesh.

Introduction

1.1 Background:

The fast increase of elderly population is a global phenomenon, noticed since the end of 19th Century.[1] Since 1950, the proportion of older persons has steadily risen from eight percent of the human population in 1950 to eleven percent in 2009. This number is expected to reach 22 percent in 2050. Population ageing, which entails an increasing share of older persons in the population, is a major global demographic trend which will intensify during the twenty-first century. The demographic transition, a process whereby reductions in mortality are followed by reductions in fertility. Together, these reductions eventually lead to smaller proportions of children and larger proportionate shares of older people in the population. Ageing is taking place almost everywhere, but its extent and speed vary. In most developed countries, the population has been ageing for many decades, while in developing countries, population ageing has taken place relatively recently, as their mortality and fertility levels have fallen. Currently, the most aged populations are in the developed countries, but the majority of older persons reside in developing countries. Given that the rate of growth of the older population in developing countries is significantly higher than in developed countries, the older population of the world will increasingly be concentrated in the less developed regions.

The trend in the number of older persons in the world is dominated by the fast growth of the older population in the less developed regions, where the size of the older population is 554 million in 2013, which is five times greater than in 1950 (108 million). The speed of change in the more developed regions has been impressive too,

but significantly slower than in the less developed regions. The older population of the more developed regions tripled between 1950 and 2013, from 94 million to 287 million, and it will increase further in coming decades, reaching 417 million.[2]

It is projected that, by 2020, there will be one billion elderly persons (≥65 years) in the world, 71% of whom will live in low-income countries. The number of elderly persons in Bangladesh was projected to double from 7.8 million in 2001 to 16.2 million by 2025. The country is currently undergoing both epidemiologic and demographic transitions, where the decline in both fertility and mortality rates in early life have resulted in increased life expectancy. According to the estimation of the United Nations, life expectancy at birth is expected to increase to 74 years in 2025. Based on data from Bangladesh, life expectancy at birth is expected to be 76.9 years for men and 85.1 years for women in 2015, calculated based on the scientific report of icddr,b. At present, based on icddr, b data, life expectancy at 60 years is additional 17.6 years for men and 18.9 years for women.[3]

The older section of the population is increasing much faster than the total population.[4] In Bangladesh, 6.9% of the population was classified as elderly in 1950[3] and which is projected to double from 7.8 million in 2001 to 16.2 million by 2025 and 17% by 2050.[4] Considering all these measuring indicators, the ageing of population is becoming a grave concern.[4]

The MDS Project collaborators agreed at the 2000 Harare MDS Workshop to use the chronological age of 60 years as a guide for the working definition of "old"; however, this definition was revisited during this meeting because this definition was not taking into account the real situation of older persons in developing countries like

Bangladesh. For statistical purposes, and unless otherwise specified, in this thesis older persons are considered to be those aged 60 years or older.

Falls are major causes of unintentional injuries among the elderly people.[5] According to WHO one commonly used definition is: 'An event, which results in a person coming to rest inadvertently on the ground or other lower level'.

Other definitions of a fall include, 'Unintentionally coming to the ground or some lower level and other than as a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis as in stroke or an epileptic seizure'.[6] That means 'A sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, the ground or other surface'.

Fall includes slips, trips, falling into other people, being lowered, loss of balance, and legs giving way. If a patient/resident is found on the floor, it should be assumed that they have fallen unless they are cognitively unimpaired and indicate that they put themselves there on purpose.[7]

So fall is defined as a person coming to rest on the ground or another lower level; sometimes a body part strikes against an object that breaks the fall. Typically, events caused by acute disorders (e.g. stroke, seizure) or overwhelming environmental hazards (e.g. being struck by a moving object) are not considered falls.[3]

Fortunately, there is evidence to suggest that falls are not a normal part of aging and many falls are preventable in the older population. Every year, one-third to one-half of the population age 65 and over experience falls. An estimated 424,000 fatal falls occur each year, making it the second leading cause of unintentional injury death, after road traffic injuries. Over 80% of fall-related fatalities occur in low and middle-

income countries, with regions of the Western Pacific and South East Asia accounting for more than two thirds of these deaths.[3] About one third of the population age 65 and over reports some difficulty with balance or ambulation; incidences increase in frequency and severity in the over age 75 population. In 2000, 1.6 million seniors were treated in emergency departments for fall-related injuries and 353,000 were hospitalized. The medical expense related to falls amounts to more than $20 billion annually in the US, and is projected to climb in to $32 billion annually by 2020.The elderly represent more than one third of all hospital injury admissions, and more than 80% of these injuries are caused by unintentional falls. In 1998, 17.2 persons per 100,000 aged 65-84 suffered a fall and 107.9 per 100,000 aged 85 and older fell. More than 300,000 hospitalizations for hip fractures occur annually in the United States; 86% occur in individuals aged 65 and older.[8] Fall fatality rate for people aged 65 and older in United States of America (USA) is 36.8 per 100,000 population (46.2 for men and 31.1 for women) whereas in Canada mortality rate for the same age group is 9.4 per 10000 population.

The major underlying causes for fall-related hospital admission are hip fracture, traumatic brain injuries and upper limb injuries. Falls may also result in a post-fall syndrome that includes dependence, loss of autonomy, confusion, immobilization and depression, which will lead to a further restriction in daily activities.[4]

Risk factors for fall-related injury were classified using a conceptual framework developed by the World Health Organization (WHO) as part of the WHO Risk Factor Model for Falls in Older Age .Under the WHO framework, the determinants of falls in older adults were grouped under biological, behavioral, environmental and socioeconomic domains.[8]

Determinants of elderly fall are Cross-cutting determinants like age, culture, gender, and determinants related to health and social services. Another major risk factor is Behavioural determinants like physical activity, healthy eating, use of medicines, risk-taking behaviours. There are also another determinants related to personal factors as for example attitude, fear of falling, coping with falling, ethnicity and race and determinants related to the physical environment, determinants related to the social environment, economic determinants which increased the risk of falls. Approaching falls in older age within the framework of the determinants of ageing help us to develop effective interventions and policies.[9]

While all people who fall are at risk of injury, the age, gender and health of the individual can affect the type and severity of injury.

Age

Age is one of the key risk factors for falls. Older people have the highest risk of death or serious injury arising from a fall and the risk increases with age. For example, in the United States of America, 20–30% of older people who fall suffer moderate to severe injuries such as bruises, hip fractures, or head traumas. This risk level may be in part due to physical, sensory, and cognitive changes associated with ageing, in combination with environments that are not adapted for an aging population.

Another high risk group is children. Childhood falls occur largely as a result of their evolving developmental stages, innate curiosity of their surroundings, and increasing levels of independence that coincide with more challenging behaviors commonly referred to as 'risk taking'. While inadequate adult supervision is a commonly cited

risk factor, the circumstances are often complex, interacting with poverty, sole parenthood, and particularly hazardous environments.

Gender

Across all age groups and regions, both genders are at risk of falls. In some countries, it has been noted that males are more likely to die from a fall, while females suffer more non-fatal falls. Older women and younger children are especially prone to falls and increased injury severity. Worldwide, males consistently sustain higher death rates and DALYs lost. Possible explanations of the greater burden seen among males may include higher levels of risk-taking behaviours and hazards within occupations.

Other risk factors include:

- occupations at elevated heights or other hazardous working conditions;
- alcohol or substance use;
- socioeconomic factors including poverty, overcrowded housing, sole parenthood, young maternal age;
- underlying medical conditions, such as neurological, cardiac or other disabling conditions;
- side effects of medication, physical inactivity and loss of balance, particularly among older people;
- poor mobility, cognition, and vision, particularly among those living in an institution, such as a nursing home or chronic care facility;
- unsafe environments, particularly for those with poor balance and limited vision.

Fall prevention strategies should be comprehensive and multifaceted. They should prioritize research and public health initiatives to further define the burden, explore variable risk factors and utilize effective prevention strategies. They should support policies that create safer environments and reduce risk factors. They should promote engineering to remove the potential for falls, the training of health care providers on evidence-based prevention strategies; and the education of individuals and communities to build risk awareness.

The government is making efforts to ease the discomfort of its senior citizens by formulating old age security schemes and allocating its expenditure. However, given the limited resources and budget deficits, it can be a huge challenge to find solutions. Besides government initiatives, some non-government organisations (NGO) are also engaged in elderly welfare related activities. Unfortunately, the role of the NGOs is not yet satisfactory in this regard. Only a handful of them are involved in ageing-related activities as one of their side programmes.

In the recent fiscal year (FY 2011-12), budgetary allocation of Tk. 891 crore has been proposed for 24.75 lac elderly people under the Old Age Allowance (OAA) programme. Though the OAA programme has been beneficial for the poor elderly people, there is a lack of clarity, accountability and proper monitoring -- along with corruption and nepotism -- in the selection process of the elderly. However, the existing allowances or programmes may help some of the elderly population, but most of them remain outside the programmes. Furthermore, some receive pension after retirement from their job, but their number is negligible.

The government has to face two here. To provide economic support to the vulnerable elderly as a constitutional obligation, which is very much difficult for a poor country

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like Bangladesh, and the other is to ensure accountable governance to achieve the success of such programmes. However, specific measures are yet to be undertaken. Under these circumstances, more budgetary allocation regarding elderly population is needed. Besides, the number of beneficiaries should be increased.

There are many lessons that can be learnt from the experience of industrial societies that are facing the problems associated with an increase in their ageing population. Careful planning should make it possible for Bangladesh to take the best from the developed world's experience while avoiding negative features. Therefore, the government, with local and international organizations, should be more innovative in promoting and implementing policies and programmes to face the challenges and make the best of the opportunities that population ageing brings. If we want to live in peace and harmony at the age of 60 years and above, the nation should come forward for the well being of our respected senior citizens from now.[10]

1.2 Conceptual Framework

1.3 Rationale:

Falls are prominent among the external causes of unintentional injury. Worldwide, the number of persons over 60 years is growing faster than any other age group specially in Bangladesh. The number of this age group was estimated to be 688 million in 2006, projected to grow to almost two billion by 2050.[5]

Although most of the falls cause minor injury but there also be long term effects. The major problem caused by falls is hip bone fracture due to bone thinning, which already exists in the elderly. It is found that the elderly at the age of 65-69 have hip bone fractures one out of two hundred falls. In addition, this rate increases when the age increases. Apart of that, if the fall results in head trauma, it might lead to partial or full paralysis. If the elderly can get help immediately after the fall, the severity of the injury can be mitigated. It also results in decreasing the risk of paralysis and death.[11]

Fall prevention is a challenge to population ageing. The numbers of falls increase in magnitude as the numbers of older adults increase in many nations throughout the world.

The information about the elderly falls is lacking in Bangladesh. It is important to estimate the magnitude of the elderly falls to convince policy makers to take necessary measures to address the problem. Determining the risk factors for elderly falls is also important to design appropriate interventions for prevention of elderly falls in Bangladesh.

1.4 Research Questions:

1. What is the prevalence of elderly falls in rural areas of Bangladesh?

2. What are the socio-demographic, behavioral, environmental and morbidity related risk factors of elderly falls in rural area of Bangladesh?

1.5 Objectives:

- **General objective:**

  - ❖ To describe elderly falls in terms of prevalence and its risk factors

- **Specific objectives:**

  - ❖ To estimate the prevalence of elderly falls as per supplied data from BHIS survey in rural area of Bangladesh.
  - ❖ To identify the socio-demographic risk factors among respondents attended at OPD and IPD.
  - ❖ To determine the behavioural risk factors of elderly fall among respondents.
  - ❖ To find out the environmental risk factors among respondents.
  - ❖ To identify the morbidity related risk factors of elderly fall among respondents.

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1.6 Lists of variables:

➢ **Dependent variable:**

Fall of Elderly people

➢ Independent variable:

1. Socio Demographic determinants:

a) Age

b) Gender

c) Marital status

d) Family type

e) Living with

f) Education

g) Occupation

h) Monthly income

e) Monthly expenditure

2. Behavioral risk factors

a) Physical activity

b) Healthy eating

c) Use of medicines

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    d) Risk-taking behaviors

    e) Footwear Type

3. Determinants related to personal factors

    a) Social interaction

    b) Awareness about fall

4. Determinants related to the physical environment

5. Determinants related to the social environment

6. Economic determinants

7. Morbidity related determinant

    a) Mobility difficultie

    b) Extremity disability

    c) ADLs limitation

    d) Chronic disease

1.7 Operational definition:

Activities of daily living:

Activities of daily living (ADLs) is a term used in healthcare to refer to daily self-care activities within an individual's place of residence, in outdoor environments, or both. Health professionals routinely refer to the ability or inability to perform ADLs as a measurement of the functional status of a person, particularly in regard to people with disabilities. ADLs are defined as "the things we normally do such as Self feeding, bathing, dressing, moving from one place to another, personal hygiene and elimination."

Arthritis:

Diagnosis was based on the reporting of (a) previous diagnosis by a doctor and having painful or stiff joints during the current clinical examination, or (b) ever having swollen joints.

Depression:

Depression is a state of low mood and aversion to activity that can affect a person's thoughts, behavior, feelings and sense of well-being.[1] People with depressed mood can feel sad, anxious, empty, hopeless, helpless, worthless, guilty, irritable, ashamed or restless.

Elderly people:

The age of 60 roughly equivalent to retirement ages in most developed countries is said to be the beginning of old age. In contrast to the chronological milestones which

mark life stages in the developed world, old age in many developing countries is seen to begin at the point when active contribution is no longer possible. In our study we take 60 years or above as elderly people.

Elderly fall:

Elderly fall consisted of all cases aged 60 years and above   who was received treatment for injuries due to fall either from indoor or outdoor.

Epilepsy:

Epilepsy (from the Ancient Greek verb meaning "to seize, possess, or afflict") is a group of neurological disorders characterized by epileptic seizures. Epileptic seizures are episodes that can vary from brief and nearly undetectable to long periods of vigorous shaking.

Fall:

According to World Health Organisation fall defined as 'An event, which results in a person coming to rest inadvertently on the ground or other lower level'

High blood pressure:

Systolic blood pressure (BP) of $\geq$140 mm Hg or diastolic BP of $\geq$90 mmHg.

Housewife:

Housewife is a term used to describe a married woman who devotes her full time in keeping of maintaining her house and who is not employed outside the home.

Kaccha:

Any place made up of mud.

Mild cognitive impairment:

Mild cognitive impairment (MCI) is an intermediate stage between the expected cognitive decline of normal aging and the more serious decline of dementia. It can involve problems with memory, language, thinking and judgment that are greater than normal age-related changes.

Mobility:

The ability to move or be moved freely and easily.

Moderate physical activity:

Moderate physical activity requires a moderate amount of efforts and noticeably accelerates the heart rate. We consider moderate physical activity if any one perform the following activity: Brisk walking, Gardening, House work, Involvement in games with children, Carrying moderate loads (<20kg).

Morbidity:

Being unhealthy relating to or indicating diseases.

Noticeable hearing loss:

It was diagnosed by examining the ear with a tuning fork. A tuning fork was stroked and held in front of the ear (AC), then again stroked and held over the mastoid process, the bone behind the ear (BC). The sound produced by the vibrating tuning

fork was compared: bone conduction (BC) and air conduction (AC). If BC < AC or AC < BC both indicates hearing loss.

Obstructive pulmonary symptoms:

This condition was diagnosed from clinical examination: presence of abnormal breathing sound, ronchi, crepitation, or wheeze in the left or right lung.

Occupation:

It means a job or profession.

Pakka:

Any place made by cement or sand

Parkinsonism:

Parkinsonism is a clinical syndrome characterized by tremor, bradykinesia, rigidity, and postural instability.

Post-graduate:

Respondents who got other degrees after completion of Bachelor degree

Primary school completed:

Respondents who have completed class I to V.

Private Service:

Any respondents engaged in private institute having fixed monthly income.

Respondents:

Respondents of this study are the elderly people in rural area.

Secondary school completed:

Respondents who have completed class VI to X or passed the SSC examination.

Senile cataract:

The respondents complaint that they have "chani" in their eyes.

Socio-demographic characteristics:

It means age, sex, education, monthly income, number of family members, marital status and number of children.

Stroke:

Diagnosis was based on physical examinations: presence of hemi or mono paresis judged to be of central origin or presence of pseudobulbar symptoms (dysarthria, dysphasia).

Urinary incontinence:

Urinary incontinence the loss of bladder control is a common and often embarrassing problem. The severity ranges from occasionally leaking urine when you cough or sneeze to having an urge to urinate that's so sudden and strong you don't get to a toilet in time.

Literature review

While reviewing available literature on "Magnitude and Determinant of Elderly Fall in a Rural Community of Bangladesh." it was found that, a very little number of studies have been done in Bangladesh. But in other countries, various studies were done related to prevalence and risk factors related to elderly fall. These literatures gave information about the socio-economic, behavioral environmental and health related risk factors, which are responsible for elderly fall. Those also gave the scenario of socio-demographic characteristics of elder people. These studies are also helpful to know prevention, control and management of elderly fall in different circumstances.

For in depth conceptualization of the study, a considerable number of research articles published in various different national and international journals, reports and abstracts were reviewed thoroughly and critically.

Review of literature was done by the following sequence:

2.1 Definition old age – an overview

2.2 An overview of elderly fall related situation all over the world including Bangladesh

2.3 An overview of risk factors associated with fall

2.1 Definition of old age – an overview:

Definition of an older or elderly person, there was a Proposed Working Definition of an Older Person in Africa for the MDS Project. They explain that most developed world countries have accepted the chronological age of 65 years as a definition of 'elderly' or older person, but like many westernized concepts, this does not adapt well to the situation in Africa. While this definition is somewhat arbitrary, it is many times associated with the age at which one can begin to receive pension benefits. At the moment, there is no United Nations standard numerical criterion, but the UN agreed cutoff is 60+ years to refer to the older population.

Although there are commonly used definitions of old age, there is no general agreement on the age at which a person becomes old. The common use of a calendar age to mark the threshold of old age assumes equivalence with biological age, yet at the same time, it is generally accepted that these two are not necessarily synonymous.

As far back as 1875, in Britain, the Friendly Societies Act, enacted the definition of old age as, "any age after 50", yet pension schemes mostly used age 60 or 65 years for eligibility. The UN has not adopted a standard criterion, but generally uses 60+ years to refer to the older population (personal correspondence, 2001).

Realistically, if a definition in Africa is to be developed, it should be either 50 or 55 years of age, but even this is somewhat arbitrary and introduces additional problems of data comparability across nations. The more traditional African definitions of an elder or 'elderly' person correlate with the chronological ages of 50 to 65 years, depending on the setting, the region and the country. Adding to the difficulty of establishing a definition, actual birth dates are quite often unknown because many

individuals in Africa do not have an official record of their birth date. In addition, chronological or "official" definitions of ageing can differ widely from traditional or community definitions of when a person is older. We will follow the lead of the developed worlds, for better or worse, and use the pensionable age limit often used by governments to set a standard for the definition.

Lacking an accepted and acceptable definition, in many instances the age at which a person became eligible for statutory and occupational retirement pensions has become the default definition. The ages of 60 and 65 years are often used, despite its arbitrary nature, for which the origins and surrounding debates can be followed from the end of the 1800's through the mid-1900's. Adding to the difficulty of establishing a definition, actual birth dates are quite often unknown because many individuals in Africa do not have an official record of their birth date.

Defining old as "The ageing process is of course a biological reality which has its own dynamic, largely beyond human control". However, it is also subject to the constructions by which each society makes sense of old age. In the developed world, chronological time plays a paramount role. The age of 60 or 65, roughly equivalent to retirement ages in most developed countries is said to be the beginning of old age. In many parts of the developing world, chronological time has little or no importance in the meaning of old age. Other socially constructed meanings of age are more significant such as the roles assigned to older people; in some cases it is the loss of roles accompanying physical decline which is significant in defining old age. Thus, in contrast to the chronological milestones which mark life stages in the developed world, old age in many developing countries is seen to begin at the point when active contribution is no longer possible." (Gorman, 2000)

Age classification varied between countries and over time, reflecting in many instances the social class differences or functional ability related to the workforce, but more often than not was a reflection of the current political and economic situation. Many times the definition is linked to the retirement age, which in some instances, was lower for women than men. This transition in livelihood became the basis for the definition of old age which occurred between the ages of 45 and 55 years for women and between the ages of 55 and 75 years for men. (Thane, 1978)

The MDS Project collaborators agreed at the 2000 Harare MDS Workshop to use the chronological age of 60 years as a guide for the working definition of "old"; however, this definition was revisited during this meeting. Many felt this definition was not taking into account the real situation of older persons in developing countries, specifically in sub-Saharan Africa. Hence, upon further deliberation and discussion during the 2001 Dar es Salaam MDS Meeting, the working definition of "older" or "old" for the purposes of this thesis was changed to the age of 50 years. It is acknowledged that this is also somewhat arbitrary and introduces additional problems of data comparability across nations, but it is believed to be a better representation of the realistic working definition in Africa. A brief summary, mainly to reflect the implications for ageing policy, of the reasons behind the decision to use this definition follows. A full description is beyond the scope of this report, but will instead be presented in a forthcoming publication.

Categories of definitions as when attention was drawn to older populations in many developing countries, the definition of old age many times followed the same path as that in more developed countries, that is, the government sets the definition by stating a retirement age. Considering that a majority of old persons in sub-Saharan Africa live

in rural areas and work outside the formal sector, and thus expect no formal retirement or retirement benefits, this imported logic seems quite illogical. Further, when this definition is applied to regions where relative life expectancy is much lower and size of older populations is much smaller, the utility of this definition becomes even more limited.

Study results published in 1980 provides a basis for a definition of old age in developing countries (Glascock, 1980). This international anthropological study was conducted in the late 1970's and included multiple areas in Africa. Definitions fell into three main categories: 1) chronology; 2) change in social role (i.e. change in work patterns, adult status of children and menopause); and 3) change in capabilities (i.e. invalid status, senility and change in physical characteristics). Results from this cultural analysis of old age suggested that change in social role is the predominant means of defining old age. When the preferred definition was chronological, it was most often accompanied by an additional definition.

These results somewhat contradict the findings of a more recent study conducted in Nigeria regarding perceptions about the onset of old age. (Togonu-Bikersteth, 1987 and 1988) Younger and older age groups had similar responses regarding the chronological onset of old age, with differences in the stated age for men and women. The results suggested that the generally accepted definition was similar to westernized definitions of old age; however, this was a unique community with culture-related norms that bestowed certain privileges and benefits at older ages. If one considers the self-definition of old age, that is old people defining old age, as people enter older ages it seems their self-definitions of old age become decreasingly multifaceted and

increasingly related to health status (Brubaker, 1975, Johnson, 1976 and Freund, 1997).

While a single definition, such as chronological age or social/cultural/functional markers, is commonly used by, amongst others, demographers, sociologists, anthropologists, economists and researchers, it seems more appropriate in Africa to use a combination of chronological, functional and social definitions. However, the challenge of how to incorporate a suitable multidimensional definition into the "pensionable age" concept remains. It was felt that by using age 50 years; this project will be indirectly incorporating these other definitions.

2.2 An overview of elderly fall and related situation all over the world including Bangladesh

Using a standard definition of 'a fall' makes reporting of falls more likely and more consistent. One commonly used definition according to WHO is:

'An event, which results in a person coming to rest inadvertently on the ground or other lower level'

Other definitions of a fall include:

- 'Unintentionally coming to the ground or some lower level and other than as a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis as in stroke or an epileptic seizure.'[12]
- 'A sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, the ground or other surface' (Abbreviated).

This includes: slips, trips, falling into other people, being lowered, loss of balance, and legs giving way. If a patient/resident is found on the floor, it should be assumed that they have fallen unless they are cognitively unimpaired and indicate that they put themselves there on purpose.[13]

- 'A fall is a sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, or the ground, other than as a consequence of a sudden onset of paralysis, epileptic seizure, or overwhelming external force.'[14]
- 'Unintentionally coming to rest on the ground, floor, or other lower level.'[15]
- 'An unexpected loss of balance resulting in coming to rest on the floor, the ground or an object below knee level.'[16]

WHO published a report on October 2012 where they report that globally, falls are a major public health problem. An estimated 424 000 fatal falls occur each year, making it the second leading cause of unintentional injury death, after road traffic injuries. Over 80% of fall-related fatalities occur in low- and middle-income countries, with regions of the Western Pacific and South East Asia accounting for more than two thirds of these deaths. In all regions of the world, death rates are highest among adults over the age of 60 years.

They also report that while all people who fall are at risk of injury, the age, gender and health of the individual can affect the type and severity of injury.

Age is one of the key risk factors for falls. Older people have the highest risk of death or serious injury arising from a fall and the risk increases with age. For example, in the United States of America, 20–30% of older people who fall suffer moderate to

severe injuries such as bruises, hip fractures, or head traumas. This risk level may be in part due to physical, sensory, and cognitive changes associated with ageing, in combination with environments that are not adapted for an aging population.

Across all age groups and regions, both genders are at risk of falls. In some countries, it has been noted that males are more likely to die from a fall, while females suffer more non-fatal falls. Older women and younger children are especially prone to falls and increased injury severity. Worldwide, males consistently sustain higher death rates and DALYs lost. Possible explanations of the greater burden seen among males may include higher levels of risk-taking behaviours and hazards within occupations.

Other risk factors include occupations at elevated heights or other hazardous working conditions; alcohol or substance use; socioeconomic factors including poverty, overcrowded housing, sole parenthood, young maternal age; underlying medical conditions, such as neurological, cardiac or other disabling conditions; side effects of medication, physical inactivity and loss of balance, particularly among older people; poor mobility, cognition, and vision, particularly among those living in an institution, such as a nursing home or chronic care facility; unsafe environments, particularly for those with poor balance and limited vision.

Though not fatal, approximately 37.3 million falls are severe enough to require medical attention occur each year. Such falls are responsible for over 17 million DALYs (disability-adjusted life years) lost[2]. The largest morbidity occurs in people aged 65 years or older, young adults aged 15–29 years and children aged 15 years or younger.

The financial costs from fall-related injuries are substantial. For people aged 65 years or older, the average health system cost per fall injury in the Republic of Finland and Australia are US$ 3611 and US$ 1049 respectively. Evidence from Canada suggests the implementation of effective prevention strategies with a subsequent 20% reduction in the incidence of falls among children under 10 could create a net savings of over US$ 120 million each year.[8]

2.3 An overview of risk factors associated with fall

A study provided by Laredo Medical Center, Department of Medicine about " Prevalence and Determinants of Falls among Older Adults" which was an analysis of the SABE I Survey in Ecuador. This study based on a nationally representative sample of older adults living in the Andes Mountains and coastal region of the country indicates that 34.7% of older adults had fallen in the previous year in Ecuador. They recognize that One-third of people over the age of 65 years who live in the community fall each year; this proportion increases to 50% by the age of 80 years. Although not all falls of older persons are injurious, about 5% of them result in a fracture, and other serious injuries occur in 5% to 10% of falls.[17] Approximately 30% of falls required medical treatment, often resulting in emergency department visits and subsequent hospitalizations, increasing the demand for healthcare services.[18] Previous studies have reported upward trends in fall-related injury hospitalizations and deaths in developed countries.[19,20] Despite these facts, there is limited information about the epidemiology of falls among older adults in developing countries.[5]

Reyes-Ortiz et al. (2005) reported that the prevalence of falls among adults aged 60 years or older across seven urban cities in Latin America ranged from 21.6% in Bridgetown, Barbados to 34% in Santiago, Chile. In Brazil, the prevalence of falls found among older adults residing in urban areas was 27.6%.[1] Moreover, among studies in Latin America, the increased risk of falling has been associated with female gender, increased age, high depressive symptoms, functional limitations, diabetes, arthritis, osteoporosis, and urinary incontinence.

In Ecuador, the proportion of persons aged 60 years or older was 6.2% in 1990 and it is expected to reach 11.9% by 2020 and 24.5% by 2050. Among them 5,227 participants with complete information on fall status, 37.4% (95% CI, 35.7–39.2) reported to have fallen in the previous year, representing an estimated 445,000 older adults in Ecuador. Recurrent falls (two or more) occurred in 23% (95%CI, 21.5–24.6) of the participants. Moreover, among those who had fallen 30.6% (95%CI, 27.9–33.5) sustained a fall-related injury. The prevalence of falls increased gradually with advancing age and was higher among women. The prevalence of fall-related injuries also increased with age and was higher among women after age of 70 years, shows the prevalence of falls stratified by gender and area of residence. Overall, the prevalence of falls varies across regions of the country.[5]

However, the highest prevalence of falls in both genders was reported among those subjects residing in the rural Andes Mountains. They found that fallers were more likely to be older, women, residing in rural areas, having poor health status, co-morbidities, being less physically active, having functional limitations on the lower extremities and personal ADLs, and having the lowest scores in the chair stand test as compared with non-fallers. In the final multivariate model, women (OR, 1.81; 95%CI,

1.32–2.48), subjects with cognitive impairment (OR, 1.71; 95% CI, 1.18–2.49), those reporting urinary incontinence (OR, 1.58; 95% CI, 1.13–2.22), and being those physically active during the previous year (OR, 1.68; 95%CI, 1.23–2.29) were variables found independently associated with increased risk of falling among older adults in Ecuador. Although not statistically significant, a physician's diagnosis of stroke (OR, 0.86; 95% CI, 0.86–2.58) and drinking alcohol ≥2 days per week (OR, 1.47; 95% CI, 0.53–4.04) were also associated with increased risk of falling. The prevalence of falls according to the number of risk factors. Overall, a gradual and linear increase in the prevalence of falls was seen as the number of risk factors increased from 19.6% among persons with no risk factors to the increased prevalence of falls and fall-related injuries with advancing age and among women. Their possible explanations for the higher incidence of fall-related injuries among women have been related to levels of physical activity, muscle weakness and loss of lower body strength, bone mass, circumstances surrounding the fall, and willingness to seek medical attention .[5]

An important finding of the present study was the strong and significant association between cognitive impairment and increased fall risk among older adults in Ecuador. Several studies have shown that fall risk is closely related to ADLs capability and that difficulty in at least one activity of daily living double the risk of falling .[21,22,23,24,25] In Ecuador, the risk of falling was 1.2-fold higher among older adults with any impairment in ADLs. This finding confirms the results of a previous study showing that any ADLs limitation among older adults in Latin America and among Mexican-Americans increases significantly the risk of falling.[21] Limitations in ADLs often reflect poor mobility and lower-limb muscle strength, which are major risk factors for

falling in older people. [26, 27, 28] In the present study, a significant association between lower-limb muscle strength and falls was found in the unadjusted regression model.

Urinary incontinence was also found an independent and significant risk factor for falls. The present finding is consistent with the results of a recent systematic review.[29]Falls related to incontinence are generally thought to result from loss of balance when rushing to the toilet. However, it is unclear whether incontinence is a primary cause of falls or it is simply a marker of generalized physical frailty.[5, 30]

A cross-sectional observational study was conducted in five of the six nursing homes of São Carlos city, SP, Brazil with a view, to identify the occurrence of falls among institutionalized elderly in São Carlos City, to describe its determining factors and to verify its relationship with handgrip strength. 61 elderly subjects (31 men and 30 women) took part of the study. Among them 54.1% of the elderly had fallen at least once in the 12 months preceding the study. The disability of watching television presented a significant correlation with falls (p=0.05), in contrast to other functional activities studied (walk, take shower and seat independently), pain and diseases. Statistically significant differences were found between the mean age of the elderly who had fallen (76.76 years, ±9.17) and those who hadn't fallen (71.05 years, ±8.67); and among grip strength of those who had fallen (19.37 kgf, ±8.92) compared to the ones who hadn't fallen (25.45 kgf, ±12.14). The variance analysis didn't show differences in the number of falls between men and women. The incidence of falls among institutionalized elderly in São Carlos City is high and the individuals who were more likely to suffer falls were the older and weaker ones, as well as those unable to watch television.[1]

A prospective cohort study based on data from the on-going longitudinal, Swedish population in Lund University, Skåne University Hospital in Sweden, Department of Health Sciences, and Division of Geriatric Medicine on falls in the general elderly population published with a view of to identify risk factors predicting falls in a general elderly population.[31]

The study population included 45.7% men and 54.3% women. Just over half the study population was in their sixties at baseline (55.5%). Approximately one in five was in their seventies or eighties (19.9% / 21.5%), and only 3.1% was in their nineties. Presents data on the incidence of falls and the basic characteristics of those defined as fallers. At the 3-year follow-up assessment, including the older subjects (78 years and older at baseline), the incidence of falls in the past six months was almost one in five (19.1%). At the 6-year follow-up assessment, almost one in seven of the participants had fallen once or more in the past six months (13.3%). Falls were almost four times more common in 90-year-olds than in 60-years olds at the 6-year assessment, and women fell almost twice as often as men throughout the study. Eleven factors were statistically significant in the age- and sex-adjusted regression model with ORs for falling ranging from 1.35 to 3.30. The use of neuroleptics (OR 3.30, 95% CI 1.15–9.43), heart failure with symptoms (OR 1.88, 95% CI 1.17–3.04), and low walking speed (OR 1.77, 95% CI 1.28–2.46) were the most prominent risk factors. The attrition analysis revealed that risk factors such as heart disease, tendency to fall, the use of fall risk drugs and low walking speed were significantly more prevalent in the non-participants.[31]

In Madrid, Spain the BMC Geriatric published a article on the study of "Factors associated with falls among older adults living in institutions" provided information

about frequency of falls and associated factors among older people living institutions. They found that among 744 residents with stays longer than 30 days, 733 elderly fall, mean age of 83.4 years (95% CI, 82.6-84.1), a mean of 3.2 diseases (95% CI, 2.9-3.5), and a mean of 4.2 medications (95% CI, 3.9-4.5). Among fallers, 68%, 21%, and 12% had 1, 2, and ≥3 falls respectively. The total number of falls was 146, corresponding to a rate of 2.4 (95% CI, 2.04-2.82) falls per person-year. The rate of at least one fall was 1.5 (95% CI, 1.22-1.84) per person-year, which translated as a 1-year risk of falling of $1 - \exp(-1.5) = 0.78$.

Strong associations were found for number of diseases ($RR = 1.40$, for an increase of 1 disease). The increase in risk is very strong in, up to 2-3 diseases. A strong association was also found for polypharmacy ($RR = 1.19$, for an increase of 1 drug). When these variables were mutually adjusted, number of diseases remained strong ($RR = 1.32$) and the effect of polypharmacy weakened ($RR = 1.07$). Regarding a possible interaction between both, they included a product term consisting of number of medications multiplied by dichotomized number of diseases. The adjusted rate ratios (95% CI) for an increase of 1 medication were 1.31 (1.05-1.65) and 1.14 (1.02-1.27) for those with 0-1 and ≥2 conditions respectively (P value for homogeneity $= 0.25$). Among psychotropic medications, antidepressants displayed a marked increased risk ($RR = 3.40$) with an equally plausible effect for anxiolytics ($RR = 1.64$). All these effects were diluted when additionally adjusted for number of diseases and polypharmacy. Functional dependence was also associated with falls, with rate ratios increasing with dependence and decreasing in the last category of total dependence. Fall rate ratios increased with level of cognitive impairment but the association was imprecise, i.e. wide confidence intervals.

Clear associations were observed for arrhythmias, anemia, peripheral arterial disease, cancer, obstructive pulmonary disease, anxiety, and arthritis. When additional adjustment was made for number of diseases and polypharmacy, many associations became doubtful although some are worth considering (arrhythmias, anxiety, depression, peripheral arterial disease, and obstructive pulmonary disease). In the case of depression and anxiety, however, almost the entire effect was explained by antidepressant and anxiolytic use. Antidepressants, use of cane and insomnia may have a stronger effect with non-severe falls, whereas obstructive pulmonary disease and hypertension may have a stronger effect with severe falls. In addition to the last two diseases probable risk factors for severe falls may encompass: Number of diseases, polypharmacy, cancer, arrhythmias, peripheral arterial disease, and arthritis.

In terms of potential population impact, higher attributable fractions for relevant variables were as follows: number of diseases (dichotomized, with reference to those with ≤ 1 condition), 84% (95% CI, 45-95%); urinary incontinence, 49% (95% CI, 20-67%); arrhythmias, 24% (95% CI, 4-40%); and antidepressants, 17% (95% CI, 5-27%).[32]

WHO provided a study on Global AGEing and Adult Health (SAGE) named "Measuring prevalence and risk factors for fall-related injury in older adults in low- and middle-income countries" in adults aged 50 years and older in six low- and middle-income countries (LMIC) to identify the annual prevalence of fall-related injury and investigate and compare risk factors associated with fall-related injury.[8]

The distribution of the population between urban and rural locations was 44.1% urban vs. 56.0% rural. The sex distribution was similar across countries (48.8% female vs. 51.2% male), except in the Russian Federation (38.9% males and 61.1% females). In

China, Mexico and South Africa over 50% of adults aged 50 and above self-reported that they had held an occupation or a job in the past year. In the pooled weighted population approximately 45% of respondents were in the two highest income quintiles. In most countries, the majority of participants completed secondary or high school. The Russian Federation had the highest completion rates of secondary or high school (74.7%) and post-secondary education (18.4%).

The prevalence of fall-related injury among all injury was highest in the Russian Federation (73.3%) and the lowest in Ghana (44.4%). Falls were a highly prevalent source of injury for women in Mexico, India and the Russian Federation. The prevalence of falls as a major source of injury was 73.4% for women and 55.4% for men. Prevalence was higher in the older age groups.

The prevalence of fall-related injury in the study population was highest in India (6.6%) and lowest in South Africa (0.9%). Fall-related injury was more prevalent among women than men in all countries except South Africa. With the exception of the Russian Federation and South Africa, the prevalence of fall-related injury in the study population in the previous twelve months, was similar in the 70-79 and 80+ age groups.

Unintentional fall-related injuries were the most common type (91.4%), and intentional (inflicted by another person) the least common type (2.6%). Fall-related injuries typically occurred in the home.

In the socioeconomic domain, education (completed secondary or high school vs. non completion of primary education) and social network (the highest or best vs. the lowest social network) were statistically significant (p<0.05). With the exception of sex (p<0.1) only factors statistically significant (p<0.05) within each of the domains. Risk factors significantly associated with an increased risk of fall-related injury are depression (p<0.01), arthritis (p<0.1), grip strength (p<0.05), insufficient intake of fruits and vegetables (p<0.05), severe or extreme sleep problems (p<0.05), water source outside the home (p<0.05) and completed secondary education (p<0.05).

The distribution of annual fall-related injury prevalence in each country's study population conditioned on binary variables that show statistically significant association (p<0.05) with fall-related injury.[8]

In India, approximately 12% of respondents who had depression, yet no sleep problems, insufficient nutrition and water in the home, reported fall-related injuries in the previous twelve months. Of the respondents in Mexico who were depressed, had severe or extreme sleep problems, accessed water outside the home and had sufficient nutrition, 50% reported fall related injuries.[10]

In Tamil Nadu State, India, Department of Geriatric Medicine in Madras Medical College and Government General Hospital published a National Regional review on "Falls on older people". They described that risk factors for falls include muscle weakness, a history of falls, use of four or more prescription medications, use of an assistive device, arthritis, depression, age older than 80 years, and impairments in gait, balance, cognition, vision, and activities of daily living.[11]

In a Multi-centric Community Study, evaluating Health Problems in the Elderly (Year 2003), in 10 states across India, covering a total population of 10,200 elderly with equal rural and urban distribution, the incidence of falls (History of a single fall in the last 6 months) was found to be 14% (Data to be published) Among the 35 states and union territories in India, Kerala has registered the highest proportion of elderly. Most falls result from a complex interplay of predisposing and precipitating factors in a person's environment. One half to two thirds of falls occur in or around the patient's home. The aged in Kerala constitute 11% of the population. Between 1961 and 1991, there has been 160% increase in the population of older adults, the majority of them

being women. Their population, which was 9% in 1991, is expected to increase to 37% by 2051.[11]

The Kerala Aging Survey (KAS), conducted among more than 5,000 elderly (2,271 men and 2,722 women) in 14 districts of Kerala, was the keystone of the study. The results of the survey have shown that the age of participants ranged 5 from 60 to over 100 years of age with 54% being women. Rajesh Kumar and Avasthi (2003) conducted a cross-sectional survey of 200 subjects over 60 years old in July 1999–April 2000 shows that, out of the total sample population, 103 (51.5%) subjects had fallen. Fracture was reported in 21.3%, and other injuries occurred in 79.6% of those who had fallen. Fractures among females (26.4%) were reported more frequently compared with males (16%) and fracture was seen more in urban subjects (29.4%) compared with rural subjects (13.4%).

History of fall and fall frequency was seen to be significantly associated with disability and psychological distress. Higher disability and consequent increasing distress was noted among those with a prior history of fall after 60 years of age and those with a history of three or more falls. The significance of falls among elderly people is that not only that the number of falls increases with age but the injury rate is highest among the oldest old (80 years) subjects with 6 history of falling more than twice. There is a vicious cycle where, due to poor perceived health and morbidity there is increased tendency to fall which itself leads to increasing disability and distress.[11]

Rashmi and Lalita (2005) in a presentation has pointed out that hip fractures in elderly people are almost always the result of falls. Regular exercise increases muscle strength, coordination and flexibility and reduces the tendency to fall. Exercise

reduces the risk of falling by 10%, and balance training programs reduces the risk by nearly 20%. They suggest that elimination of environmental hazards, the avoidance of drugs which impair balance and management of neuromuscular disorders play a role in fracture prevention (Wark, 1993).

The study by Johnson (2006) involved 82 community living and 63 institutionalized women aged 60 years or older in Trivandrum, Kerala, India, found that significantly lower percentage (45%) of community dwelling participants suffered a fall in the previous year, compared to 64% of those in the Long Term Care (LTC) settings (p < .05). Overall, of those who fell, 74% reported an injury (e.g., cuts and bruises, fractures) as a result of the fall, and 48% of older adults in the community and 70% in the LTC setting required medical treatment as a result of the falls. It is estimated that nearly 1.5 to 2 million persons are injured and 1 million succumb to death every year in India. Gururaj (2002) has found that road traffic injuries are the leading cause (60%) of traumatic brain injuries followed by falls (20%-25%) and violence (10%).

Health services impact and costs of falls in older people Falls are an important cause of morbidity and mortality in the elderly. Most often the cause of fall is multifactorial. Falls and their sequalae are potentially preventable and hence it is of importance to know the risk factors for falls in the elderly. Asian elders make relatively heavy use of health services: this may be due to higher levels of morbidity, but controlled comparisons have not been carried out. A comparison of the prevalence and severity of chronic diseases and use of health services of Asian and indigenous elders were made.

In Gujarati Asians, higher prevalence of diagnosed diseases, with the exception of chronic obstructive airways disease, but lower risk of falls and urinary incontinence.

Asian subjects had higher life satisfaction scores and lower prevalence of depressed mood.[11]

A recent study, published in the Journal of the American Geriatrics Society (2005), reveals that older people in residential care can reduce their incidence of falls if they take a vitamin D supplement for two years. They found that that vitamin D use cut the risk of falls 27% to 37 % compared with placebo.[10, 33]

Krishnaswamy and Shanthi (2005) evaluated 100 patients above 60 years with falls among them 68% were females and more prevalent in people >70 years. Of the medical conditions predisposing to falls, musculoskeletal problems rank first, followed by visual defect, neurological illness, syncope, vestibular causes, hypertension, postural hypotension and dementia. Drug induced falls were commonly associated with sedatives and hypnotics usage.

Fall is an event caused by age associated diseases like Parkinson's disease, cognitive decline and musculoskeletal problems in association with physiological changes like impairment of sensory system, impairment of righting reflex and decrease in lean body mass. The incidence of falls increases with advancing age. It is one of the leading causes of death in elderly due to its complications of which 50% is hip fracture. Serious injuries and fractures, restricted mobility and loss of independence leading to functional decline, psychological fear of falling (post fall syndrome) and permanent disability. More than 90% of hip fractures are associated with falls in persons above 70 years of age and is associated with greater mortality.[33]

The incidence of falls was less in exercising group than sedentary group. Among the exercising group who had falls, 60% did not sustain hip fracture, indicating that

muscle strength and endurance improves with regular exercise which prevents falls by better neuromuscular control and fracture by better dissipation of force (Rees and Neuoham, 1998; Cummings, 1998).

The study by Krishnaswamy and Shanthi has also indicated that musculoskeletal problems like osteoarthritis, rheumatoid arthritis, myopathy secondary to hypothyroidism, cervical and lumbar spondylosis were the cause for falls in elderly. Neurological illnesses, which cause deterioration of sensorimotor function of muscle, contribute to falls. Musculoskeletal disease, physical disability or limited activity increased the risk of fall by two to four times (Davis, Ross, Nevitt and Richart, 1999).

In the study of Epidemiology of medication related falls and fractures, it was found that psychotropic drugs have two fold increased risk of falls due to their central depressant effect. Diuretic therapy by causing electrolyte imbalance can precipitate falls and increase risk of fracture. Among the drug-induced falls, psychotropic drugs have increased risk of falls and fracture due to central depressant effect. Diuretic therapy causes electrolyte imbalance, which precipitates falls (Heidrich, Stergachis and Gross, 1991).

Risk factors for falls include muscle weakness, a history of falls, use of four or more prescription medications, use of an assistive device, arthritis, depression, age older than 80 years, and impairments in gait, balance, cognition, vision, and activities of daily living. Most falls result from a complex interplay of predisposing and precipitating factors in a person's environment. One half to two thirds of falls occur in or around the patient's home.[33]

Assessment of the morbidity profile and its determinants will help in the application of interventions, both medical and social, to improve the health status and thus the quality of life of the elderly in Northern India. The distribution of history of fall among elderly people over 60 years old shows that, out of the total sample population, 103 (51.5%) subjects had fallen. Fracture was reported in 21.3%, and other injuries occurred in 79.6% of those who had fallen. Fractures among females (26.4%) were reported more frequently compared with males (16%) and fracture was seen more in urban subjects (29.4%) compared with rural subjects (13.4%). History of fall and fall frequency was seen to be significantly associated with disability and psychological distress. Higher disability and consequent increasing distress was noted among those with a prior history of fall after 60 years of age and those with a history of three or more falls. The significance of falls among elderly people is that not only that the number of falls increases with age but the injury rate is highest among the oldest old (80 years) subjects with 6 history of falling more than twice. There is a vicious cycle where, due to poor perceived health and morbidity there is increased tendency to fall which itself leads to increasing disability and distress.

Methodology

3.1 Study design:

1. Secondary analysis of Bangladesh Health and Injury Survey (BHIS) data which was obtained from Centre for injury prevention and Research, Bangladesh, to estimate the prevalence of elderly falls among the rural peoples.

2. Analytical type of case control study to determine the risk factors of elderly people aged 60 years and above who had injury due to falls in rural Bangladesh.

3.2 Study place:

1. For Secondary analysis Bangladesh Health and Injury Survey (BHIS) data was collected from twelve districts of Bangladesh. In each district, one upazila (rural sub-district) and in each upazila, two unions were selected for the study.

2. For the case control study it was carried out at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), is an orthopaedic and Rehabilitation institute and undergraduate & post-graduate institute, situated in Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh and the another study place was Dhaka Medical College and Hospital (DMC & H), situated in the centre of the Dhaka city. Availability of good number of study subjects, assurance of all positive help and cooperation from the

administrations and all departments and easy communication are the reasons for selecting these two study places.

3.3 Study period:

1. The field activities of Bangladesh Health and Injury Survey (BIHS) for data collection were conducted between January and December 2003.

2. The case control study was conducted for a period of one year which effect from 1st July 2014 to 30th June 2015. The study was started with protocol preparation and finished with final report submission. Data were collected from January 2015 to March 2015. The detailed work schedule has been appended as Appendix-4.

3.4 Study population:

1. **For** secondary **analysis: A**ll the elderly population aged 60 years and above residing in rural area of Bangladesh. This data were obtained from BHIS Survey data that had been covering 171,366 households and a total surveyed population of 819,429and among them 46157 elderly people were indentified.

2. **For case control study:**

a) **Cases:** The study population consisted of all patients aged 60 years and above were received treatment for injuries due to fall either from indoor or outdoor in NITOR.

b) **Controls:** For each elderly fall, at least two elderly people, age and sex matched from same socio – economic condition.

Inclusion criteria:

- All the patients at the age of 60 years and above who received indoor or outdoor services at NITOR and Dhaka Medical College and Hospital (DMC & H), Dhaka.

- Those who participated the study willingly.

Exclusion criteria:

- Those patients who were severely ill.

- Unwilling to participate in the study.

3.5 Sample size:

1. **For prevalence study:** Analysis of Bangladesh Health and Injury Survey (BHIS) data that has been covering 171,366 households and a total surveyed population of 819,429. Among them total numbers of 46157 elder people (60 years and above) were identified by case selection with the help of SPSS for windows version 16.

2. **For case control study:** 137 elderly falls were identified and 274 age sex matched controls were included in the study. Sample size has been calculated utilising formula for case control study from EPI-info. (The essential free software tool for public health practice)

Case-Control Study (Comparison of ill and not-ill)

		Kelsey	Fleiss	Fleiss w/ CC
Two-sided confidence level:	95% ▼			
Power:	80 %			
		Cases	123	126	137
Ratio of controls to cases:	2			
		Controls	245	252	274
Percent of controls exposed:	20 %			
		Total	368	378	411
Odds ratio:	2			
Percent of cases with exposure:	33.3 %			

3.6 Sampling technique:

1. **For prevalence study:** Twelve out of 64 districts were randomly selected for the survey. Multi-stage cluster sampling was used to select 171,366 household; 88,380 from rural areas. In each district, one upazila (rural sub-district) was randomly chosen. In each upazila, two unions were selected randomly for the study.

2. **For case control study:**137 cases was selected from all consecutive cases who attended outpatient / inpatient department and who was coming from rural area only, of National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) during specific data collection period and application of the inclusion criteria mentioned above.

Matched control was selected from all consecutive cases aged 60 years and above coming from rural area who was admitted in different department due to different illness rather than fall injury, of Dhaka Medical College and Hospital (DMC & H).

3.7 Data collection tools:

1. **For prevalence study:** Data administered a set of instruments at each household. Five sets of questionnaire were used for this survey.

2. **For case control study:** Data was collected by using semi-structured and pretested interviewed questionnaire and checklist. The questionnaire contained both open-ended and close-ended questions. First section was for respondent identification, part two was for collecting information on socio-demographic risk factors, part three on information about fall, part four was about behavioral risk factors, five about environmental risk factors and the last one about morbidity related risk factors.

3.8 Methods of Data collection:

1. **For prevalence study:** Data were collected by face to face interview. There were 48 data collectors and six supervisors. The data collectors were university graduates with previous experience in community research. They were given extensive hands-on-training with standardized role-playing scenarios, interviewing techniques in real situations and record keeping. The instruments were pre-tested and revised several times prior to the actual survey.

2. **For case control study:** Data were collected by face to face interview of the respondents. For data collection two collectors including researcher herself were involved. The selected data collectors had previous experience on collecting data by interview method. Before pre-testing the questionnaires, two-day training was conducted. During training dummy interview was practiced to ensure proper implementation of the instrument during collection of data. The

instrument was pretested twice and modified accordingly. The final interview schedule was implemented. One respondent was interviewed once. No medical examination or test was done.

3.9 Data processing and analysis:

1. For prevalence study: Data analysis was done by using SPSS for windows version 16. Then various tables were made and analyzed according to the objectives. Prevalence was calculated considering midyear population of the surveillance area as denominator and number of falls identified in surveillance area in previous year as numerator. The formula of Prevalence is given below:

Number of existing cases (old & new) of a specified disease

during a given period of time interval

$$\rule{13cm}{0.4pt} \times\ 1000$$

Estimated mid-interval population at risk

3. **For case control study:** Data were processed and analyzed using SPSS for windows version 16. Data were cleaned and edited by running frequency, cross tabulation and logical checks. Data processing was done by coding, recoding, sorting, categorizing, computing etc. Frequency and descriptive analysis were done initially followed by bi-variate analysis. All variables were coded into dichotomised values except age, which was categorized. Chi-square test for categorical variables and the *t*-test for continuous variables were used to compare the characteristics of participants who reported a fall and those who

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did not. Subsequently, those variables statistically significant (P value$\leq$ .05) in the univariate analyses were entered into a logistic regression model to evaluate the independent associations between falls and characteristics of the participants. Results of the regression model are presented as odds ratios (ORs) with their 95% confidence intervals (95% CI). The association between exposure to the individual risk factor and the incidence of falls was statistically analysed using crude odds ratios (OR). Multiple logistic regression analysis, adjusted for age and sex, was used to calculate the predicted risk of falling, and was presented as the OR to fall when exposed to the particular risk factor. The factors in each retained component were dichotomised into a 'dummy-variable', representing the whole component. The ORs for falling for these components were analysed in a final multiple logistic regression model, with the components adjusted for each other. The prevalence of falls was also examined according to the number of independent risk factors found in the multivariate model. Trend in fall prevalence according to the number of risk factors was examined with the chi-square test for trend.

3.10 Ethical consideration:

- At first ethical clearance was obtained from BIHS. Before conducting the face to face interview, nature and the purpose of the study was explained and a verbal consent was obtained from the respondent with the assurance that confidentiality of data would be maintained with respect to information provided by them. The benefits they can get from the study were explained. Ethical consideration was maintained in the following point specifically:
- Not harmful condition for the respondents.

- Respondents willing to participate or not to participate.

- The respondent may abstain from answering question from the questionnaire at any time.

- Respondent may not deprive from any facilities if she withdraw her consent from the study.

- The result of the study may be helpful for further improvement of the health service.

3.11 Limitation of study:

The limitations of this study are as follows:

- As the study was conducted on all consecutive cases who attended outpatient and inpatient department as samples, the result are not generalisable. Data on information about fall, attitude, environmental risk factors, and morbidity of the respondents, were collected based on the statements of the respondents which might not be free from recall bias.

- Data on Body mass index is an important risk factor for elderly fall, but data could not be collected on that issue.

- Statistical modelling was not done for data analysis.

- The study was conducted applying quantitative method only.

Results

4.1 Secondary analysis:

Falls are generally most frequent injury in elder people in developed countries and in other developing countries. They were also known to be very common in Bangladesh.

Bangladesh Health and Injury Survey (BHIS) which was a cross sectional survey, conducted to estimate incidence and proportional morbidity and mortality of fall related injury in elder people. They suggest that an epidemiological transition has taken place in Bangladesh and fall related injury is now one of the major causes of morbidity and mortality. The official statistics on injuries are difficult to interpret as there is a wide variation among the many figures. There is very little data on actual causes of fall related injury at the community level which is truly nationally representative. It is generally reported that fall in elder people above 60 years of age experienced more by female than male.

The Secondary analysis of Bangladesh Health and Injury Survey data available at Centre for injury prevention and Research, Bangladesh to estimate the prevalence of elderly falls among the rural peoples. The total numbers of 46157 elderly people (60 years and above) were identified from the BHIS data. Among them fall related injury experienced by 456 elderly people. The prevalence of fall had been calculated by using the formula of prevalence which is already mentioned in methodology. The prevalence of elderly fall in rural area of Bangladesh was 9.879/1000 population.

Data were presented through tables and figures and were organized under following sections:

Table 4.1.1: Distribution of prevalence of elderly fall by age group

Age group(years)	Population at risk	No of fall	Age specific rate/1000
60 to 64	17019	139	8.1
65 to69	9749	77	8
70+	11785	240	20
Total	46157	456	10

From BHIS data it was found that above 70 years old people fall more than that of others age group. Among the 60 to 64 age group and 65 to 69 age group the prevalence of fall was almost same that was 8.1/1000 population whereas above 70 years old the prevalence of fall more than double that was 20/1000 population.

Table 4.1.2: Distribution of prevalence of elderly fall by age and sex

Age group	Population at risk		Total no. of fall		Prevalence/1000 pop^n	
	Male	Female	Male	Female	Male	Female
60 to 64	13154	11469	54	85	4.10	7.41
65 to 69	5659	4090	29	48	5.12	11.74
70+	6657	5128	102	138	15.33	26.91
Total	25470	20687	185	271	7.26	13.1

This table shows that among the total number of elder people, 25470 were male and 20687 were female and among the total number (456) of elderly fall, 185 were male

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and 271 were female. The prevalence of elderly fall among male is 7.26/1000 which is almost double among female that is 13.10/1000 population.

Figure 4.1.1: Distribution of location of fall
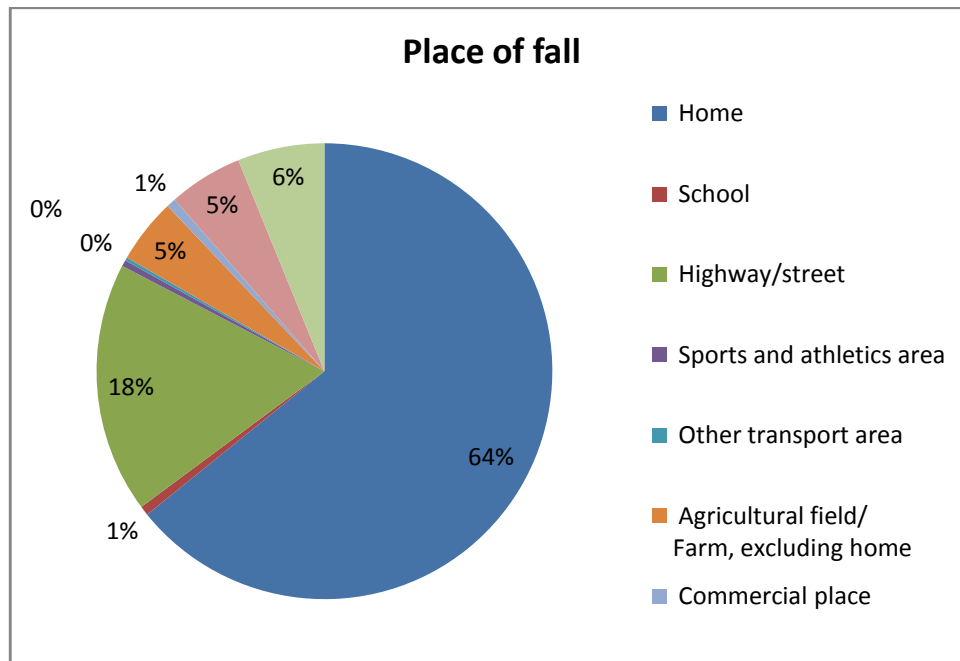
This figure shows majority (64%) of fall occurred at home. The second most common location was the streets (18%).

Mortality pattern of elder people due to fall:

The total number of 46157 elderly people (60 years and above) were identified in the BHIS data where fall related injury followed by death were 73. The prevalence of elderly fall related death in rural area of Bangladesh was 1.6/100,000 population.

Table 4.1.3: Distribution of prevalence of fall related death by age group

Age group	Population at risk	No of death due to fall	Prevalence/100,000 pop^n
60 to 64	17019	8	0.47
65to 69	9749	16	1.6
70+	11785	49	4.1
Total	46157	73	1.6

From BHIS data it was found that above 70 years elderly death due to fall more than that of 60 to 69 age group. The above table shows that, among 60 to 64 age group prevalence of death due to fall is 0.47/100,000 and 65 to 69 it is almost triple that is 1.6/1000 and above 70 years it was 4.1/1000.

Table 4.1.4: Distribution of prevalence of elderly death due to fall according to age group with the relation of sex

Age group	Population at risk		Total no. death due to fall		Prevalence/100,000 pop^n	
	Male	Female	Male	Female	Male	Female
60 to 64	13154	11469	6	2	0.46	0.17
65 to 69	5659	4090	9	7	1.59	1.71
70+	6657	5128	20	29	3.00	5.65
Total	25470	20687	35	38	1.4	1.84

This table show that among the total number of elder people, 25470 were male and 20687 were female and the prevalence of elderly death due to fall among female is

1.84/100,000 population which is greater than the prevalence in male that is 1.4/100,000 population. The prevalence of elderly death due to fall was more in female than male in above 70 years age group but between 65 to 69 years old death due to fall was almost similar in both sex. It is surprising that fall death was less in female than male in 60 to 64 age group.

4.2 Results of case control study:

The case control study was carried out among 137 elderly falls and 274 age, sex matched controls in National Institute of Traumatology and Orthopaedic Rehabilitation, in Sher-e-Bangla Nagar and Dhaka Medical College Hospital, Dhaka, Bangladesh to depict a picture of elderly falls in rural areas of Bangladesh. Data were presented through tables and figures and were organized under following sections:

4.2.1: Socio-demographic Characteristics:

Valuable information regarding Socio-demographic Characteristics among elderly person was collected, collected data was analyzed and the results were presented in the following tables:

Table-4.2.1a: Distribution of respondents by age group

Age group (in years)	Case		Control	
	Frequency	**Percentage %**	**Frequency**	**Percentage %**
60-64	70	51.1	127	46.4
65-69	45	32.8	93	33.9
70+	22	16.1	54	19.7
Total	137	100	274	100

Above table shows the mean age of the respondents was 65.17±6.034 years and 65.24+6.116 years for the cases and controls. More than half of the respondents were in the 60-64 age groups among the cases (51.1%) and controls (46.4%) were in 60-64 age group.

Table-4.2.1b: Distribution of respondents by Religion

Religion	Case		Control	
	Frequency	**Percentage %**	**Frequency**	**Percentage %**
Islam	119	86.9	254	92.7
Others	18	13.1	20	7.3
Total	137	100	274	100

Approximately 119 (86.9%) and 254 (92.7%) were Muslim respectively and very few were from others religion.

Table-4.2.1c: Distribution of respondents by marital status

Marital status	Case		Control	
	Frequency	Percentage %	Frequency	Percentage %
Currently married	86	62.8	240	87.6
Widow/Divorced	51	37.2	34	12.4
Total	137	100	274	100

Majority of elderly people were married 86 (62.8%) and 240 (87.6%) among case and control groups respectively and very few were from others like widow and divorced.

4.2.2: Fall related information

Figure-4.2.2a: Distribution of causes of fall
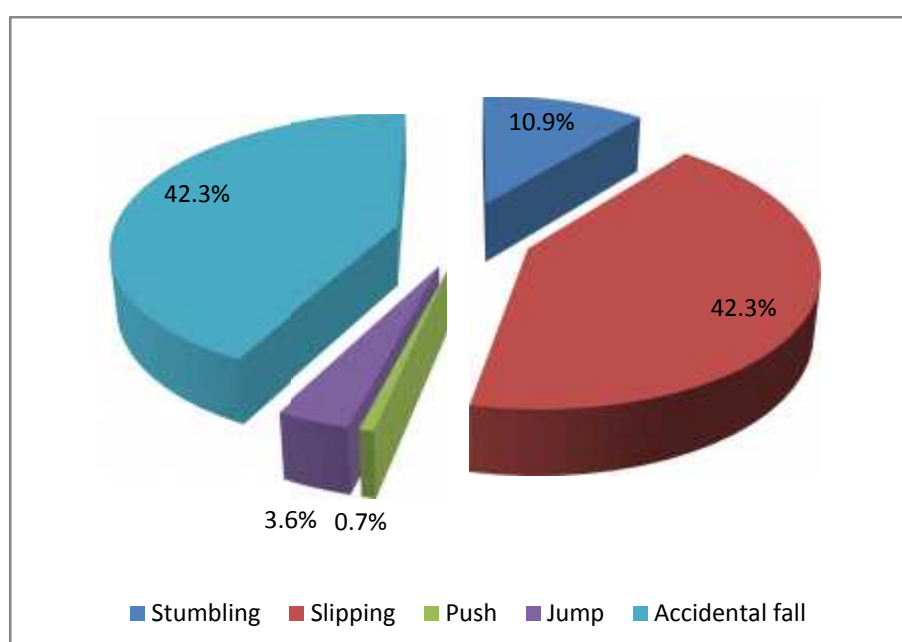
Majority of fall causes were slipping and accidental, both contribute same figure.

Figure-4.2.2b: Distribution of location of fall according to age group
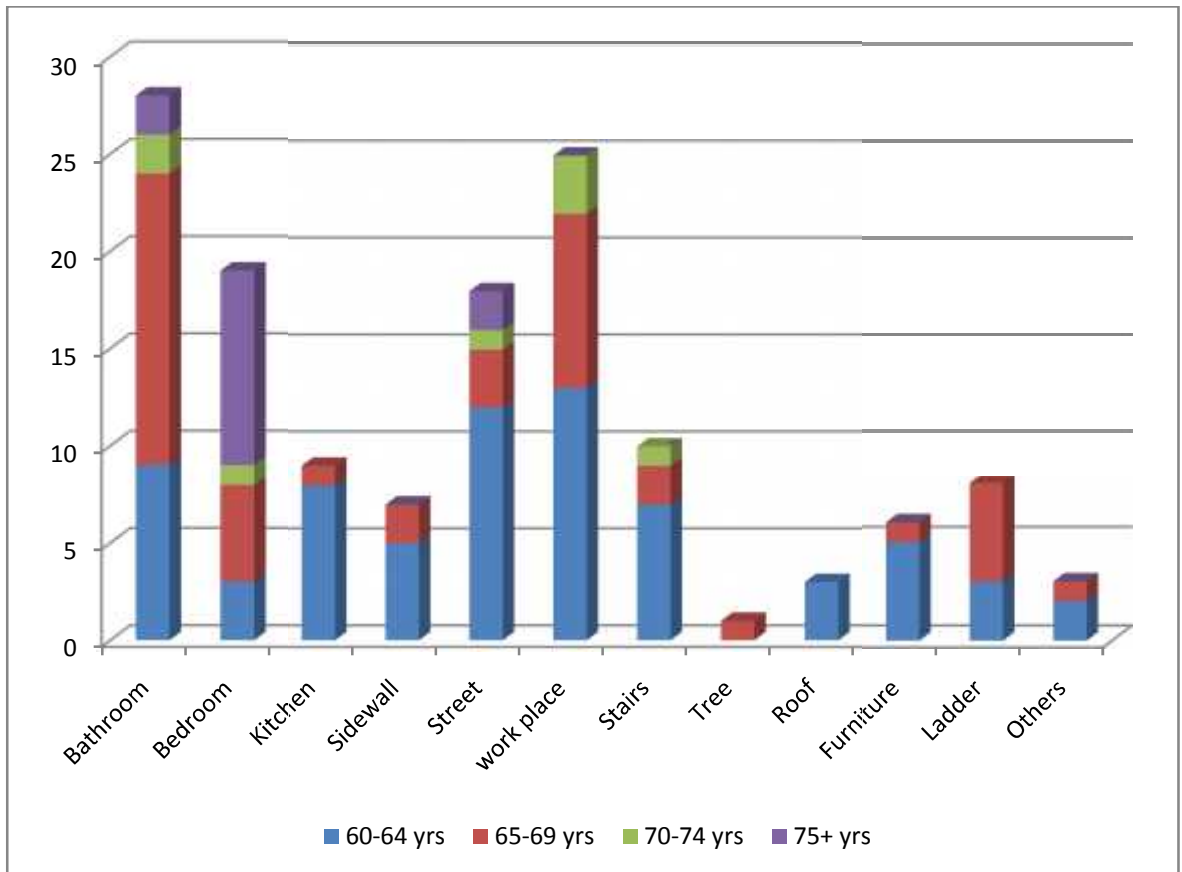
Among 60-64 yrs of age common location of fall were workplace & street. History of fall in the bathroom was more common in age group of 65-69 yrs and above 75 yrs, bedroom fall was the most common.

Figure-4.2.2c: Distribution of location of fall according to sex
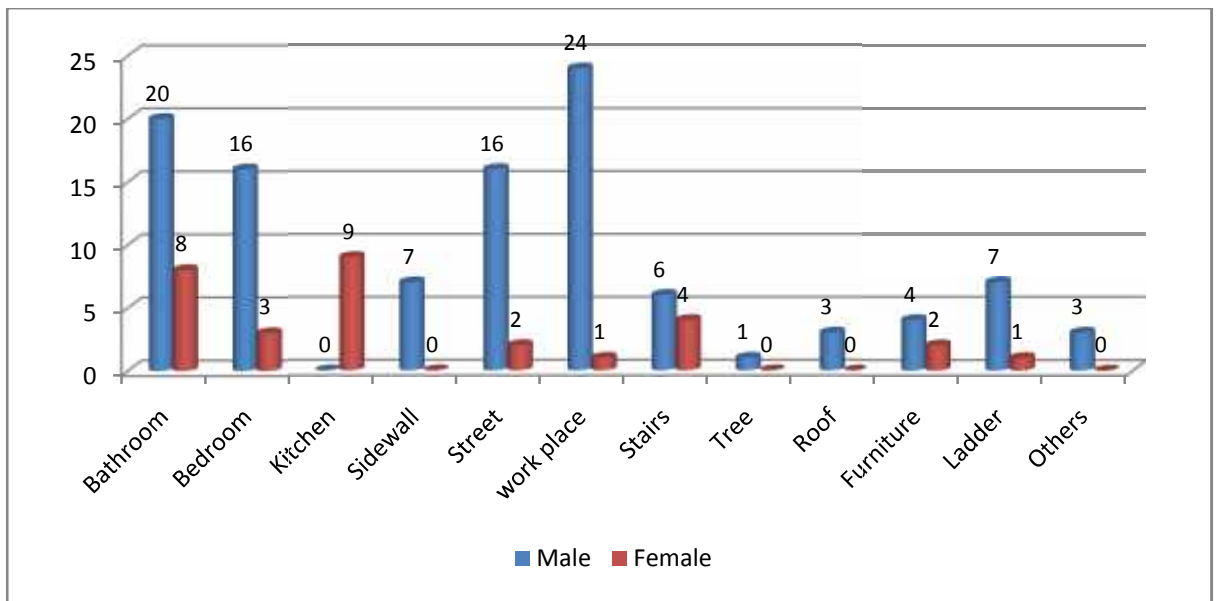
Regarding fall location by sex most common place was workplace followed by bathroom & bedroom in male whereas in female it was kitchen followed by bathroom.

Figure-4.2.2d: Distribution of cause of fall according to sex
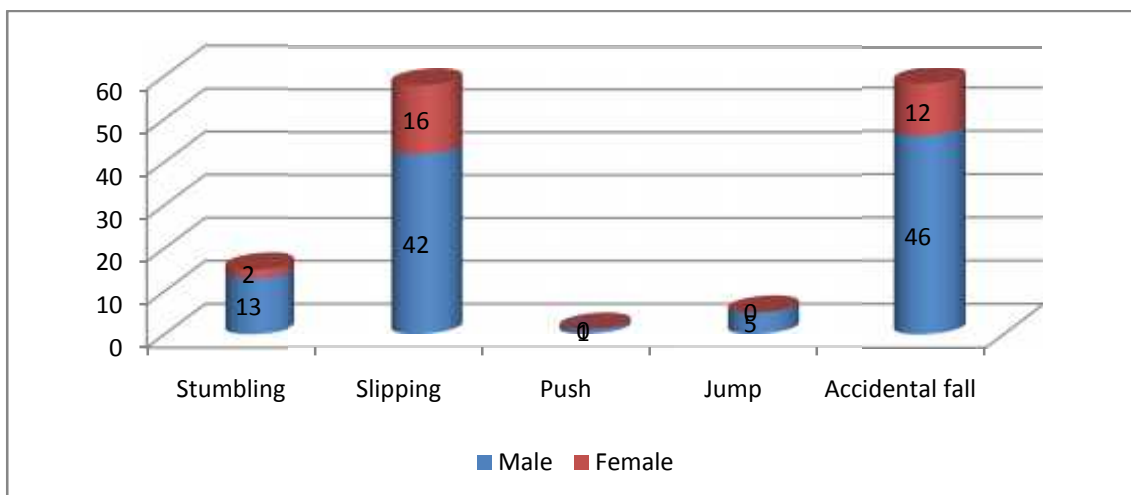
Cause of fall by sex it was revealed that among male, more common causes of fall were accidental fall (46%) and fall due to slipping (42%) but in female slipping (16%) was the commonest cause of fall followed by accidental fall (12%).

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Figure- 4.2.2e: Distribution of causes of fall according to age
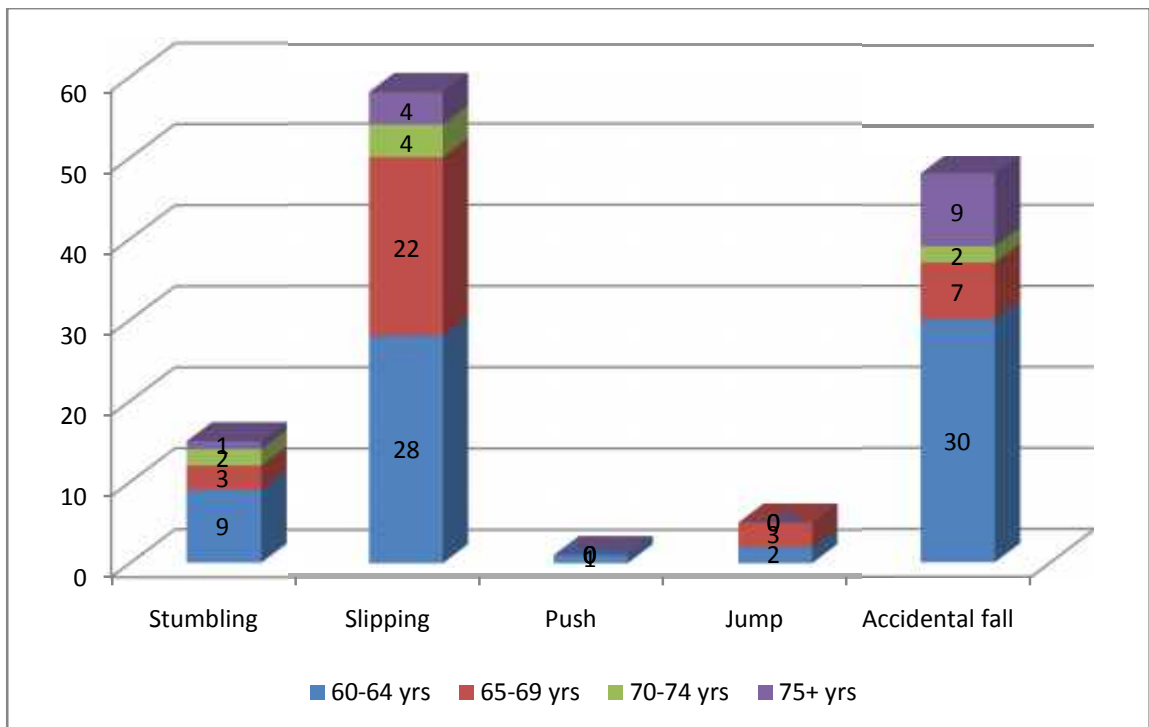
Among 60-64 years of age most common cause of fall was accidental fall (30) and slipping (28) nearby but slipping (22 & 4) was the most common in age group of 65-69 years and 70-74 years respectively. Above 75 years it was accidental fall (9).

4.2.3: Risk factors regarding fall

Table-4.2.3a: Distribution of the respondents by socio-demographic Risk factors

Variable	Case	Control	X^2/P-value
Family type			
Nuclear	19 (13.9)	151 (55.1)	64.048 (1); <0.001
Joined	118 (86.1)	123 (44.9)	
Family member			
1-3	5(3.6)	32 (11.7)	26.025 (1); <0.001
4-5	28 (44.3)	105 (38.3)	
5+	104 (75.9)	107 (50.0)	
Living with			
Alone	1 (0.7)	7 (2.6)	5.188 (2); NS
With Family	135 (98.5)	256 (93.4)	
Old home	1 (0.7)	11 (4.0)	
Education			
None	27 (19.7)	100 (36.5)	19.276 (5); <0.05
<Primary	21 (15.3)	28 (10.2)	
Primary	43 (31.4)	69 (25.2)	
Secondary	28 (20.4)	37 (13.5)	
College	17 (12.4)	27 (9.9)	
PG	1 (0.7)	13 (4.7)	
Occupation		`	
Day wagers	5 (3.6)	18 (6.6)	33.520 (7); <0.001
House wife	29 (21.2)	110 (40.1)	
Farmer	26 (19.0)	34 (12.4)	
Service	18 (13.1)	38 (13.9)	
Business	32 (23.4)	23 (8.4)	
Retired	24 (17.5)	40 (14.6)	
Others	3 (2.2)	11 (8.7)	
Monthly income			
<5000 Tk.	6 (4.4)	58 (21.2)	49.246 (3); <0.001
5000-10000 Tk.	12 (8.8)	65 (23.7)	
10000-15000 Tk.	40 (29.2)	75 (27.4)	
15000+ Tk.	79 (57.7)	76 (27.7)	
Monthly expenditure			
Up to 5000 Tk.	8 (5.8)	86 (31.4)	49.512 (3); <0.001
5001-10000 Tk.	53 (36.7)	118 (43.1)	
10000+ Tk.	76 (55.5)	70 (25.5)	

Above table shows that 137 elder person majority 118 (86.1%) lived in joint family with their family 135 (98.5%) and 75.9% reported there were six or more members in their household. Among control majority had nuclear type of family 151 (55.1%).

Strong statistical association was revealed between types of family and family members with the groups (case & control). $X^2 = 64.048$ (1); <0.001 and $X^{2=} 26.025$ (1); <0.001.

The data revealed that in terms of the literacy and academic background of the interviewees, the largest group 43 (31.4 %) comprised those who were completed primary level of education among cases whereas among control, the largest group 100 (36.5%) were reported no formal education. Statistical association was revealed (P < 0.05).

Large majority of the Patients were in business - about 32 (23.4%), followed by house wife 29 (21.2%) among cases whereas majority was housewife 110 (40.1%) in control group. Strong statistical association was revealed between occupation with the groups (case & control). $X^2 = 33.520$ (7); <0.001.

Mean monthly income of the family was Tk. 14114.36 ±11014.140; minimum was Tk. 2000/ and maximum Tk. 30000.00/. Majority family had an income taka 10,000 and above for the cases and controls. Monthly expenditure also showed similar result (11418.49 ±7722.002). Statistical association was revealed (P < 0.001).

In socio-demographic risk factors it was found that fall rates were more prevalent among largest group who were completed primary level of education, majority had nuclear type of family and among male majority engaged in business.

Table-4.2.3b: Distribution of behavioral risk factors of the respondents

Variable	Case	Control	X^2/P-value
Physical activity			
Brisk walking	29 (21.2)	32 (11.7)	
Gardening	11 (8.0)	6 (2.2)	
House work	39 (28.5)	194 (70.8)	
Games	4 (2.9)	4 (1.5)	75.344 (6); <0.001
Carrying load(<20kg)	13 (9.5)	14 (5.1)	
Multiple	9 (6.6)	1 (0.4)	
No participation	32 (23.4)	23 (8.4)	
Medication			
Yes	77 (56.2)	126 (46.0)	3.816 (1); NS
No	60 (43.8)	148(54.0)	
Medication name			
No medicine	60 (43.8)	148 (54.0)	
Anti HTN	22 (16.1)	48 (17.5)	
Anti DM	12 (8.8)	39 (14.2)	
NSAID	14 (10.2)	6 (2.2)	36.572 (7); <0.001
Vitamins	6 (4.4)	1 (0.4)	
Anti-depressant	7 (5.1)	4 (1.5)	
Multiple	11 (8.0)	27 (9.9)	
Anti-Asthma	5 (3.6)	1 (0.4)	
Foot wear			
Properly fitting	85 (62.0)	78 (28.5)	74.154 (2); <0.001
Not properly fitting	37 (27.0)	192 (70.1)	
Barefoot	15 (11.0)	4 (1.5)	
Footwear kind			
Shoe	23 (16.8)	46 (16.8)	18.836 (2); <0.001
Slipper	99 (72.3)	224 (81.8)	
Sole type			
Rubber sole	63 (46.0)	69 (25.2)	34.182 (2); <0.001
Slick soles	36 (26.3)	155 (56.6)	
Social interaction			
Good	125 (91.2)	243 (88.7)	1.605 (2); NS
Not good not bad	10 (7.3)	29 (10.6)	
Bad	2 (1.5)	2 (0.7)	
Aware about fall			
Yes	83 (60.6)	241 (88.0)	41.008 (2); <0.001
No	54 (39.4)	33 (12.0)	
Exp. of previous fall			
Yes	43 (31.4)	30 (10.9)	171.804 (2); <0.001
No	94 (68.6)	244 (89.1)	
Times of fall			
1 times	27 (19.7)	19 (6.9)	
2 times	12 (8.8)	11 (4.0)	
3 times	3 (2.2)	0 (0.0)	96.049 (4); <0.001
3 times+	1 (0.7)	0 (0.0)	

Figure showed that elderly person with history of fall, whether they participated physical activities, it was reported that among male majority had no participation

(28%) whereas in female it was only four. Respondents who participated, majority noticed brisk walking (27%) followed by house work (21%) and carrying moderate load (13%) among male, but it was house work (8%) followed by gardening (5%) & brisk walking (2%) among female.

Regarding behavioral risk factor, majority of the respondents of case group performed house work (28.5%) followed by brisk walking (21.2%), whereas in control group similarity observed as house work (70.8%) followed by brisk walking (11.7%).

Among cases more than half (56.2%) had history of taking medicine and majority took antihypertensive drug (16.1%). Less than half (46.0%) had drug history in control group but here also majority took antihypertensive drug (17.5%).

Among cases foot wear was properly fitted (62.0%) and their foot wear kind was slipper (72.3%) with rubber sole (46.0%), they had good social interaction (91.2%) and majority were aware about fall (60.6%). Whereas among control foot wear was not properly fitted (70.1%) and their foot wear kind was slipper (81.8%) with slick sole (56.6%), they had good social interaction (88.7%) and majority were aware about fall (88.0%). Strong statistical association was revealed between physical activity, foot wear, foot wear kind, sole type and aware about fall with case & control $(p<0.001)$.

About 31.4% had experience of previous fall and 19.7% had fall history of 01 time and 2 times & more was 11.7%.

In behavioral risk factors, majority had no participation in physical work. Majority had history of taking medicine and among them majority took antihypertensive drug. Their foot wear was properly fitted and their foot wear kind was slipper with rubber sole.

Table-4.2.3c: Distribution of environmental risk factors of respondents

Variable	Case	Control	X^2/P-value
Floor Mud Mosaic Cement	51 (37.2) 15 (10.9) 71 (51.8)	159 (58.0) 42 (15.3) 73 (26.6)	25.530 (2); <0.001
Bathroom Dry Wet	33 (24.1) 104 (75.9)	81 (29.6) 193 (70.5)	19.19 (2); NS
Slippery Yes No	111 (81.0) 26 (19.0)	237 (86.5) 37 (13.5)	2.109 (2); NS
Tube well Yes No	119 (86.9) 18 (13.1)	258 (94.2) 16 (5.8)	6.413 (2); <0.05
Place around tube well Pucca Kutcha	99 (72.3) 38 (27.7)	136 (49.6) 138 (50.4)	19.099 (1); <0.001
Place Dry Wet	34 (24.8) 103 (75.2)	105 (38.3) 169 (61.7)	7.441 (1); <0.05
Sidewalks Yes No	75 (54.7) 62 (45.3)	211 (77.0) 63 (23.0)	21.389 (1); <0.001
Slippery Yes No	69 (50.4) 68 (49.6)	192 (70.1) 82 (29.9)	15.306 (1); <0.001

Regarding floor type, 51.8% reported it was cement and 58.0% reported mud among case and control group respectively. Around 70.0% reported bathroom was wet and more than 80.0% reported it was slippery in both groups. Place around the tube well was pucca (72.3% and 49.6%), wet (75.2% and 61.7%), with cracked or uneven (54.7% and 77.0%) and slippery (50.4% and 70.1%) among the groups. Statistical significance was not found only bathroom & its condition.

Table-4.2.3d: Distribution of health related risk factors of respondents

Variable	Case	Control	X^2/P-value
Extremity Disability			
Yes	40(29.2)	146 (53.5)	23.990 (3); <0.001
No	97(70.8)	128 (46.5)	
Mobility difficulties			
Yes	42(30.7)	156 (56.9)	25.260 (1); <0.001
No	95(69.3)	118 (43.1)	
Limitation			
Bathing	1(0.7)	15 (5.5)	
Dressing	3(2.2)	10 (3.6)	
Moving	21(15.3)	30(10.9)	
Personal hygiene	0(0.0)	1 (0.4)	39.568 (6); <0.001
Elimination	1(0.7)	11 (4.0)	
Multiple	20(14.6)	99 (36.1)	
Senile cataract			
Yes	12(8.8)	94 (34.3)	31.146 (1); <0.001
No	125(91.2)	180 (65.3)	
Hearing loss/deafness			
Yes	4(2.9)	21(7.7)	3.599 (1); NS
No	133(97.1)	253(92.3)	
Cognitive impairment			
Yes	1(0.7)	17(6.2)	6.536 (1); <0.05
No	136(99.3)	257(93.8)	
Chronic OPD			
Yes	13(9.5)	10(3.6)	5.895 (1); <0.05
No	124(90.5)	264(96.4)	
Hypertension			
Yes	44(32.1)	115(42.0)	3.739 (1); NS
No	93(67.9)	159(58.0)	
Stroke			
Yes	9 (6.6)	28 (10.2)	1.485 (1); NS
No	128 (93.4)	246 (89.8)	
Depression			
Yes	5 (3.64)	13 (4.7)	0.261 (1); NS
No	132 (96.36)	261(95.3)	
Diabetes mellitus			
Yes	30 (21.9)	60 (21.9)	0.000 (1); NS
No	107 (78.1)	214 (78.1)	
Urinary incontinence			
Yes	3 (2.19)	33 (12.0)	11.097 (1); <0.001
No	134 (97.81)	241 (88.0)	
Arthritis			
Yes	52 (38.0)	154 (56.2)	12.166 (1); <0.001
No	85 (62.0)	120 (43.8)	
Parkinsonism			
Yes	4 (2.9)	2 (0.7)	3.044 (1); NS
No	133 97.1)	272 (99.3)	
Epilepsy			
Yes	1 (0.7)	1 (0.4)	0.251 (1); NS
No	136 (99.3)	273 (99.6)	
Asthma			
Yes	4 (2.9)	10 (3.65)	0.311 (1); NS
No	133 (97.1)	264 (96.35)	

Regarding health & physical examination majority 97(70.8%) were reported extremity disability and 95(69.3%) were no mobility difficulties with common limitation was moving 21(15.3%) in case group whereas in control majority 156 (56.9%) and 146 (53.5%) had mobility difficulties and extremity disability with multiple limitation 99 (36.1%). Statistical association was found in mobility difficulties, extremity disability, limitation of activities, senile cataract, cognitive impairment, chronic OPD, urinary incontinence and arthritis.

4.2.4- Association between risk factors and elderly fall:

Association between elderly fall and socio-demographic, behavioural, environmental and morbidity related risk factors was analyzed and described below:

Table-4.2.4: Association between risk factors and elderly fall

Variable	Odds Ratio (95% CI)	Adjusted odd (95% CI)
Family		
Nuclear	1.00 (Reference)	1.00 (Reference)
Joined	0.131 (0.076-0.225)	0.203 (0.085 - 0.484)
Living with		
Alone	1.00 (Reference)	1.00 (Reference)
Family	0.271 (0.033 – 2.225)	0.559 (0.019 - 16.153)
Old home	1.571 (0.084 – 29.409)	1.554 (0.028 - 232.095)
Education		
None	1.00 (Reference)	1.00 (Reference)
<Primary	1.778 (1.369 – 5.637)	0.260 (0.078 -0.869)
Primary	1.308 (1.304 – 4.084)	0.668 (0.254 – 1.758)
Secondary	1.803(1.464 – 5.366)	0.507 (0.164 – 1.566)
College	1.332 (1.112 – 4.892)	0.709 (0.197 – 2.555)
PG	0.285 (0.036 – 2.276)	2.874 (0.475 - 72.610)
Occupation		
Day wagers	1.00 (Reference)	1.00 (Reference)
House wife	0.949 (0.325 – 2.772)	0.925 (0.157 – 5.449)
Farmer	1.753 (0.903 – 8.392)	0.673 (0.109 – 4.140)
Service	1.705 (0.546 – 5.324)	2.415 (0.0388 – 15.010)
Business	2.009 (1.624 - 15.449)	0.409 (0.067 – 2.480)
Retired	2.160 (0.710 – 6.579)	2.486 (0.384 – 16.106)
Others	0.655 (1.080 – 3.973)	0.125 (0.108 – 11.681)
Physical activity		
No	1.00 (Reference)	1.00 (Reference)
Brisk walking	0.101 (0.012-0.844)	0.223 (0.030 – 1.667)
Gardening	0.204 (0.021-2.018)	1.634 (0.525 – 5.083)
House work	0.022 (0.003 – 0.181)	0.318 (0.036 – 2.847)
Games	0.111 (0.009 – 1.337)	0.283 (0.570 – 9.139)
Carrying load (<20kg)	0.103 (0.011 – 0.931)	0.439 (0.133 – 1.455)
Multiple	0.155 (0.018 – 1.360)	0.178 (0.012 – 2.645)
Medication		
No	1.00 (Reference)	1.00 (Reference)
Yes	1.507 (0.998 – 2.278)	1.803 (0.801 – 4.057)
Foot wear		
Properly fitting	1.00 (Reference)	1.00 (Reference)
Not properly fitting	3.655 (3.544 – 9.022)	2.010 (0.804 – 5.027)
Barefoot	0.291 (0.092 – 0.913)	0.032 (0.002 - .422)
Footwear kind		
Shoe	1.00 (Reference)	1.00 (Reference)
Slipper	1.131 (0.650 – 1.968)	0.814 (0.309 – 2.140)
Sole type		
Rubber sole	1.00 (Reference)	1.00 (Reference)
Slick soles	2.931 (1.389 – 6.469)	1.944 (0.406 – 2.197)
Social interaction		
Good	1.00 (Reference)	1.00 (Reference)
Not good not bad	1.492 (0.704 – 3.159)	1.624 (0.404 – 6.526)
Bad	0.514 (0.072 – 3.695)	0.125 (0.000 – 34.328)

Variable	Odds Ratio (95% CI)	Adjusted odd (95% CI)
Floor		
Cement	1.00 (Reference)	1.00 (Reference)
Mosaic	2.032 (1.926 – 4.775)	1.781 (0.548 – 5.792)
Mud	1.723 (1.388 – 5.343)	0.953 (0.346 – 2.624)
Bathroom		
Dry	1.00 (Reference)	1.00 (Reference)
Wet	0.756 (0.0.473 – 1.209)	1.050 (0.397 – 2.782)
Slippery		
No	1.00 (Reference)	1.00 (Reference)
Yes	1.500 (0.866 – 2.600)	1.288 (0.431 – 3.850)
Tube well		
No	1.00 (Reference)	1.00 (Reference)
Yes	1.439 (1.202 – 4.949)	0.373 (0.109 – 1.284)
Place around tube well		
Pucca	1.00 (Reference)	1.00 (Reference)
Kutcha	0.378 (0.243 – 0.589)	1.487 (0.636 – 3.476)
Place		
Dry	1.00 (Reference)	1.00 (Reference)
Wet	0.531 (0.336 – 0.840)	0.515 (0.182 – 1.458)
Sidewalks		
No	1.00 (Reference)	1.00 (Reference)
Yes	2.769 (1.786 4.293)	1.132 (0.368 – 3.485)
Slippery		
No	1.00 (Reference)	1.00 (Reference)
Yes	2.308 (1.511 – 3.523)	3.018 (0.561 – 16.248)
Mobility difficulties		
No	1.00 (Reference)	1.00 (Reference)
Yes	2.990 (1.936 – 4.619)	2.623 (1.047 – 8.238)
Lower extremity Disability		
No	1.00 (Reference)	1.00 (Reference)
Yes	2.766 (1.785 – 4.287)	1.230 (0.014 – 3.746)
Senile cataract		
No	1.00 (Reference)	1.00 (Reference)
Yes	1.440 (1.861 – 2.344)	1.229 (0.083 – 0.633)
Cognitive impairment		
No	1.00 (Reference)	1.00 (Reference)
Yes	1.996 (1.185 – 2.324)	0.006 (0.000 – 0.272)
Chronic OPD		
No	1.00 (Reference)	1.00 (Reference)
Yes	0.361 (0.154 – 0.847)	2.423 (1.314 – 31.400)
Urinary incontinence		
No	1.00 (Reference)	1.00 (Reference)
Yes	3.154(5.919 – 7.60)	1.903 (0.179 – 4.548)
Arthritis		
No	1.00 (Reference)	1.00 (Reference)
Yes	2.098 (1.379 – 3.191)	0.616 (0.299 – 1.269)

The odds ratios with 95% CI were estimated for socio-demographic factors for elderly fall and revealed that joint family (OR= 0.203, CI=0.085 – 0.484), old home (OR= 1.554, CI= 0.028- 232.095), educational level and retired (OR=2.486, CI=0.384 - 16.106) were significantly associated with elderly fall.

In behavioural risk factors for elderly fall revealed that among physical activity - brisk walking, house work , carrying load were significantly associated with elderly fall which act as protective factors whereas Gardening (OR= 1.634, CI= 0.525- 5.083) act as risk factor for elderly fall. Taking medicine (OR= 1.803, CI= 0.801- 4.057). Foot wear not properly fitting (OR= 3.655, CI= 3.544 – 9.022) and slick sole (OR=1.944, CI=0.406 – 2.197) were significantly associated with elderly fall. Awareness about fall (OR= 0.210, CI= 0.128 – 0.347) represent as protective factor.

Among environmental risk factors for elderly fall it was revealed that floor made of mosaic (OR= 1.781, CI =0.584 – 5.792), wet bathroom (OR= 1.050, CI= 0.397- 2.782) & slippery bathroom (OR= 1.288, CI= 0.431-3.850), place around tube well that was kutcha (OR= 1.487, CI= 0.636 – 3.476), uneven sidewalk (OR= 1.132, CI=0.368- 3.485), and slippery condition (OR= **3**.018, CI= 0.561 – 16.248) were significantly associated with elderly fall.

Regarding health & physical factors for elderly fall revealed that mobility difficulties and extremity disability were significantly associated with elderly fall. The odds ratios with 95% CI, revealed that some diseases also significantly associated with elderly fall such as senile cataract (OR= 1.229, CI=0.083 – 0.633), COPD (OR= 2.423, CI= 1.314- 31.400) and urinary incontinence (OR= 1.903, CI= 0.179 – 4.548).

Discussion

The main finding in this study was presence of strong association between multiple risk factors and the fall rate. We also found clear associations with other factors consistently reported in the literature such as physical activity, recurrent fall, urinary incontinence and ADLs. Among specific medical conditions, COPD showed the clearest association. There were two protective factors like they had good social interaction and majority were aware about fall which were significantly associated with elderly fall. Although we were unable to classify the socio-demographic status which is very related to fall in older age and cannot address the elaborate environmental determinants, numerous personal characteristics were studied in sufficient depth, mostly linked to health status (patient-related or intrinsic factors).

Elderly fall are best studied where they occur, which is in the community. Data gathered at two hospitals rather than the community is subject to many sources of bias. Many of the biases are so large that they can lead to data that misrepresents picture of fall within the community.

To understand these biases and their importance, it is useful to consider how deaths due to falls occurring in the community are reported by the health information system.

If a case admitted at a hospital, the cause reported is usually the final cause of admission and not the underlying cause. For example, the final cause of admission in an elderly person with complain of infectious complication of Pneumonia but the underlying cause is actually the hip fracture caused by fall, which is an injury. Injury and Non-communicable causes are most affected by this source of bias, which is a misclassification bias.

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Interview was done on injured elderly patient who was admitted in hospital due to fall and generally they answered as they think which might not the real picture always. That was recall bias.

There are several dozen diseases legally required to be reported by a health facility. These diseases are predominantly infectious and the requirement for reporting creates a systematic reporting bias favoring infectious diseases over non- communicable and injury causes.

To estimate the prevalence of elderly fall in rural areas of Bangladesh a secondary analysis was done on BHIS Survey data which was collected from twelve districts of Bangladesh that has been covering 46157 elderly people In secondary analysis it was found that the prevalence of elderly fall was 10/1000 population and death due to fall was 1.6/100,000 population, in rural area of Bangladesh.

From BHIS data it was found that above 70 years old people fall more than that of others age group. Among the 60 to 64 age group and 65 to 69 age group the prevalence of fall was almost same that was 8.1/1000 population whereas above 70 years old the prevalence of fall almost double that was 20/1000 population.

 This finding is coinciding with other studies that we reviewed about elderly fall. Most of study revealed that fall proportion increased by age like in Ecuador, 50% fall increased by the age of 80 years.[5, 1] The secondary analysis showed that female were more vulnerable than male. Fall rates were highest in female (almost double) in all age group and majority female were in age of above 70 years. Death due to fall among female also more than male. This finding is almost similar with that of other study like in Ecuador fallers were more likely to be older& women.[5] Another study in Brazil, they also found that women are prioritized than man for fall. In Thailand

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Prince of Songkla University, they also revealed that women fell almost twice as often as men.[1]

The case control study was carried out among 137 elderly falls and 274 matched controls in National Institute of Traumatology and Orthopaedic Rehabilitation, in Sher-e-Bangla Nagar and Dhaka Medical College Hospital, Dhaka, Bangladesh to depict a picture of elderly falls in rural areas of Bangladesh. There is no missing data and nobody refused to participate in this study. The outcomes of the study are discussed below:

History of fall in the bathroom was more common in age group of 65-69 years and above 75 years; bedroom fall was the most common place. It was revealed that among male, more common causes of fall were accidental fall and in female slipping was the commonest cause of fall followed by accidental fall. Regarding fall location most common place was workplace followed by bathroom & bedroom in male whereas in female it was kitchen followed by bathroom which was usually related to everyday activities. In Ireland's National Hospital Discharge Survey (NHDS), published that most fractures are the result of a fall in the home, usually related to everyday activities such as walking on stairs, going to the bathroom, or working in the kitchen.[39]

This study showed that elderly person with history of fall, whether they participated physical activities, it was reported that only few respondents of case group performed house work (28.5%) followed by brisk walking (21.2%), whereas in control group majority observed as house work followed by brisk walking . The odds ratios with 95% CI were estimated for associated behavioral risk factors for elderly fall revealed that among physical activity - brisk walking, house work, carrying load were significantly associated with elderly fall which act as protective factors. Another study in Ecuador faller is more likely to be being less physically active

compared with non-fallers. being those physically active during the previous year (OR, 1.68; 95%CI, 1.23–2.29) were variables found independently associated with increased risk of falling among elderly people in Ecuador.[5] The Kerala Aging Survey (KAS) in 2003 found that regular physical exercise reduces the risk of falling by 10% and balance training programs reduces the risk by nearly 20%.[11] A recent study, published in the Journal of the American Geriatrics Society (2005), also reveals that the incidence of falls was less in exercising group than sedentary group. Among the exercising group who had falls, 60% did not sustain hip fracture, indicating that muscle strength and endurance improves with regular exercise which prevents falls by better neuromuscular control and fracture by better dissipation of force .[33]

Strong statistical association was revealed between, foot wear, foot wear kind and sole type with case & control (p<0.001). Not properly fitting footwear and slick sole were significantly associated with elderly fall. In 2010 Ireland's comprehensive health website published that many falls are the result of hazards like inadequate footwear. They suggest that elder people should wear properly-fitting shoes with nonskid soles, avoid high heels, tie your shoe laces, use a long-handled shoehorn if they have trouble putting on shoes and never walk in their stocking feet, replace slippers that have stretched out of shape and are too loose.[39]

In this study about one third, had experience of previous fall and 19.7% had fall history of 01 time and 2 times & more was 11.7% among cases. Strong statistical association was revealed between experience of previous fall and recurrent fall with case & control (p<0.001). This result is nearly similar with a study conducted in Ecuador recurrent falls was reported (two or more) in 23% of the participants.[5] Prince of Songkla University done a prospective cohort study, revealed that almost one in seven of the participants had fallen once or more(13.3%).[1] In Madrid, Spain the BMC Geriatric published a article Among fallers, 68%, 21%, and 12% had 1, 2, and ≥3 falls

respectively.[32] The Kerala Aging Survey (KAS) higher disability and consequent increasing distress was noted among those with a history of three or more falls.[11]

The significance of falls among elderly people is that not only that the number of falls increases with age but the injury rate is highest among the oldest old (80 years) subjects with history of falling more than twice. There is a vicious cycle where, due to poor perceived health and morbidity there is increased tendency to fall which itself leads to increasing disability and distress.[11]Journal of the American Geriatrics Society (2005), reveals that intrinsic causes for falls were more prevalent in people >70 years. Musculoskeletal disease, physical disability or limited activity increased the risk of fall by two to four times.[10, 33]

In this study it was found that many fall were results from environmental risk factors like mosaic floor, wet and slippery bathroom, place around tube well that was kaccha, uneven sidewalk with slippery condition. In 2010 Centers for Disease Control and Prevention (CDC) report that many falls are the result of hazards like slippery or wet surfaces, poor lighting and cluttered pathways in the home.[39]A study of Epidemiology of medication related falls and fractures, they state that One half to two thirds of falls occur in or around the patient's home.[39]

Regarding health & physical factors this study revealed that extremity disability and mobility difficulties with multiple limitations that are ADLs were significantly associated with elderly fall. This result also coincide with another study where fallers were more likely to be having functional limitations on the lower extremities and personal ADLs compared with non-fallers (OR, 1.71; 95% CI, 1.18–2.49).[5]

Several studies have shown that fall risk is closely related to ADLs capability and that difficulty in at least one activity of daily living double the risk of falling.[21,22,23,24,25] In

Ecuador, the risk of falling was 1.2-fold higher among older adults with any impairment in with similar or equivalent ADLs. Any ADLs limitation among older adults in Latin America and among Mexican-Americans increases significantly the risk of falling.[21] Limitations in ADLs often reflect poor mobility and lower-limb muscle strength, which are major risk factors for falling in older people.[26,27,28]

But our result is not consistent with the study in Madrid, the BMC Geriatric published that fall rate ratios increased with level of cognitive impairment but the association was imprecise, i.e. wide confidence intervals. It might be explained by since persons with severe functional limitations are usually less exposed to such risks. With respect to cognition, the risk function displayed a pattern of continuous increase in rate ratios as the level of impairment increased, but with substantial statistical imprecision.[32]

Statistical association was found in some co-morbidities such as senile cataract, COP and urinary incontinence (OR= 1.903, CI= 0.179 – 4.548). Some studies in Latin America, the increased risk of falling has been associated with depressive symptoms, diabetes, arthritis, osteoporosis, and urinary incontinence.[1,21,40] In Ecuador, they found that fallers were more likely to be having co-morbidities, as compared with non-fallers.[5] Urinary incontinence was also found an independent and significant risk factor for falls (OR, 1.58; 95% CI, 1.13–2.22). The present finding is consistent with the results of a recent systematic review.[29] Falls related to incontinence are generally thought to result from loss of balance when rushing to the toilet. However, it is unclear whether incontinence is a primary cause of falls or it is simply a marker of generalized physical frailty .[5,30] In Thailand heart failure has strong association with fall (OR 1.88, 95% CI 1.17–3.04).[1]

In Madrid, Spain the BMC Geriatric published an article. Clear associations were observed for arrhythmias, anemia, peripheral arterial disease, cancer, obstructive pulmonary disease, anxiety, and arthritis. Obstructive pulmonary disease and hypertension may have a stronger effect with severe falls. Strong association was found in urinary incontinence (95% CI, 20-67%); arrhythmias and antidepressants (95% CI, 5-27%).[32]

WHO provided a study on Global AGEing and Adult Health (SAGE), they state that risk factors significantly associated with an increased risk of fall-related injury were depression (p<0.01), arthritis (p<0.1), severe or extreme sleep problems (p<0.05).[8] In India, approximately 12% of respondents who had depression, yet no sleep problems, reported fall-related injuries in the previous twelve months. Of the respondents in Mexico who were depressed, had severe or extreme sleep problems and 50% reported fall related injuries.[11]

In another study indicated that musculoskeletal problems like osteoarthritis, rheumatoid arthritis, myopathy secondary to hypothyroidism, cervical and lumbar spondylosis were the cause for falls in elderly. Neurological illnesses also contribute to falls. Musculoskeletal disease, physical disability or limited activity increased the risk of fall by two to four times .[33]

Number of diseases remained a very strong risk factor. Although it is true that this effect may well reflect the sum of causal contributors inherent in the different diseases, considering some type of cumulative component leading to weakness and frailty is nonetheless compelling (and in line with a proposed approach to the concept and measurement of frailty.[41] However, it should be noted that the great part of the increase in risk occurs when comparing people from 0-1 conditions (whose risk is certainly very low) to 2-3 diseases.[32]

Multiple medicine as well as taking medicine significantly associated with elderly fall (OR= 1.803, CI= 0.801- 4.057), this findings is coincide with the study conducted in Madrid, Spain. The BMC Geriatric published that among 733 elderly fall, a mean of 4.2 medications (95% CI, 3.9-4.5). A strong association was also found for polypharmacy (RR = 1.19, for an increase of 1 drug). The adjusted rate ratios (95% CI) for an increase of 1 medication were 1.31 (1.05-1.65) and 1.14 (1.02-1.27) for those with 0-1 and ≥2 conditions respectively. Among psychotropic medications, antidepressants displayed a marked increased risk (RR = 3.40) with an equally plausible effect for anxiolytics (RR = 1.64) which is differ from our study.[32]

The role of polypharmacy complicates the issue, as it may act as both a confounder and an intermediate factor. As regards the interaction between these two variables, it was found that polypharmacy was a stronger risk factor for falls in those with 0 or 1 chronic condition versus those with a higher number of diseases.[39] Among community-dwelling older people, however, a study on women reported results very similar to this study, including the role of polypharmacy and its interaction with number of conditions.[42]

6.1 Conclusion:

This study reveals the existing situation and information regarding elderly fall among rural area of Bangladesh. In certain part of the world, elderly fall is still a common cause of mortality and long term morbidly. Every year, one-third to half of the population age 65 and over experience falls. About one third of the population age 65 and over reports some difficulty with balance or ambulation; incidences increase in frequency and severity in the over age 75 population. Falls are a leading cause of fatal and nonfatal injuries in older adults. The main finding of secondary analysis was fall rate was increased by age and highest in female among all the age group. In case control study majority of fall causes were slipping and accidental, common place was bathroom in age group of 65-69 years and above 75 years, bedroom fall was the most common. Strong statistical association was revealed between types of family, physical activities, foot wear, home environment, mobility difficulties, extremity disability, limitation of activities, senile cataract, COPD and urinary incontinence and the fall rate. There were some protective factors that are they had good social interaction and majorities were aware about fall and physical activity except gardening which were significantly associated with elderly fall. Previous studies have reported upward trends in fall-related injury hospitalizations and deaths in developed countries.[57, 58] Despite these facts; there is limited information about the epidemiology of falls among older adults in developing countries. Knowledge of the epidemiology of falls may assist public health authorities to implement prevention strategies among individuals at higher risk of falling. Thus, the aims of the present study were to estimate the prevalence of falls and to determine characteristics associated with fall risk among persons aged 60 years or older in Bangladesh. This was a hospital-based study conducted on small sample size. A well-designed population based study is needed to confirm the risk factors related to elderly fall which in turn help prevention of mortality and morbidity of 60 years and above age group in Bangladesh.

6.2 Recommendations

- Special attention should be given on female elderly person in all age group and provide expertise and advocacy to them regarding fall.

- Sedentary life style should be avoided and encourage them for effective moderate physical activities like brisk walking, house work etc. at least 30 to 45 minutes daily. Caution should take during gardening.

- Use of proper foot wear may help to prevent fall and for that effective and sustained health education have to be given.

- Clinicians need to be aware about elderly people concerning the multiple independent risk factors like mobility difficulties, extremity disability, limitation of daily activities and various morbidity like senile cataract, COPD and urinary incontinence which were responsible for fall and comprehensive information should be given to elderly people.

- Elimination of environmental risk factors can be achieved by home modification. Different technology is proved to be useful by designing interventions to reducing risk   of fall.

- Regarding intake of drug specially anti-hypertensive drug, elderly people should be care full and must follow the instruction of doctor.

- Regular follow up and management of neuromuscular disorders play a role in fracture prevention.

- The government should making efforts to ease the discomfort of its senior citizens by formulating old age security schemes and allocating its expenditure.

- The lack of a designated agency for elderly people (there is for example UN agency that deals specifically with older persons) translates into a lack of action and advocacy in respect to elderly people's needs in emergencies.

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Appendix 1

QUESTIONNAIRE ON
Study on Magnitude and Determinants of Elderly Falls in a Rural Community of Bangladesh.
Department of Epidemiology & Biostatistics
BIHS

Consent note

As-Salamu Alaikum. I am Dr. Shamima Choudhury a student of M.Phil, conducting a study on "Magnitude and Determinants of Elderly Falls in a Rural Community of Bangladesh" from the Dept. of Epidemiology and Biostatistics to accomplish our academic requirements.
The following information is provided for you to decide whether you wish to participate in the present study. It will take less than 15 minutes to complete the following questionnaire. You may refuse to provide answer and not participate in this study. You should be aware that even if you agree to participate, you are free to withdraw at any time. If you do withdraw from this study, it will have no affect on you. All information will strictly be kept confidential and will be used only for the academic purpose. I am anticipating your cooperation in this regard.

ENGLISH QUESTIONNAIRE

Part one: Respondent Identification

ID no:
Subject: 1. Case   2. Control
Name of Respondent:……………………
Address: Village**…………….**   Thana/Post Office**……………………..**
          District**…………………**

Telephone/Cell:

Part two: Socio Demographic Information

1. What is your current age (in completed years)   :

2. What is your gender   **:**1. Male   2. Female

3. What is your religion   **:**1. Islam   2. Hindu   3. Christian
                                      4. Buddhist   5. Others

4. What is your current marital status?   **:**1. Married   2. Widow
                                      3. Separated/Divorced

5. What type of family do you have?   **:**1. Nuclear   2. Joint

6. What is the number of family members of your family?

7. With whom do you live? : 1. Alone   2. With family member
    3. Old home

8. What is the highest level of education you have completed?
    0. No formal schooling   1. Less than primary school
    2. Primary school completed   3. Secondary school completed
    4. College completed   5. Post graduate degree
9. What is your main occupation?
    1. Day wagers   2. House wife   3. Farmer
    4. Service   5. Business   6. Retired
    7. Others (Please specify)

10. What is your monthly income (BDT)?

11. What is your monthly family expenditure (BDT)?

Part three: Information on Fall

12. When did you fall : …………………………………………

13. Fall due to
    1. Stumbling   2. Slipping, tripping   3. Push   4.Jump
    5. Accidental fall
14. Location of fall
    1. Bathroom   2. Bedroom   3. Kitchen   4. Side walk
    5. Street   6. Workplace   7. Sports   8. Stairs
    9. Tree   10. Roof   11. Furniture   12. Ladder
    13. Others(Specify) …………………………………………
15. Do you have any experience of previous fall?:   1. Yes   2. No

16. If yes, then how many times?:

Part four: Information about behavioral risk factors

17. Do you take any medications which are as directed by health professionals?:
    1. Yes   2. No

19. If yes, what type of medication do you take? : 1. Anti HTN   2. Anti DM
    3. NSAID   4. Vitamine   5. Anti Depressant
    6. Anti Asthma   7. Multiple

18. Have you taken regular participation in moderate physical activity like : ☐
    1. Brisk walking   2. Gardening   3. House work
    4. Involvement in games with children   5. Carrying moderate loads(<20kg)
    6. Multiple   7. No participation

20. How is your footwear?   **:** ☐
    1. Properly fitting shoes   2. Not properly fitting shoes   3. Barefoot

21. If use footwear , then what kind of footwear it is?: ☐
                      1. Shoe   2. Slipper

22. If use slipper, then what type of soles?: ☐
        1. Slipper with rubber soles   2. Slipper with slick soles

23. How is your social interaction? : ☐
        1. Good   2. Not good not bad   3. Bad

24. Are you aware about possible fall?   **:**   1. Yes   2. No ☐

Part five: Information about Environmental risk factors

25. How is your housing condition?

    a) What is the form in your floor?:   1. Mud   2. Mosaic   3. Cement ☐

    b) How is your bathroom?   **:**   1. Dry   2. Wet ☐

    c) According to your opinion, is it Slippery(Usually or at the time of fall)?: ☐
        1. Yes   2. No

    d) Is there any tube well?:   1. Yes   2. No ☐

    e) If yes, then how is the place around the tube well?:1. Puccaa   2. Kutcha ☐

    f) Is that place: 1. Dry   2. Wet ☐

    g) Is there any Crack or uneven sidewalks around your house?: ☐
        1. Yes   2. No

    h) According to your opinion, usually is it Slippery?:1. Yes   2. No ☐

Part six: Health Information and Physical Examination

26. Have you any difficulties with your current mobility?:   1. Yes   2. No   ☐

27. Do you have any lower extremity disability?   :   1. Yes   2. No   ☐

28. Did you have any limitation to do?   :   ☐

1. Bathing   2. Dressing   3. Self feeding   4. Moving from one place to another
5. Personal hygiene   6. Elimination (toileting)   7. Multiple
8. No limitation

29. Do you have any diseases like: :

1. Senile Cataract	1. Yes	2. No	☐
2. Noticeable hearing loss/Deafness	1. Yes	2. No	☐
3. Cognitive impairment	1. Yes	2. No	☐
4. COPD	1. Yes	2. No	☐
5. Hypertension	1. Yes	2. No	☐
6. Stroke	1. Yes	2. No	☐
7. Depression	1. Yes	2. No	☐
8. Diabetes Mellitus	1. Yes	2. No	☐
9. Urinary incontinence	1. Yes	2. No	☐
10. Arthritis	1. Yes	2. No	☐
11. Parkinsonism	1. Yes	2. No	☐
12. Epilepsy	1. Yes	2. No	☐

Appendix -02

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QUESTIONNAIRE ON
Study on Magnitude and Determinants of Elderly Falls in a Rural Community of Bangladesh.
Department of Epidemiology & Biostatistics
BIHS

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সম্মতি পত্র

আস্‌সালামু আলাইকুম। আমি ডাঃ শামিমা চৌধুরী, বাংলাদেশ ইনস্টিটিউট অব হেলথ সাইন্স এর এপিডেমিওলজি এন্ড বায়োস্টেটিসটিক্স বিভাগের এম.ফিল কোর্সে অধ্যয়নরত শিক্ষার্থী। আমি বর্তমানে এম.ফিল কোর্সের পাঠ্যসূচীর অর্ন্তভূক্ত গবেষণা কাজে নিয়োজিত। এই তথ্যগুল আপনাকে প্রদান করা হচ্ছে যাতে আপনি এই গবেষণা কাজে অংশগ্রহন করবেন কিনা তা স্বাধীনভাবে সিদ্ধান্ত নিতে পারেন। নিম্মোক্ত প্রশ্নপত্রটি পূরণ করতে আনুমানিক ১৫ মিনিট সময় লাগবে। উত্তর দেওয়া বা না দেওয়া সম্পূর্ণ আপনার ইচ্ছার উপর নির্ভর করবে। যদিও আপনি সম্মতি দিচ্ছেন, তবুও যেকোন সময় এ থেকে সরে যেতে পারেন। প্রদত্ত সকল তথ্য সম্পূর্ণভাবে গোপন রাখা হবে এবং মাত্র পাঠ্যসূচির অর্তর্ভূক্ত গবেষনা কাজে ব্যবহৃত হবে। তাই আমি সার্বিকভাবে আপনার সহযোগিতা কামনা করছি।

আই.ডি.নং	০				তারিখঃ	
Subject		Case / Control				

বাংলা প্রশ্নমালা

আর্থ সামাজিক তথ্যাবলী

নাম :

ঠিকানা : গ্রাম- থানা/উপজেলা- জেলাঃ
ফোন নম্বর :

১. বয়স (পূর্ণ বছরে) :
২. লিঙ্গ : ১. পুরুষ ২. মহিলা
৩. ধর্ম :
১. ইসলাম ২. হিন্দু ৩. খ্রীষ্টান ৪. বৌদ্ধ ৫. অন্যান্য

৪. বৈবাহিক অবস্থা :
১. বিবাহিত ২. বিধবা ৩. তালাকপ্রাপ্ত

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৫. আপনার পরিবার কোন প্রকারের?:

       ১. একক   ২. যৌথ

৬. আপনার পরিবারের সদস্য সংখ্যা কত?...

৭. আপনি কার সঙ্গে বসবাস করেন?   :

     ১. একা   ২. পরিবারের সদস্য   ৩. বৃদ্ধাশ্রম

৮. আপনার শিক্ষাগত যোগ্যতা কি ?   :

     ১. অশিক্ষিত   ২. শুধুমাত্র স্বাক্ষর করতে পারি   ৩. প্রাথমিক
     4. উচ্চ মাধ্যমিক   ৫. স্নাতক   ৬. স্নাতকোত্তর

৯. আপনার প্রধান পেশা কি?   :

     ১.   দিনমজুর   ২.   গৃহিনী   ৩. কৃষক
     4.   চাকুরীজিবী   ৫.   ব্যবসায়ী   ৬. অবসরপ্রাপ্ত

১০. আপনার মাসিক আয় কত?   :...

১১. আপনার মাসিক ব্যায় কত?   :...

<u>পড়ে যাওয়া সংক্রান্ত তথ্যাবলী</u>

১২. আপনি কবে পড়ে গিয়েছিলেন?:...

১৩. পড়ে যাওয়ার কারণ   :

     ১.   হোঁচট খাওয়া   ২.   ঘুমানো অবস্থায়   ৩. ধাক্কা খেয়ে
     4.   লাফদিতে গিয়ে   ৫. হঠাৎ পড়ে যাওয়া   ৬. অকারন
     ৭.   অন্যান্য (অনুগ্রহ করে নির্দিষ্ট করুন)...

১৪. পড়ে যাওয়ার স্থান/জায়গা   :

     ১.   গোসলখানা   ২.   শোবার ঘর   ৩. রান্না ঘর   4.   ফুটপাত
     ৫.   রাস্তা   ৬.   অফিস   ৭. ক্রীড়া প্রতিযোগিতা ৮. সিঁড়ি
     ৯.   গাছ   ১০.   ছাদ   ১১. আসবাবপত্র   ১২. মই
     ১৩.   অন্যান্য (অনুগ্রহ করে নির্দিষ্ট করুন)...

১৫. আপনার কি পূর্বে পড়ে যাওয়ার অভিজ্ঞতা আছে ?

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১. হ্যাঁ   ২. না

১৬. যদি হ্যাঁ হয় তা হলে কতবার? :............   ....

<u>ঝুঁকিপূর্ণ আচরনগত তথ্যাবলা</u>

১৭. আপনি কি ডাক্তারের পরামর্শ অনুযায়ী কোন ঔষধ খান? :

১. হ্যাঁ   ২. না

১৮. যদি হ্যাঁ হয়, অনুগ্রহ করে নির্দিষ্ট করুন:...

১৯. আপনি কি প্রতিদিন মাঝারী ধরনের শারীরিক পরিশ্রম করেন? যেমন :

১. দ্রুত হাঁটা   ২.   বাগান করা ৩.   ঘরের কাজ ৪.   বাচ্চাদের সঙ্গে খেলা

৫.   হালকা বোঝা বহন করা (<২০ কেজি)

২০. আপনার পাদুকার ধরন কেমন ছিল ? :

১. পায়ের মাপের সমান   ২. পায়ের মাপ অপেক্ষা বড়

২১. যদি পাদুকা হয় তা হলে ধরন কেমন?:

১. জুতা   ২. চটি জুতা

২২. যদি চটি জুতা হয় তা হলে জুতার তলা কি ধরনের?

১. রাবারের   ২. পিচ্ছিল

২৩. আপনার সঙ্গে প্রতিবেশীর সম্পর্ক কেমন ?   :

১. ভাল   ২. ভালোও না, খারাপও না   ৩. খারাপ

২৪. আপনার কি পড়ে যাওয়ার ভয়ের অনুভূতি আছে? :

১. হ্যাঁ   ২. না

<u>ঝুঁকিপূর্ণ পরিবেশ সংক্রান্ত তথ্যাবলী</u>

২৫. আপনার বাড়ীর পারিপার্শ্বিক পরিবেশ কেমন?

ক) আপনার মেঝে কি উপাদান দিয়ে তৈরি?   ১. মাটি   ২. মোজাইক   ৩. সিমেন্ট

খ)আপনার বাথরুমের অবস্থা কেমন ?   ১. শুকনা   ২. ভেজা

Appendix -02

গ) আপনার মতে বাথরুম কি পিচ্ছিল ? ১. হ্যাঁ ২. না ☐

ঘ) আপনার বাড়ীতে কোন টিউবওয়েল/কল আছে কি? ১. হ্যাঁ ২. না ☐

ঙ) যদি হ্যাঁ হয় তা হলে টিউবওয়েল এ ১. পাঁকা ২. কাঁচা ☐

চ) ঐ জায়গা কেমন থাকে? ১. শুকনা ২. ভেজা ☐

ছ) আপনার বাড়ীর চারপাশে কোন অসমান রাস্তা আছে কি না? ১. হ্যাঁ ২. না ☐

জ) আপনার মতে রাস্তা কি সাধারণত পিচ্ছিল থাকে? ১. হ্যাঁ ২. না ☐

স্বাস্থ্যতথ্য এবং স্বাস্থ্য পরীক্ষা

২৬. আপনার বর্তমান চলাফেরায় কি কোন অসবিধা আছে ? : ১. হ্যাঁ ২. না ☐

২৭. আপনার কি কোমড়ের নীচের অংশ থেকে পায়ের পাতা পর্যন্ত কোন অক্ষমতা আছে ?: ১. হ্যাঁ ২. না ☐

২৮. আপনার নিম্নলিখিত কাজগুলো করতে অসুবিধা হয় কি? : ☐
   ১. গোসল ২. কাপড় পড়া ৩. নিজের হাতে খাওয়া
   ৪. এক স্থান থেকে অন্য স্থানে যাওয়া ৫. নিজের পরিচ্ছন্নতা ৬. শৌচকার্য ৭. একাধিক
   ৮. কোন অসুবিধা নেই ☐

২৯. আপনার কি নিম্নলিখিত কোন রোগ অছে? :

১) **Senile Cataract** (বার্ধক্যজনিত ছানি): ১. হ্যাঁ ২. না ☐

২) **Noticeable hearing loss/Deafness** (লক্ষনীয় শ্রবণ ক্ষতি/বধিরতা): ১. হ্যাঁ ২. না ☐

৩) **Cognitive impairment**(জ্ঞানীয় বৈকল্য): ১. হ্যাঁ ২. না ☐

৪) **COPD** (দীর্ঘস্থায়ী শ্বাসকষ্ট/হাপানী): ১. হ্যাঁ ২. না ☐

৫) **Hypertension** (উচ্চ রক্তচাপ): ১. হ্যাঁ ২. না ☐

৬) **Stroke** (স্ট্রোক) : ১. হ্যাঁ ২. না ☐

৭) **Depression** (বিষন্নতা): ১. হ্যাঁ ২. না ☐

৮) **Diabetes Mellitus** (ডায়াবেটিস): ১. হ্যাঁ ২. না ☐

৯) **Urinary incontinence** (প্রস্রাবে অসংযম): ১. হ্যাঁ ২. না ☐

১০) **Arthritis** (বাত) : ১. হ্যাঁ ২. না ☐

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Appendix -02

১১) Parkinsonism :   ১. হ্যাঁ   ২. না

১২) Epilepsy: ১. হ্যাঁ   ২. না

Appendix3: <u>**Work plan for M.PhilThesis**</u>

Activity details (Work Description)	Oct ' 14 Weeks				Nov ' 14 Weeks				Dec ' 14 Weeks				Jan ' 15 Weeks				Feb ' 15 Weeks				Mar '15 Weeks				Apr ' 15 Weeks				May ' 15 Weeks			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Protocol development-introduction and rationale	▓	▓	▓	▓																												
Literature review					▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓													
Questionnaire development, training Ofthedata collector, and pilot study				▓	▓	▓	▓	▓	▓	▓	▓																					
Data Collection													▓	▓	▓	▓	▓	▓	▓	▓												
Data analyses																					▓	▓	▓	▓	▓							
Report writing																										▓	▓	▓				
Submission-Draft Report																													▓			
Finalizing the Report																														▓		
Submission- Final Report																																▓